Methods in Enzymology

Volume 282

Vitamins and Coenzymes

Part L

EDITED BY

Donald B. McCormick

DEPARTMENT OF BIOCHEMISTRY
EMORY UNIVERSITY
ATLANTA, GEORGIA

John W. Suttie

DEPARTMENTS OF BIOCHEMISTRY AND NUTRITIONAL SCIENCES
UNIVERSITY OF WISCONSIN-MADISON
MADISON, WISCONSIN

Conrad Wagner

DEPARTMENT OF VETERANS AFFA\RS MEDICAL CENTER
AND DEPARTMENT OF BIOCHEMISTRY
VANDERBILT UNIVERSITY SCHOOL OF MEDICINE
NASHVILLE, TENNESSEE



ACADEMIC PRESS

San Diego London Boston New York Sydney Tokyo Toronto

Table of Contents

CONTRIBUTORS TO VOLUME 282		ix
PREFACE		xiii
VOLUMES IN SERIES		xv
Section I. Vitami	in A	
 Generation and Characterization of Cellular Reti- noic Acid-Binding Proteins from Escherichia coli Expression Systems 	Andrew W. Norris and Ellen Li	3
2. Generating and Characterizing Retinoid Receptors from <i>Escherichia coli</i> and Insect Cell Expression Systems	Margaret Clagett-Dame and Joyce J. Repa	13
3. Expression and Characterization of Retinoid Receptors in Yeast	ELIZABETH A. ALLEGRETTO AND RICHARD A. HEYMAN	25
4. Use of in Situ Hybridization Techniques to Study Embryonic Expression of Retinoid Receptors and Binding Proteins	Annie Rowe and Paul M. Brickell	33
5. Use of Quantitative Polymerase Chain Reaction to Study Retinoid Receptor Expression	Nicoletta Ferrari, Giorgio Vidali, and Ulrich Pfeffer	48
 Use of Quantitative Polymerase Chain Reaction to Study Cellular Retinoic Acid-Binding Protein-II mRNA Expression in Human Skin 	Lubing Zhou, Gail Otulakowski, and Catherine Y. Lau	64
7. Use of Transgenic Mice to Study Activation of Reti- noic Acid-Responsive Promoters	Leszek Wojnowski and Andreas Zimmer	77
8. Use of Transgenic Mice to Eliminate Retinoic Acid Receptor Function in Specific Tissues	Mitinori Saitou, Toshihiro Tanaka, and Akira Kakizuka	85
Use of Reporter Cells to Study Endogenous Reti- noid Sources in Embryonic Tissues	MICHAEL A. WAGNER	98
10. Preparation of Radiolabeled 9-cis- and all-trans-	PRAVEEN K. TADIKONDA AND HECTOR F. DELUCA	108

11.	Identification and Quantification of Retinoic Acid and Other Metabolites from β -Carotene Excentric Cleavage in Human Intestine <i>in Vitro</i> and Ferret Intestine <i>in Vivo</i>		117
12.	Assessing Metabolism of β -[13 C]Carotene Using High-Precision Isotope Ratio Mass Spectrometry		130
13.	Atmospheric Pressure Chemical Ionization and Electron Capture Negative Chemical Ionization Mass Spectrometry in Studying β -Carotene Conversion to Retinol in Humans	BRUCE A. ANDRIEN,	140
	Section II. Vitam	in D	
14.	Synthesis of [3\$\alpha\$-\$^3\$H]Vitamin D\$_3 and 1\$\alpha\$,25-Dihydroxy[1\$\beta\$-\$^3\$H]Vitamin D\$_3	RAHUL RAY AND MICHAEL F. HOLICK	157
15.	Assay of 1,25-Dihydroxyvitamin D_3 from Serum Samples: Use of Receptor-Binding or Enzyme-Coupled Reporter Analysis		164
16.	Quantitation of 25-Hydroxyvitamin D and 1,25-Di- hydroxyvitamin D by Radioimmunoassay Using Radioiodinated Tracers	BRUCE W. HOLLIS	174
17.	Assay of Vitamin D Derivatives and Purification of Vitamin D Hydroxylases	Yoshihiko Ohyama, Shin-ichi Hayashi, Emiko Usui, Mitsuhide Noshiro, and Kyu-Ichiro Okuda	186
18.	Assay of 25-Hydroxyvitamin D 1α -Hydroxylase and 24-Hydroxylase	Matthew J. Beckman and Hector F. DeLuca	200
19.	$\label{eq:molecular cloning of Vitamin D_3 Hydroxylases} \begin{tabular}{ll} Molecular Cloning of Vitamin D_3 Hydroxylases \\ & \cdot \\$	Mitsuhide Noshiro, Yoshihiko Ohyama, Emiko Usui, Megumi Akiyoshi-Shibata, Yoshiyasu Yabusaki, and Kyu-Ichiro Okuda	213
20.	Role of $1\alpha,25$ -Dihydroxyvitamin D_3 in Osteoclast Differentiation and Function	Tatsuo Suda, Eijiro Jimi, Ichiro Nakamura, and Naoyuki Takahashi	223
21.	Assay of Direct Effect of 1,25-Dihydroxyvitamin D_3 on Calcium Ion Influx into Cultured Osteoblasts		236

