

Methods in Enzymology

Volume 309

Amyloid, Prions, and Other Protein Aggregates

EDITED BY Ronald Wetzel

UNIVERSITY OF TENNESSEE MEDICAL CENTER
KNOXVILLE, TENNESSEE

Technische Universität Darmstadt
FACHBEREICH 10 — BIOLOGIE
— Bibliothek —
Schnittspahnstraße 10
D-6 4 2 8 7 Darmstadt

Inv.-Nr. 21167



ACADEMIC PRESS

San Diego London Boston New York Sydney Tokyo Toronto

Table of Contents

Contributors to Volume 309		хi
Preface		xvii
Volumes in Series		xix
Section I. Characterization of in Vi	vo Protein Deposition	
A´. Identification and Isolation	of Aggregates	
Staining Methods for Identification of Amyloid in Tissue	Gunilla T. Westermark, Kenneth H. Johnson, and Per Westermark	3
2. Isolation and Characterization of Amyloid Fibrils from Tissue	GLENYS A. TENNENT	26
3. Isolating Inclusion Bodies from Bacteria	George Georgiou and Pascal Valax	48
4. Isolation of Amyloid Deposits from Brain	ALEX EUGENE ROHER AND YU-MIN KUO	58
B. Isolation and Characterization of Prot	ein Deposit Components	
5. Microextraction and Purification Techniques Applicable to Chemical Characterization of Amyloid Proteins in Minute Amounts of Tissue	*	69
6. Purification of Paired Helical Filament Tau and Normal Tau from Human Brain Tissue	Virginia MY. Lee, Jun Wang, and John Trojanowski	81
 Chemical Modifications of Deposited Amyloid-β Peptides 	JONATHAN D. LOWENSON, STEVEN CLARKE, AND ALEX EUGENE ROHER	89
C. Characterization of Aggregates	in Situ and in Vitro	
8. Monoclonal Antibodies Specific for the Native, Disease-Associated Isoform of Prion Protein	CARSTEN KORTH, PETER STREIT, AND BRUNO OESCH	106

9. A	ssays of Protease-Resistant Prion Protein and Its Formation	BRYON CAUGHEY, MOTOHIRO HORIUCHI, RÉMI DEMAIMAY, AND GREGORY RAYMOND	122
10. <i>In</i>	2 Situ Methods for Detection and Localization of Markers of Oxidative Stress: Application in Neurodegenerative Disorders		133
11. A	dvanced Glycation End Products: Detection and Reversal	YOUSEF AL-ABED, APHRODITE KAPURNIOTU, AND RICHARD BUCALA	152
12. A	nalysis of Transglutaminase-Catalyzed Isopeptide Bonds in Paired Helical Filaments and Neurofi- brillary Tangles from Alzheimer's Disease		172
5	Section II. Characterization of in Vi	itro Protein Deposition	
	A. Managing the Aggregati	on Process	
13. M	Methodological and Chemical Factors Affecting Amyloid- β Peptide Amyloidogenicity	MICHAEL G. ZAGORSKI, JING YANG, HAIYAN SHAO, KAN MA, HONG ZENG, AND ANITA HONG	189
14. In	n Vitro Immunoglobulin Light Chain Fibrillogenesis	JONATHAN WALL, CHARLES L. MURPHY, AND ALAN SOLOMON	204
15. In	nhibition of Aggregation Side Reactions during in Vitro Protein Folding	Eliana De Bernardez Clark, Elisabeth Schwarz, and Rainer Rudolph	217
	nhibition of Stress-Induced Aggregation of Protein Therapeutics	JOHN F. CARPENTER, BRENT S. KENDRICK, BYEONG S. CHANG, MARK C. MANNING, AND THEODORE W. RANDOLPH	236
	B. Aggregation The	ory	
17. A	analysis of Protein Aggregation Kinetics	Frank Ferrone	256
	C. Monitoring Aggregate Growth	by Dye Binding	
18. Q	Quantification of β -Sheet Amyloid Fibril Structures with Thioflavin T	*	274

