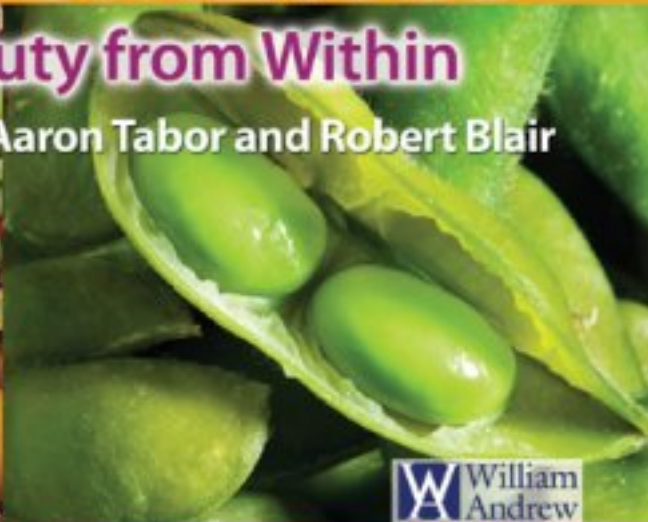


# NUTRITIONAL COSMETICS

**Beauty from Within**

Edited by Aaron Tabor and Robert Blair



 William  
Andrew

# **PERSONAL CARE AND COSMETIC TECHNOLOGY**

**Series Editor: Meyer Rosen**

*President, Interactive Consulting, Inc., NY, USA*

- 9780815515043 Delivery System Handbook for Personal Care and  
Cosmetic Products: Technology, Applications and Formulations (2005)  
Edited by Meyer Rosen
- 9780815515678 Global Regulatory Issues for the Cosmetics Industry,  
volume 1 (2007) Edited by C. I. Betton
- 9780815515692 Global Regulatory Issues for the Cosmetics Industry,  
volume 2 (2009) Edited by Karl Lintner
- 9780815515722 Cosmetic Applications of Laser and Light-Based  
Systems (2009) Edited by Gurpreet S. Ahluwalia
- 9780815515845 Skin Aging Handbook: An Integrated Approach to  
Biochemistry and Product Development (2008) Edited by  
Nava Dayan
- 9780815520290 Nutritional Cosmetics: Beauty from Within (2009)  
Edited by Aaron Tabor and Robert M. Blair

William Andrew is an imprint of Elsevier  
Linacre House, Jordan Hill, Oxford OX2 8DP, UK  
30 Corporate Drive, Suite 400, Burlington, MA 01803, USA

First edition 2009

Copyright © 2009 Elsevier Inc. All rights reserved

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher

Permissions may be sought directly from Elsevier's Science & Technology Rights Department in Oxford, UK: phone (+44) (0) 1865 843830; fax (+44) (0) 1865 853333; email: [permissions@elsevier.com](mailto:permissions@elsevier.com). Alternatively visit the Science and Technology website at [www.elsevierdirect.com/rights](http://www.elsevierdirect.com/rights) for further information

**Notice**

No responsibility is assumed by the publisher for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein. Because of rapid advances in the medical sciences, in particular, independent verification of diagnoses and drug dosages should be made

**British Library Cataloguing in Publication Data**

A catalogue record for this book is available from the British Library

**Library of Congress Cataloging-in-Publication Data**

A catalog record for this book is available from the Library of Congress

ISBN: 978-0-8155-2029-0

For information on all William Andrew publications  
visit our website at [elsevierdirect.com](http://elsevierdirect.com)

Printed and bound in United States of America

09 10 11 12 11 10 9 8 7 6 5 4 3 2 1

**Working together to grow  
libraries in developing countries**  
[www.elsevier.com](http://www.elsevier.com) | [www.bookaid.org](http://www.bookaid.org) | [www.sabre.org](http://www.sabre.org)

**ELSEVIER**    **BOOK AID**  
An imprint of    International    Sabre Foundation

*We dedicate this book to everyone who believes beauty is more than  
skin deep.*

# Contributors

---

**Farrukh Afaq, PhD**

Associate Scientist  
Department of Dermatology  
University of Wisconsin  
4385 Medical Sciences Center  
1300 University Avenue  
Madison, WI 53706  
Phone: +1 608 263 5519  
Email: fafaq@dermatology.wisc.edu

