

Methods in Enzymology

Volume 281

Vitamins and Coenzymes

Part K

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 AFFAIRS 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 281	ix
PREFACE	xiii
VOLUMES IN SERIES	xv

Section I. Folic Acid

1. Total Chemical Synthesis of Chirally Pure (6 <i>S</i>)-Tetrahydrofolic Acid	STEVEN W. BAILEY AND JUNE E. AYLING	3
2. Analysis of Folates Using Combined Affinity and Ion-Pair Chromatography	PAMELA J. BAGLEY AND JACOB SELHUB	16
3. Molar Quantitation of Folates by Gas Chromatography-Mass Spectrometry	CHERUPPOLIL R. SANTHOSH-KUMAR AND J. FRED KOLHOUSE	26
4. Microbiological Assay of Folates in 96-Well Microtiter Plates	DONALD W. HORNE	38
5. Microbiological Assay for Serum, Plasma, and Red Cell Folate Using Cryopreserved, Microtiter Plate Method	ANNE M. MOLLOY AND JOHN M. SCOTT	43
6. Determination of Tetrahydrobiopterin Biosynthetic Activities by High-Performance Liquid Chromatography with Fluorescence Detection	ERNST R. WERNER, HELMUT WACHTER, AND GABRIELE WERNER-FELMAYER	53
7. Microtiter Plate Assay for Biopterin Using Cryopreserved <i>Crithidia fasciculata</i>	ROBERT J. LEEMING	61
8. Identification and Assay of Folate Catabolites in Human Urine	JOE McPARTLIN AND JOHN M. SCOTT	70
9. Enzymatic Determination of Folylpolylglutamate Pools	VERNE SCHIRCH	77
10. Synthesis and Interconversion of Reduced Folyl-polyglutamates	VERNE SCHIRCH	81
11. Chemical Synthesis of (6 <i>S</i>)-5-Formyl-5,6,7,8-tetrahydropteroylpoly- γ -L-glutamates	ANTHONY L. FITZHUGH AND RHONE K. AKEE	88
12. Biotin Derivatives of Folate Compounds: Synthesis and Utilization for Visualization and Affinity Purification of Folate Transport Proteins	JIANGUO FAN AND FRANK HUENNEKENS	97

13. Preparation of Stable Isotopically Labeled Folates for <i>in Vivo</i> Investigation of Folate Absorption and Metabolism	CHRISTINE M. PFEIFFER AND JESSE F. GREGORY III	106
14. Interconversion of 6- and 7-Substituted Tetrahydropterins via Enzyme-Generated 4a-Hydroxytetrahydropterin Intermediates	SHELDON MILSTIEN	116
15. Enzymatic Synthesis of 6 <i>R</i> -[U- ¹⁴ C]Tetrahydrobiopterin from [U- ¹⁴ C]GTP	MASAAKI HOSHIGA AND KAZUYUKI HATAKEYAMA	123
16. Use of 10-Formyl-5,8-dideazafolate as Substrate for Rat 10-Formyltetrahydrofolate Dehydrogenase	ROBERT J. COOK	129
17. Human Cytosolic Folylpoly- γ -glutamate Synthase	IAN ATKINSON, TIMOTHY GARROW, ALBERT BRENNER, AND BARRY SHANE	134
18. Folylpolyglutamate Synthase from Higher Plants	HELENA C. IMESON AND EDWIN A. COSSINS	141
19. Purification of Folate-Dependent Enzymes from Rabbit Liver	VERNE SCHIRCH	146
20. Human 5,10-Methenyltetrahydrofolate Synthetase	JACQUES JOLIVET	162
21. Mitochondrial NAD-Dependent Methylenetetrahydrofolate Dehydrogenase-Methenyltetrahydrofolate Cyclohydrolase	ROBERT E. MACKENZIE	171
22. Monofunctional NAD-Dependent 5,10-Methylenetetrahydrofolate Dehydrogenase from <i>Saccharomyces cerevisiae</i>	DEAN R. APPLING AND MARY G. WEST	178
23. Methionine Synthase from Pig Liver	RUMA BANERJEE, ZHIQIANG CHEN, AND SUMEDHA GULATI	189
24. Purification and Assay of Cobalamin-Dependent Methionine Synthase from <i>Escherichia coli</i>	JOSEPH T. JARRETT, CELIA W. GOULDING, KERRY FLUHR, SHA HUANG, AND ROWENA G. MATTHEWS	196
25. Formyltetrahydrofolate Hydrolase from <i>Escherichia coli</i>	HOWARD ZALKIN	214
26. Use of ¹³ C Nuclear Magnetic Resonance to Evaluate Metabolic Flux through Folate One-Carbon Pools in <i>Saccharomyces cerevisiae</i>	DEAN R. APPLING, EVDOKIA KASTANOS, LAURA B. PASTERNAK, AND YAKOV Y. WOLDMAN	218