19.	Quantifying Amyloid by Congo Red Spectral Assay	WILLIAM E. KLUNK, ROBERT F. JACOB, AND R. PRESTON MASON	285
20.	Kinetic Analysis of Amyloid Fibril Formation	Hironobu Naiki and Fumitake Gejyo	305
	D. Measurement and Characterization of	Assembly Intermediates	
21.	Small-Zone, High-Speed Gel Filtration Chromatography to Detect Protein Aggregation Associated with Light Chain Pathologies		318
22.	Detection of Early Aggregation Intermediates by Native Gel Electrophoresis and Native Western Blotting		333
F	E. Monitoring Aggregate Growth by Measurir	ng Solid-Phase Accumulatio	n
23.	Deposition of Soluble Amyloid- β onto Amyloid Templates: Identification of Amyloid Fibril Extension Inhibitors	•	350
24.	Membrane Filter Assay for Detection of Amyloid- like Polyglutamine-Containing Protein Aggre- gates		375
25.	Analysis of Fibril Elongation Using Surface Plasmon Resonance Biosensors	DAVID G. MYSZKA, STEPHEN J. WOOD, AND ANJA LEONA BIERE	386
26.	Methods for Studying Protein Adsorption	Vladimir Hlady, Jos Buijs, and Herbert P. Jennissen	402
	F. Monitoring Aggregate Growth and Struc	ture Using Light Scattering	
27.	Monitoring Protein Assembly Using Quasielastic Light Scattering Spectroscopy	ALEKSEY LOMAKIN, GEORGE B. BENEDEK, AND DAVID B. TEPLOW	429
28.	Flow Cytometric Characterization of Amyloid Fibrils	Jonathan Wall and Alan Solomon	460
	G. Aggregation Inhib	itors	·
29.	Screening for Pharmacologic Inhibitors of Amyloid Fibril Formation	Harry LeVine III and Jeffrey D. Scholten	467

30.	Design and Testing of Inhibitors of Fibril Formation	Mark A. Findeis and Susan M. Molineaux	476
	Section III. Aggregate and Precurs	sor Protein Structure	
	A. Aggregate Morpho	ology	
31.	Electron Microscopy of Prefibrillar Structures and Amyloid Fibrils	Ellen Holm Nielsen, Mads Nybo, and Sven-Erik Svehag	491
32.	In Situ Electron Microscopy of Amyloid Deposits in Tissues	Sadayuki Inoue and Robert Kisilevsky	496
33.	Analysis of Amyloid-β Assemblies Using Tapping Mode Atomic Force Microscopy under Ambient Conditions		510
	B. Molecular Level Aggregat	e Structure	
34.	X-Ray Fiber Diffraction of Amyloid Fibrils	Louise C. Serpell, Paul E. Fraser, and Margaret Sunde	526
35.	Solid State Nuclear Magnetic Resonance of Protein Deposits	DAVID E. WEMMER	536
36.	Fourier Transform Infrared Spectroscopy in Analysis of Protein Deposits	SANGITA SESHADRI, RITU KHURANA, AND ANTHONY L. FINK	559
37.	Stable Isotope-Labeled Peptides in Study of Protein Aggregation	MICHAEL A. BALDWIN	576
38.	Mapping Protein Conformations in Fibril Structures Using Monoclonal Antibodies	ERIK LUNDGREN, HAKAN PERSSON, KARIN ANDERSSON, ANDERS OLOFSSON, INGRID DACKLIN, AND	
	•	GUNDARS GOLDSTEINS	591
	C. Characterization of Precursor	Protein Structure	
39.	Analysis of Protein Structure by Solution Optical Spectroscopy	Wilfredo Colón	605
40.	Probing Conformations of Amyloidogenic Proteins by Hydrogen Exchange and Mass Spectroscopy		633

Section IV. Cellular and Organismic Consequences of Protein Deposition

$\overset{\textstyle \subset}{{\rm A.}}$ Microbial Model Systems

41.	Yeast Prion [X+] and Its Determinant, Sup35p	TRICIA R. SERIO, ANIL G. CASHIKAR, JAHAN J. MOSLEHI, ANTHONY S. KOWAL, AND SUSAN L. LINDQUIST	649
	B. Animal Models of Protein Dep	osition Diseases	
42.	The Senescence-Accelerated Mouse	KEIICHI HIGUCHI, MASANORI HOSOKAWA, AND TOSHIO TAKEDA	674
43.	Detection of Polyglutamine Aggregation in Mouse Models	STEPHEN W. DAVIES, KIRUPA SATHASIVAM, CARL HOBBS, PATRICK DOHERTY, LAURA MANGIARINI, EBERHARD SCHERZINGER, ERICH E. WANKER, AND GILLIAM P. BATES	687
44.	A Mouse Model for Serum Amyloid A Amyloidosis	MARK S. KINDY AND FREDERICK C. DE BEER	701
	C. Cell Studies on Protein Aggre	gate Cytotoxicity	
45.	Toxicity of Protein Aggregates in PC12 Cells: 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium Bromide Assay	MARK S. SHEARMAN	716
46.	Inflammatory Responses to Amyloid Fibrils	STEPHEN L. YATES, JUNE KOCSIS-ANGLE, PAULA EMBURY, AND KURT R. BRUNDEN	723
47.	Impairment of Membrane Transport and Signal Transduction Systems by Amyloidogenic Pro- teins	Mark P. Mattson	733
48.	Amyloid β -Peptide-Associated Free Radical Oxidative Stress, Neurotoxicity, and Alzheimer's Disease		746

AUTHOR INDEX

TABLE OF CONTENTS

769

	••	
_		ţ
. ~		•
•		
	-,	
•		
		\
	*	
	·	•
	x	
		L.
•		. ,