Section III. Vitamin E

22. Vitamin E Status and Immune Function	Alison Beharka, Susan Redican, Lynette Leka, and Simin Nikbin Meydani	247
23. Inhibition of Platelet Adhesion as Functional Test for Vitamin E Status	Manfred Steiner	264
24. Inhibition of Plasma Cholesterol Ester Hydroperox- ide and Phosphatidylcholine Hydroperoxide For- mation as Measures of Antioxidant Status	Noriko Noguchi and Etsuo Niki	271
25. α -Tocopherol-Binding Proteins: Purification and Characterization	ASIM K. DUTTA-ROY	278
26. α-Carboxyethyl-6-Hydroxychroman as Urinary Metabolite of Vitamin E	Manfred Schultz, Marcel Leist, Angelika Elsner, and Regina Brigelius-Flohé	297
Section IV. Vitam	in K	
27. Purification of Vitamin K-Dependent Carboxylase from Cultured Cells	KATHLEEN L. BERKNER AND BETH A. McNALLY	313
28. Purification of Native Bovine Carboxylase and Expression and Purification of Recombinant Bovine Carboxylase		333
29. Purification of γ -Glutamyl Carboxylase from Bovine Liver	SHEUE-MEI WU, VASANTHA P. MUTUCUMARANA, AND DARREL W. STAFFORD	346
30. Assay of Vitamin K-Dependent Carboxylase Activity in Hepatic and Extrahepatic Tissues	ROGER J. T. J. HOUBEN, BERRY A. M. SOUTE, AND CEES VERMEER	358
31. Expression of Human Anticoagulation Protein C and γ-Carboxyglutamic Acid Mutants in Mammalian Cell Cultures		369
32. Determination of Site-Specific γ-Carboxyglutamic Acid Formation by Vitamin K-Dependent Carboxylase Utilizing De-γ-carboxy Bone Gla Protein as Substrate		384
33. Purification of Warfarin-Sensitive Vitamin K Epoxide Reductase	Reidar Wallin and Thomas M. Guenthner	395

34.	Determination of Vitamin K Compounds in Plasma or Serum by High-Performance Liquid Chroma- tography Using Postcolumn Chemical Reduction and Fluorimetric Detection		408
35.	Assay of Phylloquinone in Plasma by High-Performance Liquid Chromatography with Electrochemical Detection	•	421
36.	Assay of Menaquinones in Plasma Utilizing Dual- Electrode Electrochemical Detection	STEPHEN J. HODGES	434
37.	Assay of Phylloquinone and Menaquinones in Human Liver	Yuл Usuı	438
38.	Determination of Phylloquinone in Foods by High-	SARAH L. BOOTH AND	
	Performance Liquid Chromatography	James A. Sadowski	446
39.	Assay of Menaquinones in Bacterial Cultures, Stool Samples, and Intestinal Contents	JOHN M. CONLY	457
Αυ	THOR INDEX		467
Crit	HECT INDEX		401