Section II. Vitamin B₁₂ and Cobalamins

27. Use of Magnetic Field Effects to Study Coenzyme B ₁₂ -Dependent Reactions	CHARLES B. GRISSOM AND ETTAYA NATARAJAN	235
28. Analysis of Cobalamin and Cobalamin Analogs by Gas Chromatography-Mass Spectrometry	DAVID P. SUNDIN AND ROBERT H. ALLEN	247
29. Expression of Functional Intrinsic Factor Using Recombinant Baculovirus	MARILYN M. GORDON, GREG RUSSELL-JONES, AND DAVID H. ALPERS	255
30. Quantitative Methods for Measurement of Transcobalamin II	SHELDON P. ROTHENBERG AND EDWARD V. QUADROS	261
31. Molecular Methods for Analysis and Expression of Transcobalamin II	LIAN QIAN, EDWARD V. QUADROS, AND SHELDON P. ROTHENBERG	269
32. Purification, Membrane Expression, and Interactions of Transcobalamin II Receptor	SANTANU BOSE AND BELLUR SEETHARAM	281
33. Purification and Characterization of Aquacobalamin Reductase from <i>Euglena gracilis</i>	FUMIO WATANABE AND YOSHIHISA NAKANO	289
34. Purification and Characterization of Aquacobalamin Reductases from Mammals	FUMIO WATANABE AND YOSHIHISA NAKANO	295

Section III. Heme

35. Continuous Coupled Assay for 5-Aminolevulinate Synthase	PETER M. SHOOLINGIN-JORDAN, JEREMY E. LELAN, AND ADRIAN J. LLOYD	309
36. Dipyromethane Cofactor Assembly of Porphobilinogen Deaminase: Formation of Apoenzyme and Preparation of Holoenzyme	PETER M. SHOOLINGIN-JORDAN, MARTIN J. WARREN, AND SARAH J. AWAN	317
37. Coupled Assay for Uroporphyrinogen III Synthase	PETER M. SHOOLINGIN-JORDAN AND ROBERT LEADBEATER	327
38. Expression and Purification of Mammalian 5-Aminolevulinate Synthase	HARRY A. DAILEY AND TAMARA A. DAILEY	336
39. Expression, Purification, and Characteristics of Mammalian Protoporphyrinogen Oxidase	TAMARA A. DAILEY AND HARRY A. DAILEY	340
40. Purification and Properties of Uroporphyrinogen Decarboxylase from Human Erythrocytes	ANDREW G. ROBERTS AND GEORGE H. ELDER	349
41. Purification and Properties of Coproporphyrinogen III Oxidase from Bovine Liver	TAKEO YOSHINAGA	355

42. Purification and Properties of Coproporphyrinogen III Oxidase from Yeast	PIERRE LABBE	367
43. Expression, Purification, and Characterization of Recombinant Mammalian Ferrochelatase	VERA M. SELLERS AND HARRY A. DAILEY	378
Section IV. Miscellaneous Vitamins and Coenzymes		
44. Structural Characterization of Modified Folates in Archaea	ROBERT H. WHITE	391
Section V. Methodologies Broadly Applicable to Vitamins and Coenzymes		
45. Biokinetic Analysis of Vitamin Absorption and Disposition in Humans	JANOS ZEMPLENI	405
46. <i>In Situ</i> Kinetics: An Approach to Recommended Intake of Vitamin C	MARK LEVINE, STEVEN C. RUMSEY, YAOHUI WANG, JAE PARK, ORAN KWON, AND NOBUYUKI AMANO	425
AUTHOR INDEX		439
SUBJECT INDEX		457