**Rajesh Agarwal, PhD**

Professor  
UCD School of Pharmacy  
4200 East 9th Avenue, C-238  
Denver, CO 80262  
Phone: +1 303 315 1381  
Fax: +1 303 315 6281  
Email: Rajesh.Agarwal@uchsc.edu

**Christian Artaria, BSc**

Indena S.p.A.  
Viale Ortles, 12  
20139 Milan  
Italy

**Yutaka Ashida, PhD**

Shiseido Co., Ltd.  
Frontier Science Labs  
2-12-1 Fukuura Kanazawa-Ku  
Yokohama 236-8643  
Japan  
Email: yutaka.ashida@to.shiseido.co.jp

**Debasis Bagchi, PhD, FACN, CNS**

Department of Pharmacological & Pharmaceutical Sciences  
College of Pharmacy  
University of Houston  
Houston, TX  
Email: dbagchi@interhealthusa.com

**Manashi Bagchi, PhD, FACN**  
Interhealth Research Center  
Benicia, CA  
Email: [mbagchi@interhealthusa.com](mailto:mbagchi@interhealthusa.com)

**Jalil Benyacoub, PhD**  
Nestle Research Center  
Vers-Chez-Les-Blancs  
P.O. Box 44  
1000 Lausanne 26  
Switzerland

**Bruno Berra, PhD**  
Professor  
Institute of General Physiology and Biochemistry, "G. Esposito"  
Via Trentacoste 2  
20134 Milan  
Italy  
Phone: +39 02 50315777  
Fax: +39 02 50315775  
Email: [bruno.berra@unimi.it](mailto:bruno.berra@unimi.it)

**Robert M. Blair, PhD**  
Physicians Pharmaceuticals, Inc.  
1031 E. Mountain Street, Building 302  
Kernersville, NC 27284  
Phone: +1 336 722 2337 Ext. 1734  
Fax: +1 336 722 7712  
Email: [drblair@revivalsoy.com](mailto:drblair@revivalsoy.com)

**Stephanie Blum, PhD**  
Nestle Research Center  
Vers-Chez-Les-Blancs  
P.O. Box 44  
1000 Lausanne 26  
Switzerland

**Lionel Breton, PhD, DrSc**

L'Oreal  
Charles Zviak Center  
90 Rue du Général Roguet  
92 583 Clichy Cedex  
France  
Phone: +33 1 47 56 7887  
Fax: +33 1 47 56 40 07

**Petra Caessens, PhD**

DMV International  
40196 State Highway 10  
Delhi, NY 13753

**Isabelle Castiel, PharmD, PhD**

Scientific Coordinator Food Supplement Research  
Life Science Research  
L'Oreal Research and Development  
L'Oreal  
Centre C. Zviak  
90 Rue du Général Roguet  
92 583 Clichy Cedex  
France  
Phone: +33 4 93 83 09 65  
Fax: +33 1 47 56 40 07  
Email: icastiel@rd.loreal.com

**Dr. Leonardo Celleno**

Department of Dermatology  
Catholic University of Sacred Heart  
Largo A. Gemelli 8  
00168 Rome  
Italy  
Phone: +39 06 3503591  
Fax: +39 06 3503547  
Email: lcelleno@libero.it

**Meera Chandramouli**

PL Thomas & Co., Inc., NJ, USA  
Phone: +1 973 984 0900 Ext. 215  
Email: PLT@PLThomas.com

**Aldo Cristoni, PhD**

Indena S.p.A.  
Viale Ortles, 12  
20139 Milan  
Italy  
Email: aldo472006@gmail.com

**Gagan Deep, PhD**

Research Associate  
UCD School of Pharmacy  
4200 East 9th Avenue, C-238  
Denver, CO 80262  
Phone: +1 303 315 1228  
Fax: +1 303 315 6281  
Email: Gagan.Deep@uchsc.edu

**Rick de Waard, PhD**

R&D Director, Nutritionals  
DMV International  
Innovium  
Nieuwe Kanaal 7r  
NL-6709 PA Wageningen  
The Netherlands  
Phone: +31 0 6 10377844

**Dushka Dimitrijevic, MSc**

Vitiva d.o.o.  
Nova vas pri Markovcih 98  
2281 Markovci  
Slovenia  
Phone: +386 2 788 87 38  
Fax: +386 2 7888 745  
Email: dushka@vitiva.si

