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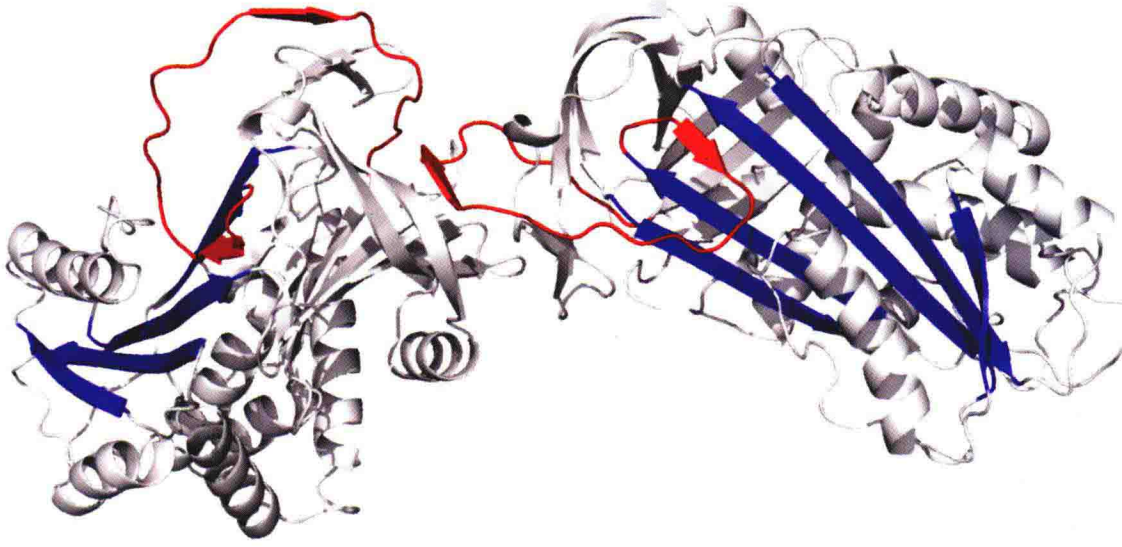
METHODS IN PROTEIN BIOCHEMISTRY



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Methods in Protein Biochemistry

Edited by Harald Tschesche

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Preface

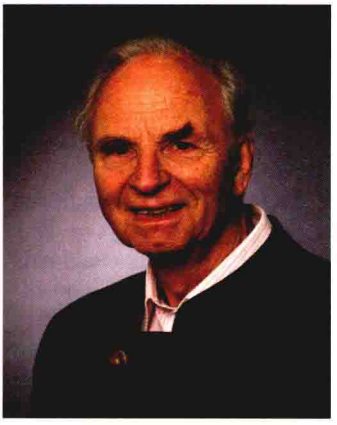
The enormous progress in protein biochemistry within the past five decades is the result of the very rapid development and progress in analytical methods. Therefore, it is the intention of this book to provide the continuously growing family of researchers involved in the study of proteins with a compendium that reviews the latest developments in the very special fields of protein studies in vitro and in vivo. It is not the aim of this book to provide a complete listing of all efforts made in a particular field but, rather, to give experts the opportunity to evaluate particular developments and to offer the inexperienced investigator an opportunity to orient himself or herself among the literature and to evaluate the chosen method in accordance with his or her special needs.

Of course, this book can only provide a highly selected assortment from the multiplicity of analytical methods, which I selected from authors that I met at research meetings, such as the International Association of Protein Structure Analysis and Proteomics (IAPSAP) and the Max-Bergman-Kreis (MBK), or that I contacted on recommendation or because of personal acquaintance. Hence, I would like to thank Ettore Appella, Carl Anderson, Jan Johansson, and Roland Schauer for support and valuable suggestions.

It is hoped that this book will help to extend methodological knowledge, assist the reader in the evaluation and application of these methods, facilitate the approach to actual scientific problems, and help avoid time-consuming and unnecessary errors.

