DRI

DIETARY REFERENCE INTAKES

FOR

Calcium,
Phosphorus,
Magnesium,
Vitamin D,
and
Fluoride

Standing Committee on the Scientific
Evaluation of Dietary Reference Intakes
Food and Nutrition Board
Institute of Medicine

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Preface

This report represents the initial report of a major new activity of the Food and Nutrition Board (FNB): the development of a comprehensive set of reference values for dietary nutrient intakes for the healthy population in the United States and Canada. Hallmarks of the new activity include (1) the establishment of a set of reference values to replace the Recommended Dietary Allowances (RDAs) for the United States published previously by the FNB; (2) for the first time, a single set of reference values for the United States and Canada; (3) the clear documentation of the derivation of the reference values; (4) the promotion of nutrient function and biologic-physical well-being; (5) the consideration of evidence concerning the prevention of disease and developmental disorders in addition to more traditional evidence of sufficient nutrient intake (for example, prevention of deficiency); (6) the examination of data about selected food components that have not been considered essential nutrients; and (7) recommendations for future research directions based on the knowledge gaps identified.

Since the publication of the last version of the U.S. *Recommended Dietary Allowances* (NRC, 1989a) and of the Canadian *Recommended Nutrient Intakes* (Health Canada, 1990), there has been a significant expansion of the research base, an increased understanding of nutrient requirements and food constituents, and a better appreciation for the different types of nutrient data needed to address the applications of dietary reference values for individuals and population groups. There are now convincing reasons to conclude that

past approaches to establishing and applying the RDAs can be improved.

Thus, the FNB considered it essential to reassess the nutrient requirement estimates that are needed for various purposes, how estimates of nutrient requirements should be developed, and how these values could be used in various settings of clinical and public health importance. To this end, the FNB's Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (DRI Committee) is taking steps that should help eliminate some of the limitations, misinterpretations, and misuses of the 1989 RDAs and their predecessors. Indeed, the DRI Committee has already concluded that the 1989 edition of the *Recommended Dietary Allowances* should now be replaced in its entirety, rather than merely updated, by a new series of publications.

The DRI Committee aims to achieve a consistent and coherent definition of requirements and of reference intakes for all essential nutrients and food components evaluated. (A brief description of the process is given in Appendix A.) In this context, the reference intake values presented in this and subsequent reports should have a broad, enduring, and useful application.

This report defines requirements and other reference intake values for calcium, phosphorus, magnesium, vitamin D, and fluoride and represents the first in a series of reports providing both dietary reference intakes and guidance related to how to use them. Changes in the prepublication version (which was released in August, 1997) have been made to increase the readability and clarity of the information provided. Improvements in format and descriptions have been made consistent with the second report released in the series (which covers B vitamins and choline, the prepublication version of which was released in April, 1998). The DRI Committee deeply appreciates the comments received from many reviewers and individuals following the release of the prepublication version.

Because of the limitations of present scientific knowledge, there are differences of opinion among scientists about some of the matters covered in this report. Reaching agreement on the interpretation of the evidence relating to calcium requirements has been a challenge, both because of the compelling conceptual argument to use *maximal* calcium retention as an indicator of adequacy as was presented in the prepublication version of this report, and subsequent statistical questions raised in the methodology used to estimate it after that version was released. In order to address these statistical issues, the DRI Committee chose in this final printed version of the report to refer to the indicator of adequacy used to

establish recommended intakes for calcium as *desirable* calcium retention. The balance data originally used in assessing maximal calcium retention were then recalculated (see Appendix E) to establish the estimates for adequacy of dietary calcium based on achieving the estimated desirable amount of calcium retention. In either case, consistent achievement of either *maximal* or *desirable* calcium intakes as the indicator of adequacy is presumed to reduce the risk of fracture secondary to osteopenia or osteoporosis.

After much careful weighing of the evidence, the DRI Committee determined that, because reducing risk of chronic disease was the intended endpoint and there were many uncertainties about the epidemiologic and experimental data, the setting of Estimated Average Requirements and Recommended Dietary Allowances for calcium could not be justified. Thus, as described in the report, Adequate Intake values were set instead.

It is not the function of this report, given the scope of work (see Appendix A, "Charge to the Panel on Calcium and Related Nutrients and Subcommittee on Upper Reference Levels"), to address applications of the DRIs. However, some uses for the different types of DRIs are described briefly in Chapter 9. The DRI Committee intends to issue a subsequent report that will focus on the uses of DRIs in various settings.

It is hoped that the critical, comprehensive analyses of available information and of knowledge gaps will greatly assist the private sector, foundations, universities, government laboratories, and other institutions with their research interests and with the development of an exciting and realistic research agenda for the next decade.

The support of Canada and Canadian scientists in this initiative for DRIs represents a pioneering first step toward the standardization of nutrient reference intakes at least within one continent.

This report reflects the work of the FNB's DRI Committee, an expert Panel on Calcium and Related Nutrients, and the Subcommittee on Upper Reference Levels of Nutrients. The committee, the panel, and the subcommittee owe a considerable debt of gratitude to the many experts who have assisted with this report. Many, but far from all, of these people are named in Appendix B. Thanks also go to the many experts who devoted so much time to discussing these issues and to Burton Altura, Chor San Khoo, and Charles Pak, initial members of the Panel on Calcium and Related Nutrients and/or the Subcommittee on Upper Reference Levels of Nutrients. The respective chairs and members of the panel and subcommittee have performed their work under great time pressure. It

is because of their dedication that this report has come into being. All gave of their time willingly and without financial reward; both the science and practice of nutrition are major beneficiaries.

The DRI Committee wishes to acknowledge the tireless efforts of the former and present FNB chairs, Janet King and Cutberto Garza, who began the initiative and played a key role in securing the funding that has been received to date. Similarly, thanks go to Allison Yates who has been instrumental in guiding this complex activity, and to Stephanie Atkinson and Ian Munro, who gave generously of their time and effort in chairing the Panel on Calcium and Related Nutrients and the Subcommittee on Upper Reference Levels of Nutrients, respectively. Finally, it is the staff of FNB who get the work completed. Special gratitude is expressed to Sandra Schlicker, study director for both the calcium panel and subcommittee, and Carol Suitor, who assumed the added responsibility of acting director of the FNB during the last few months of this project. The committee also recognizes the contributions of Elisabeth Reese, Kimberly Brewer, Alice Kulik, Sheila Moats, Gail Spears, Donna Livingston, and Geraldine Kennedo. We also thank Judith Grumstrup-Scott for editing the manuscript and Mike Edington and Claudia Carl for assistance with publication.

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