**David Djerassi**

President  
Intrachem Technologies  
New York, NY  
Email: daviddjerassi@msn.com



**Zoe Diana Draelos, MD**

Dermatology Consulting Services, Inc.  
2444 N. Main Street  
High Point, NC 27262-7833  
Email: [zraelos@northstate.net](mailto:zraelos@northstate.net)

**Craig A. Elmets, MD**

Department of Dermatology  
University of Alabama at Birmingham  
Birmingham, AL 35294

**Andrea Giori, PhD**

Indena S.p.A.  
Viale Ortles, 12  
20139 Milan  
Italy  
Email: [andrea.giori@indena.com](mailto:andrea.giori@indena.com)

**Audrey Gueniche, PharmD, PhD**

Project Director  
Oral Route Research—Skin and Hair  
L'Oreal  
Charles Zviak Center  
90 Rue du Général Roguet  
92 583 Clichy Cedex  
France  
Phone: +33 1 47 56 40 15 or +33 6 60 99 24 67  
Fax: +33 1 47 56 78 88  
Email: [agueniche@rd.loreal.com](mailto:agueniche@rd.loreal.com)

**Rebat M. Halder, MD**

Professor and Chairman  
Department of Dermatology  
Howard University College of Medicine  
2041 Georgia Avenue, N.W.  
Washington, DC 20060  
Phone: +1 202 865 6725  
Fax: +1 202 865 1757  
Email: [halderderm@rcn.com](mailto:halderderm@rcn.com)

**Takeshi Ikemoto, PhD**

Kanebo Cosmetics  
Basic Research Laboratory  
3-28, 5-Chome, Kotobuki-Cho, Odawara-Shi  
Kanagawa-Ken, 250-0002, Japan

**Eunsun Jung**

Biospectrum Life Science Institute  
SK Ventium 101-701  
#552 Dangjung Dong  
Gunpo City  
Gyunggi Do, 435-776  
Republic of Korea  
Phone: +82 31 436 2090  
Fax: +82 31 436 0605

**Santosh K. Katiyar, PhD**

Associate Professor of Dermatology  
Department of Dermatology  
1670 University Boulevard  
Volker Hall 557, Box 202  
University of Alabama at Birmingham  
Birmingham, AL 35294  
Phone: +1 205 975 2608  
Fax: +1 205 934 5745  
Email: skatiyar@uab.edu

**Suchitra Katiyar, BS, MPH**

Department of Dermatology  
University of Alabama at Birmingham  
Birmingham, AL 35294

**Manjinder Kaur, PhD**

Research Associate  
UCD School of Pharmacy  
4200 East 9th Avenue, C-238  
Denver, CO 80262  
Phone: +1 303 315 2187  
Fax: +1 303 315 6281  
Email: Manjinder.Kaur@uchsc.edu

**Saebom Kim, PhD**

Biospectrum Life Science Institute  
SK Ventium 101-701  
#552 Dangjung Dong  
Gunpo City  
Gyunggi Do, 435-776  
Republic of Korea  
Phone: +82 31 436 2090  
Fax: +82 31 436 0605

**Su Na Kim**

Natural Products Research Institute  
College of Pharmacy  
Seoul National University  
28 Yeonkun-Dong, Jongno-Ku  
Seoul 110-460  
Korea

**Yeong Shik Kim, PhD**

Professor  
Natural Products Research Institute  
College of Pharmacy  
Seoul National University  
28 Yeonkun-Dong, Jongno-Ku  
Seoul 110-460  
Korea  
Phone: +82 2 740 8929  
Fax: +82 2 765 4768  
Email: kims@snu.ac.kr

**Chesahna Kindred, MD, MBA**

Department of Dermatology  
Howard University College of Medicine  
2041 Georgia Avenue, N.W.  
Washington, DC 20060

**Majda Hadolin Kolar, PhD**

Vitiva d.d.