Münster, August 2011
Harald Tschesche

Editor



Prof. Dr. Harald Tschesche (em.), Professor of Biochemistry at the University of Bielefeld studied Chemistry at the University Bonn and Chemistry and Microbiology at the University Heidelberg, where he received his doctorate with the Nobel Laureate Prof Wittig. After a year as research associate at the Massachusetts Institute of Technology (MIT) he worked with Prof. Weygand at the Technical University in Munich (TUM) and habilitated in 1970. He got nomination for chairs at the Universities of Braunschweig, Essen, and Bielefeld. He published 366 peer reviewed scientific articles and edited 9 books including the German translation of the Lehninger, Nelson, Cox: Principles in Biochemistry, 1994. He received the Max-Bergmann Medal 1994 for Peptide and Protein Research; and is a member of the board of directors for the International Association for Protein Structure Analysis and Proteomics (IAPSAP) and an executive board member of the association for Research and Technology Transfer (GFT) at the University Bielefeld.

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Abbreviations

Aβ	amyloid β peptide
ACP	acyl carrier protein
ACP-L46W	*Vibrio harveyi* ACP with leucine to tryptophan mutation at position 46
ACTH	adrenocorticotropic hormone
AD	Alzheimer's disease
AMP	adenosinmonophosphate
ANS	anilinonaphtalene sulfonic acid
AP	acceptor peptide
APP	amyloid precursor protein
ATF6	activating transcription factor 6
ATP	adenosine triphosphate
AUC	analytical ultracentrifugation
BAG-1	Bcl2-associated athanogen
BAL	bronchoalveolar lavage fluid
BC	O^2-Benzylcytosine
BG	O^6-Benzylguanine
BiP	binding protein
BirA	biotin ligase
BSA	bovine serum albumin
BS^2G	bis(sulfosuccinimidyl) glutarate
BS^3	bis(sulfosuccinimidyl) suberate
BTP	bromothenylpteridine
BVA	biological variation analysis
CAL	CFTR-associated ligand
CALI	chromophore-assisted laser inactivation
CAP	chaperone-assisted proteasomal degradation
CASA	chaperone-assisted selective autophagy
CCD	charge coupled device (two-dimensional position sensitive detector)
CD	circular dichroism
CDI	1,1′-carbonyldiimidazole
CDT	1,1′-carbonyldi(1,2,4-triazole)
CF	cystic fibrosis
CFTR	cystic fibrosis transmembrane conductance regulator
CGHC	cysteine-containing active sites
CHAPS	3-[(3-cholamidopropyl)-dimethylammonio]-1-propanesulfonate
CHIP	carboxy terminus of Hsc70 interacting protein
CHO	choline oxidase
CI2	chymotrypsin inhibitor 2
CJD	Creutzfeld-Jakob disease

CMA	chaperone-mediated autophagy
CMC	critical micelle concentration
CNX	calnexin
CoA	coenzyme A
ConA	concanavalin A
COPD	chronic obstructive pulmonary disease
CP	O^6-benzyl-4-chloropyrimidine
CRIPT	cysteine-rich interactor of PDZ three
CRT	calreticulin
CRYAB	crystallin B
CSD	charge state distribution
cycL46W	backbone-cyclized variant of ACP-L46W
(cyc)ORF	(cyclization) open reading frame
CZ	cruzipain
DCM	dichloromethane
DDM	*n*-dodecyl-β-D-maltoside
deoxy HbA	deoxygenated form of human hemoglobin
DhaA	haloalkane dehalogenase
DHR	discs large homology repeat
di-α HbA	carbonmonoxy form of human hemoglobin in which the two α-chains have been linked covalently by a single glycine residue
DIA	differential in-gel analysis
DIGE	difference gel electrophoresis
DIPEA	diisopropylethylamine
DLC plate	diamond-like carbon-coated plate
Dlg	discs large
DM	n-decyl-β-D-maltoside
DMD	Duchenne muscular dystrophy
DMF	dimethylformamide
DMSO	dimethyl sulfoxide
DNA	deoxyribonucleic acid
Dol	dolichol
DPC	*n*-dodecyl phosphocholine
DSG	disuccinimidyl glutarate
DSS	disuccinimidyl suberate
dSTORM	direct stochastic optical reconstruction microscopy
DTT	dithiothreitol
Eco	*Escherichia coli*
EDC	ethyl diisopropyl carbodiimide
eDHFR	*Escherichia coli* dihydrofolate reductase
EDTA	ethylenediaminetetraacetic acid
EEDQ	ethyl 1,2-dihydro-2-ethoxyquinoline-1-carboxylate
EM	electron microscopy
Endo H	endo-β-N-acetylglucosaminidase H
EPR	electron paramagnetic resonance