Nova vas 98

2281 Markovci

Slovenia

Phone: +386 2 7888 736

Fax: +386 2 7888 745

Email: majda@vitiva.si

**Dr. Jean Krutmann, MD**

Professor of Dermatology &amp; Environmental Medicine

Director

Institut für Umweltmedizinische Forschung (IUF)

at the Heinrich-Heine-University Düsseldorf gGmbH

Auf'm Hennekamp 50

D-40225 Düsseldorf

Germany

Phone: +49 211 3389 224

Fax: +49 211 3389 226

Email: krutmann@rz.uni-duesseldorf.de

**Francis C. Lau, PhD, FACN**

Interhealth Research Center

Benicia, CA

Email: flau@interhealthusa.com

**Jongsung Lee**

Natural Products Research Institute

College of Pharmacy

Seoul National University

28 Yeonkun-Dong, Jongno-Ku

Seoul 110-460

Korea

**Juhyeon Lee**

Natural Products Research Institute

College of Pharmacy

Seoul National University

28 Yeonkun-Dong, Jongno-Ku

Seoul 110-460

Korea

**Howard I. Maibach, MD**

Department of Dermatology  
University of California  
90 Medical Center Way  
Surge 110, Box 0989  
San Francisco, CA 94143-0989  
Phone: +1 949 533 6892  
Fax: +1 415 753 5304  
E-mail: MaibachH@derm.ucsf.edu

**Giada Maramaldi, BSc**

Indena S.p.A.  
Viale Ortles, 12  
20139 Milan  
Italy  
Email: giada.maramaldi@indena.com

**Pierfrancesco Morganti, PhD**

R&D Director  
Mavi Sud. S.r.l.  
Via dell'Industria 1  
04011 Aprilia (LT)  
Italy  
Email: morganti@mavicosmetics.it

**Hasan Mukhtar, PhD**

Helfaer Professor of Cancer Research  
Director and Vice Chair of Research  
Department of Dermatology  
University of Wisconsin  
4385 Medical Sciences Center  
1300 University Avenue  
Madison, WI 53706  
Phone: +1 608 263 3927  
Email: hmukhtar@wisc.edu

**Ayako Noguchi, MSc**

Kyowa Hakko U.S.A., Inc.  
767 Third Avenue, 19th Floor  
New York, NY 10017  
Phone: +1 212.319.5353  
Email: info@kyowa-usa.com

**Christian O. Oresajo, PhD**

Department of Dermatology  
Howard University College of Medicine  
2041 Georgia Avenue, N.W.  
Washington, DC 20060

**Deokhoon Park, PhD**

Biospectrum Life Science Institute  
SK Ventium 101-701  
#552 Dangjung Dong  
Gunpo City  
Gyunggi Do, 435-776  
Republic of Korea  
Phone: +82 31 436 2090  
Fax: +82 31 436 0605

**Nadine Pomarede, MD**

Isocell, Paris, France  
and  
PL Thomas & Co., Inc., NJ, USA  
Phone: +1 973 984 0900 Ext. 215  
Email: PLT@PLThomas.com

**Myriam Richelle, PhD**

Nestle Research Center  
Nestec Ltd  
P.O. Box 44  
CH-1000  
Lausanne 26  
Switzerland  
Phone: +41 21 785 84 07  
Fax: +41 21 785 85 44  
Email: myriam.richelle@rdls.nestle.com

**Angela Maria Rizzo, PhD**

Professor

Institute of General Physiology and Biochemistry, "G. Esposito"

Via Trentacoste 2

20134 Milan

Italy

Phone: +39 02 50315789

Fax: +39 02 50315775

Email: [angelamaria.rizzo@unimi.it](mailto:angelamaria.rizzo@unimi.it)**Hiroshi Shimoda, PhD**

Oryza Oil &amp; Fat Chemical Co., Ltd.

1 Numata, Kitagata-cho

Ichinomiya-city, Aichi

493-8001, Japan

Phone: +81 586 86 5141

Fax: +81 586 86 6191

Email: [kaihatsu@mri.biglobe.ne.jp](mailto:kaihatsu@mri.biglobe.ne.jp)**Heike Stelling, PhD**

Nestle Research Center

Nestec Ltd

P.O. Box 44

CH-1000

Lausanne 26

Switzerland

**Deeba N. Syed, MBBS**

Research Specialist

Department of Dermatology

University of Wisconsin

4385 Medical Sciences Center

1300 University Avenue

Madison, WI 53706

Phone: +1 608 263 5519

Email: [dsyed@dermatology.wisc.edu](mailto:dsyed@dermatology.wisc.edu)

**Aaron Tabor, MD**

Physicians Pharmaceuticals, Inc.  
1031 E. Mountain Street, Building 302  
Kernersville, NC 27284  
Phone: +1 336 722 2337  
Fax: +1 336 722 7712  
Email: drtabor@revivalsoy.com