ER	endoplasmic reticulum
ERAD	ER-associated degradation
ERGIC	ER-Golgi intermediate compartment
ESES	epilepsy of slow-wave sleep
ESI-LIT/TOF MS	electrospray ionization-linear ion trap/time-of-flight mass spectrometry
ESI-Q/TOF MS	electrospray ionization-quadrupole/time-of-flight mass spectrometry
FAD	familial Alzheimer's disease
FENIB	familial encephalopathy with neuroserpin inclusion bodies
FMOC	9-fluorenylmethoxycarbonyl
FP	fluorescent protein
FP	fluorescence polarization
FRET	fluorescence resonance energy transfer
FRET	Förster resonance energy transfer
FTIR	Fourier transform infrared spectroscopy
GABA	γ-Aminobutyric acid
GI	glucosidase I
GII	glucosidase II
GFP	green fluorescent protein
GpA	glycophorin A
GPCR	G protein-coupled receptor
GSH	glutathione
GST	glutathione S-transferase
GSTO1	glutathione S-transferase omega 1
GuK	a guanylate kinase domain
hAGT	O^6-alkylguanine-DNA alkyltransferase
HB	hydrogen-bonding
HbA	adult human hemoglobin
HbCO A	carbonmonoxy form of adult human hemoglobin
HEPES	4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid
hGH	human growth hormone
hGHR	hGH-receptor complex
Hip	Hsc/Hsp70 interacting protein
hIPSCs	human-induced pluripotent stem cells
His_6	hexahistidine sequence
HMPA	4-hydroxymethylphenoxyacetic acid
HPLC	high-performance liquid chromatography
Hsc70	70 kDa heat-shock cognate protein
HSMR	*Halobacterium salinarum* small multidrug resistance transporter
HspBP1	Hsp70 binding protein 1
HumLib	peptide library of human C-terminal protein sequences
I_C	C-terminal split intein fragment
IDP	intrinsically disordered protein
IEF	isoelectric focusing

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IM-MS	ion mobility–mass spectrometry
IMS	intermembrane space
$I_N(H)$	N-terminal split intein fragment (with C-terminal His_6-tag)
IPG	immobilized pH gradient
IPTG	isopropyl β-D-1-thiogalactopyranoside
IPTG	isopropyl-β,D-thiogalactopyranoside
IRE1	inositol-requiring kinase 1
IR-MALDI-TOF MS	infrared–matrix-assisted laser desorption ionization–time-of-flight mass spectrometry
I_{SC}	short-circuit current
KD	dissociation constant
kDa	kilo Dalton
LAP	LplA acceptor peptide
LC	liquid chromatography
LDAO	lauryl dimethylamine oxide
linL46W	linear variant of ACP-L46W with identical primary sequence as cycL46W
LplA	lipoic acid ligase
LTQ OT	linear ion trap Orbitrap
LTQ OT MS	linear ion trap Orbitrap mass spectrometry
MAGUKs	membrane associated guanylate kinases
MALDI	matrix-assisted laser desorption/ionization
MALDI MS	matrix-assisted laser desorption ionization mass spectrometry
MALDI-TOF MS	matrix-assisted laser desorption ionization–time-of-flight mass spectrometry
MALDI-TOF/TOF MS	matrix-assisted laser desorption ionization–time-of-flight/time-of-flight mass spectrometry
Man 6-P	mannose 6-phosphate
MARS	multiple affinity removal system
MBP	maltose binding protein
MD	molecular dynamics
MEM	minimal essential medium
MES	2-(N-morpholino)ethanesulfonic acid
met HbA	oxidized form of adult human hemoglobin (liganded with a water molecule as ligand)
MHC	major histocompatibility complex
MINT	molecular interaction database
MLFTPP	macroaffinity ligand-facilitated three-phase partitioning
MPDZ	human multiple PDZ domain protein
MRH	mannose 6-P receptor homologous
MS	mass spectrometry
MS/MS	tandem mass spectrometry
M_W	molecular weight
MX	macromolecular crystallography