**Dr. Federica Tamburi**

Department of Dermatology  
Catholic University of Sacred Heart  
Largo A. Gemelli 8  
00168 Rome  
Italy  
Phone: +39 06 3503591  
Fax: +39 06 3503547

**Simona Urbancic**

Vitiva d.d.  
Nova vas 98  
2281 Markovci  
Slovenia  
Phone: +386 2 7888 736  
Fax: +386 2 7888 745  
Email: service@vitiva.si

**James Varani, PhD**

Department of Pathology  
The University of Michigan  
1301 Catherine Road/Box 0602  
Ann Arbor, MI 48109  
Phone: +1 734 615 0298  
Fax: +1 734 763 6476  
Email: varani@umich.edu

**Jeanette Waller, MD**

Department of Dermatology  
University of California  
90 Medical Center Way  
Surge 110, Box 0989  
San Francisco, CA 94143-0989  
Email: WallerJ@derm.ucsf.edu



**Angela Walter**

Market Development Manager  
DMV International  
40196 State Highway 10  
Delhi, NY 13753  
Phone: +1 607 746 0206  
Email: [angela.walter@dmv-ny.com](mailto:angela.walter@dmv-ny.com)

**Wendeline Wouters, PhD**

Nutrition Science & Technical Sales Support Manager  
DMV International  
40196 State Highway 10  
Delhi, NY 13753  
Phone: +1 607 746 0126  
Fax: +1 607 746 0183  
Email: [wendeline.wouters@dmv-ny.com](mailto:wendeline.wouters@dmv-ny.com)

**Shirley Zafra-Stone, BS**

Interhealth Research Center  
Benicia, CA  
Email: [sstone@interhealthusa.com](mailto:sstone@interhealthusa.com)

**Danny Zaghi**

1299 Bedford Ct.  
Sunnyvale, CA 94087  
Email: [dannyzaghi@yahoo.com](mailto:dannyzaghi@yahoo.com)

**Mohammad Abu Zaid, PhD**

Assistant Researcher  
Department of Dermatology  
University of Wisconsin  
4385 Medical Sciences Center  
1300 University Avenue  
Madison, WI 53706  
Phone: +1 608 263 5519  
Email: [azaid@dermatology.wisc.edu](mailto:azaid@dermatology.wisc.edu)

# Foreword

---

We will all live decades longer than our grandparents and parents and will have better health in our later years. With this enhanced longevity, we all want to look as young as we feel. Especially because we are inundated with images of youthful beauty on television, in films, and in glossy fashion magazines, we feel social pressure to improve our appearance. Aspiring to maintain “eternal youth” and to look good is not new and is not just superficial “vanity.” Our human nature dictates that we take care of ourselves and enhance our appearance. Throughout history, women from Cleopatra to Marie Antoinette to today’s movie stars have used cosmetics and nutrients to beautify and rejuvenate. Indeed recent psychological studies have proven that the better we look, the better we feel, and the healthier, happier, and more productive we become.

Today in the United States the number of over-45-year-olds is growing at three times the rate of the general population. To meet this demand, the cosmetic, nutrition, and health care industries have created an enormous variety of anti-aging nutritional products, supplements, topical treatments, and medical and cosmetic procedures. Information and misinformation abound. Sales representatives and retail clerks, popular press editorials and advertisements, television commercials and infomercials, news and beauty segments, home shopping networks, and the internet—all present nutritional supplements and skin care products promising beautification with reversal of the appearance of aging. How can we navigate our way through this labyrinth of claims and counterclaims?

Over 25 years ago, the prominent dermatologist Dr. Albert Kligman defined the category “cosmeceuticals” to describe topical formulations that improve the appearance of the skin by actually altering the function of the skin in a scientifically measurable way. More recently the terms “nutricosmetics” or “nutraceuticals” have defined foods and dietary supplements that benefit the health and beauty of the skin by directly affecting mechanisms and metabolism. Such cosmeceuticals and nutricosmetics are not subject to the stringent criteria and costly studies required for “drugs” in order to provide scientific and medical proof of safety and efficacy for approval by the U.S. Food and Drug Administration. Therefore, while savvy marketers promote products based loosely on science, consumers and even physicians cannot truly judge the merits of most claims.

This text, *Nutritional Cosmetics: Beauty from Within*, edited by Aaron Tabor, MD, and Robert M. Blair, PhD, presents for the first time

a compendium of the science behind dietary ingredients with the potential to benefit the health and therefore the appearance of the skin. The authors are medical doctors and scientists from academia and industry who recognize that careful, controlled studies are required to demonstrate efficacy of specific ingredients in humans, even after mechanisms of action are demonstrated in *in vitro* and in animal models. Furthermore, substantiation of each specific formulation of each product applied topically or taken orally is of utmost importance. The molecular form and the purity of the active component, the concentration, the vehicle, the pH, and the coating all affect the absorption and activity and therefore the efficacy.

This text opens with chapters describing in detail the structure and the physiology of the skin as well as the ethnic variations in certain properties and disorders of the skin and differences in cultural practices. In the following chapters, we realize that, amazingly, even several decades ago, we did not understand that environmental pollutants affect the skin, particularly sun exposure and smoking. These chapters summarize current research on mechanisms and consequences of these external onslaughts, particularly describing recent discoveries regarding the distinction between intrinsic, natural aging and extrinsic, premature aging, elucidating distinct clinical manifestations and mechanisms of each. With this review of skin physiology, how nutricosmetic ingredients can be studied to prove efficacy can be understood.

The rest of this book compiles evidence and verification as previously published in the scientific and medical literature as well as internal studies by industry about dietary ingredients with potential for skin health—including those already being applied topically. With this documentation, the reader will recognize that there are indeed nutritional supplements that have scientific substantiation of preventing and reversing aging, of protecting, of moisturizing, and of treating specific problems of the skin.

The most comprehensively researched nutricosmetics are antioxidants (vitamins C and E, carotenoids, coenzyme Q10, as well as botanicals such as the polyphenols [catechins] in green tea, the tannins and flavanoids in pomegranate, resveratrol in grapes, anthocyanins in berries, silibinin in milk thistle, carnosic and rosmarinic acids in rosemary, and genistein in soy), as well as antioxidant enzymes and trace mineral cofactors for these enzymes (such as selenium and zinc). Studies on each of these are excellently and comprehensively reviewed.

Certain nutricosmetics affect epidermal moisturization and barrier function and/or the extracellular matrix. Some ingredients can increase synthesis of collagen and prevent the UV-induced degradation of collagen and elastic tissue by matrix metalloproteinases; others increase fibroblast

proliferation and cell turnover and may even induce signaling for cellular differentiation or apoptosis. A review of evidence that amino acids, ceramides, and other plant extracts can influence epidermal moisturization and dermal mechanisms is presented.

One important chapter summarizes the benefits to the skin of probiotics (living microorganisms), which influence the composition and/or metabolism of the endogenous gut and skin microbiota. By modulating immune function, probiotics are prophylactic and therapeutic for atopic dermatitis, skin sensitivity, and food allergies. *Lactobacillus johnsonii* protects Langerhans cells from depletion after UV radiation, whereas *Lactobacillus pesodorus* inhibits odor-producing bacteria of the gut and armpits.

Numerous epidemiological studies link the abundance of particular nutrients with disease prevention and improved health. Armed with these correlations, doctors and scientists have incorporated certain of these nutrients into topical and oral formulations to improve the health and appearance of the skin. This text comprehensively reviews research on nutrients for which there is evidence of benefit to the skin “from within.” Future skin care will undoubtedly focus on these cosmeceuticals and nutraceuticals. In confirming that we can indeed achieve “beauty through science,” this book is a springboard to stimulate new ideas and future research.

Karen E. Burke, MD, PhD  
Department of Dermatology  
Mount Sinai Medical Center  
New York, NY, USA

# Preface

---

Nutritional cosmetics, more commonly referred to as nutricosmetics, embraces the idea that beauty can be enhanced through the consumption of functional dietary products that may support healthier and thus more beautiful skin. The term nutricosmetics appears to borrow from the terms nutraceuticals and cosmeceuticals to reflect the goal of these products, that is, to provide health and beauty benefits to the skin via nutritional products consumed on a regular basis.

The idea that food or other dietary ingredients can support healthy skin and beauty has existed for ages. Some of the earliest dietary products marketed for skin health and beauty included Merz Spezial-Dragees in 1964 and Oenobiol's Solaire in 1989. Despite these early forays into the nutrition and beauty arena, the market for nutricosmetic products has only recently begun to take off with any real force. A recent market research report by Kline & Company indicates that the global nutricosmetic market is valued at \$1.5 billion with the vast majority of that due to the markets in Japan and Europe. According to Euromonitor International, the market for nutricosmetics was \$2.1 billion, which was only 3% of the overall skincare market, suggesting that nutricosmetics is still very much an emerging market. In fact, various market analyses suggest that the market for nutricosmetic products will continue to increase at a substantial rate.

At the moment it appears that the marketing of nutricosmetics is ahead of the science for these products and ingredients in general, though that is not to say that quality research has not been done on some nutricosmetic ingredients. To date, there are a multitude of ingredients now being marketed for their purported skin health and beauty benefits and their utility for incorporation into nutricosmetic products. These ingredients often are marketed based on their antioxidant capacity and the resulting inferred skin benefits. However, in many cases no research on their actual dermatological benefits has been published or conducted. Nonetheless, many of these ingredients are already being applied topically with positive results, so it would not be totally surprising if oral consumption produced similar effects.

A look into the peer-reviewed scientific literature reveals an emerging body of evidence in support of the potential benefits of nutritional products for skin health. The studies are wide ranging and explore the effects of ingredients on both mechanistic endpoints (antioxidant capacity, anti-inflammatory properties, modulation of enzymes involved in extracellular

matrix restructuring, etc.) and functional endpoints (anti-wrinkling, reduction of erythema, skin hydration, etc.). While the science in this area is quickly emerging, it is far from extensive enough to provide definitive conclusions at this time. In addition to the growing body of evidence published in the scientific literature, a plethora of information has been presented only in industry white papers or marketing materials. These materials show the promise of many of the marketed ingredients and also provide a great starting point for more definitive studies.

The purpose of this book was to compile the scientific evidence showing the potential benefits of at least some of the better-studied nutricosmetic ingredients. We started this project by searching the peer-reviewed literature for nutritional ingredients with evidence of skin health benefits. We additionally contacted several industry leaders currently marketing nutricosmetic products backed by scientific research. The response from the thought leaders in this field was overwhelming and the result is this compilation of excellent contributions that delve into the science behind dietary ingredients for improved skin health.

It is apparent that consumers today are very well informed and take their personal care very seriously. More and more consumers are looking for products that are both environmentally friendly and provide specific health benefits that meet their specific needs. With this interest in the potential health benefits of the products they consume, the importance of the science behind the products will continue to grow. While many functional ingredients will initially do well in the market based on their novelty, we believe that ingredients and products with sound science behind them will lead the way in the field of nutricosmetics.

Aaron T. Tabor, MD, and Robert M. Blair, PhD  
June 2009

---

# Introduction

**Aaron Tabor, MD, and Robert M. Blair, PhD**

*Physicians Pharmaceuticals Inc., Kernersville, NC, USA*

---

## **I.1 What is “Nutritional Cosmetics”?**

Nutritional cosmetics, which is probably better known in the industry as nutricosmetics, encompasses the concept that orally ingestible dietary products may support healthier and thus more beautiful skin. This is not totally unlike the term nutraceutical; however, this latter term typically refers to foods and dietary supplements that support better overall health. Similarly, the term cosmeceutical refers to products generally designed for topical application and which contain active ingredients with benefits for improved skin health.

The term nutricosmetics appears to borrow from the terms nutraceuticals and cosmeceuticals to reflect the goal of these products, that is to provide beauty and health benefits to the skin via nutritional products consumed on a regular basis. This concept encompasses a unique amalgamation of the nutrition and personal care industries.

More and more nutricosmetic products are reaching the retail shelves and can be found as functional beverages (e.g., NutriSoda from Andrea Beverage Co., Skin Balance Water from Borba), dietary supplements (e.g., Murad’s Firm & Tone dietary supplement, Perricone’s Skin & Total Body dietary supplement), and functional foods (e.g., Danone’s Essensis beauty yogurt, Ecco Bella’s Chocolate Instant Bliss Beauty Bar).

## **1.2 The Nutricosmetic Market**

While the idea that dietary ingredients can support healthy skin and beauty has been around for some time, it seems that it is only now receiving much attention. As such, the market for nutricosmetic products has only recently begun to take off with any real force. According to the 2006 Datamonitor report “Seeking Beauty Through Nutrition” (from Seaton T. Wellness trends in personal care. *Beauty from the Inside & Out* 2006; 1:16–22), sales of oral beauty supplements in 2005 was \$742 million in the United States, \$224 million in France, \$162 million in Germany, and \$95 million in the United Kingdom. Expected growth of oral beauty supplement sales through the year 2010 ranges from approximately 7% to 12%.

According to this article, the Datamonitor report further indicated that half of the survey participants considered themselves conscious of skin nutrition, while nearly half of the respondents believed that what they ate could have just as much effect on skin health as topical products. With this belief and consumers’ ever-growing interest in the science behind the products they choose, we believe that ingredients and products with sound science behind them will lead the way in the field of nutricosmetics.

## **1.3 “Nutritional Cosmetics: Beauty from Within”—An Overview**

There are a multitude of ingredients now being marketed for their purported skin health and beauty benefits and their utility for incorporation into nutricosmetic products. These ingredients often are marketed based on their antioxidant capacity and inferred skin benefits, though little or no research on their dermatological benefits has been published. However, many of these ingredients are already being applied topically with a reduction in wrinkles, so it is not that much of a surprise that oral consumption may produce similar effects.

Nonetheless, there are quite a few dietary ingredients with scientific backing for their potential skin health benefits. Though some of this evidence has been published in the scientific literature, a plethora of information has been presented only in industry white papers or marketing materials. The purpose of this book is to compile the scientific evidence showing the potential benefits of at least some of these nutricosmetic ingredients. By including the efforts of both academic and industry investigators, we believe that the presentation of the known scientific data with new information brings the state of nutricosmetic science up to the present



and provides a foundation from which to generate new ideas and information. Where possible, information specifically about the benefits of ingredients consumed orally for skin health is presented.

Part 1 of this book consists of four chapters that provide an excellent overview of skin biology, including an in-depth look at the structure and function of skin and its components by Dr. Leonardo Celleno, an examination of ethnic skin by Dr. Chesahna Kindred, and overviews of both natural (Mr. Danny Zaghi) and premature (Dr. Jean Krutmann) aging of the skin.

In Chapter 5, Dr. Pierfrancesco Morganti discusses the concept of “beauty from within” and the integration of functional foods with cosmeceuticals for total body beauty from the inside and the outside. Vitamins and minerals have been reported to have healthful benefits for the skin. These are explored in Chapters 6 (Dr. Myriam Richelle) and 7 (Dr. Bruno Berra).

One of the most popular categories of nutricosmetic ingredients is the antioxidants. These ingredients have been proposed to support skin health and beauty through their ability to suppress and/or reverse oxidative damage to the skin caused by such stressors as UV light from the sun. Some of the more popular and efficacious ingredients are examined in Part 4 of the book, which starts off with an excellent overview of the potential benefits of botanical antioxidants by Dr. Mohammad Abu Zaid, which briefly touches upon the role of several specific ingredients. This part of the book also includes chapters on carotenoids (Dr. Pierfrancesco Morganti), coenzyme Q10 (Dr. Yutaka Ashida), healthy fruits (Dr. Francis Lau), olive fruit (Dr. Aldo Cristoni), and the skin’s natural antioxidant enzymes (Dr. Nadine Pomarede).

One of the more important aspects of healthy looking skin is a smooth appearance. However, a smooth appearance can be difficult to maintain without a firm foundation and proper hydration. Dr. James Varani and Dr. Zoe Draelos discuss the importance of these aspects. Natural dietary ingredients that may support a firm skin foundation and proper skin hydration are discussed in Parts 5 and 6 of the book. A firm, skin-supporting foundation may be boosted with ingredients that are precursors to the skin’s extracellular matrix like amino acids. Additionally, ingredients that stimulate collagen synthesis and inhibit enzymes responsible for the breakdown of the extracellular matrix may support the skin’s foundation. Proper hydration is important for both the skin’s barrier function and for a smooth appearance. Such ingredients as rice ceramides and tocotrienols are discussed in this regard. Additionally, ingredients that support fibroblast proliferation and cell turnover may lead to smoother, healthier-looking skin.

In addition to dietary ingredients that may help support a firm foundation and good skin hydration, a number of other ingredients have been