NADH	nicotinamide adenine dinucleotide
NCL	native chemical ligation
NEM	N-ethyl maleimide
NG	n-nonyl-β-D-glucoside
NHB	non-hydrogen-bonding
NHERF	Na^+/H^+ exchanger regulatory factor
NMP	N-methylpyrolidone
NMR	nuclear magnetic resonance
Nu	nucleophile
OG	n-octyl-β-D-gluocoside
OM	outer membrane
ORF	open reading frame
OST	oligosaccharyltransferase
PAGE	polyacrylamide gel electrophoresis
PALM	photoactivated localization microscopy
PAS	periodic acid Schiff
PCA	principal components analysis
PCR	polymerase chain reaction
PDB	Protein Data Bank
PDI	protein disulfide isomerase
PDZ	initial letter of PSD-95, Dlg, ZO-1
PEG	polyethylene glycol
PEM	protein epitope mimetic
PERK	PKR-like ER kinase
PES	polyethersulfone
PID	protein interaction domain
PIR	protein interaction reporter
PMF	peptide mass fingerprinting
PMSF	phenylmethylsulphonyl fluoride
PMT	photomultiplier tube
pNPG	p-nitrophenyl α-D-glucopyranoside
POI	protein of interest
PPI	protein-protein interaction
PPTase	4′-phosphopantetheinyl transferase
PRIME	probe incorporation mediated by enzymes
PrP^C	prion protein, cellular form
PrP^{SC}	prion protein, scrapie form
PSD-95	postsynaptic density 95
PSF	point spread function
PTFE	polytetrafluoroethylene
PVDF	polyvinylidene difluoride
QC	quality control
RCL	reactive center loop
Rg	radius of gyration

RG	reactive group
r-HbA	adult human hemoglobin exhibiting the double mutation (αV96W/βN108K)
RhoBo	rhodamine-derived bisboronic acid
RNA	ribonucleic acid
ROS	reactive oxygen species
SAR	structure–activity relationships
SAXS	small-angle X-ray solution scattering
SBA	soybean agglutinin
SCX	strong cation exchange
SDS	sodium dodecyl sulfate
SDS-PAGE	sodium dodecyl sulfate–polyacrylamide gel electrophoresis
SE-AUC	sedimentation equilibrium analytical ultracentrifugation
SEC	size exclusion chromatography
SH2	src-homology 2
SH3	src homology 3
SICLOPPS	split intein-mediated circular ligation of peptides and proteins
SkMCs	human skeletal muscle cells
SM	supplement mix
SMART	simple modular architecture research tool
SMCGM	skeletal muscle cell growth medium
SMR	small multidrug resistance transporter
SOD	superoxide dismutase
SPFO	sodium perfluorooctanoate
SPPS	solid-phase peptide synthesis
SPR	surface plasmon resonance
SrtA	Sortase A
SSA	sulfosalicylic acid
SSE	secondary structure elements
STED	stimulated emission depletion microscopy
STORM	stochastic optical reconstruction microscopy
SubAna	substitutional analysis
TBS	Tris-buffered saline
t-BuOH	tertiary butanol (2-methylpropan-2-ol)
TCA	trichloracetic acid
TCCD	two-color coincidence detection
TDI	thiol-disulfide interchange
TEV	Tobacco etch virus
TFA	trifluoroacetic acid
TIBS	triisobutylsilane
TM	transmembrane
TM4	TM helix four
TMP	trimethoprim
TNS	trypsin neutralization solution
TOF	time-of-flight

TOF/TOF	tandem time-of-flight
TOM	translocase of the outer membrane of mitochondria
TPP	three-phase partitioning
TR-WAXS	time-resolved wide-angle X-ray solution scattering
TS	transition state
TTET	triplet-triplet energy transfer
Ubc	ubiquitin conjugating enzyme
UGGT	UDP-Glc:glycoprotein glucosyltransferase
UPR	unfolded protein response
Vha	vibrio harveyi
WAXS	wide-angle X-ray solution scattering
WT	wild-type
WW	domain with two highly conserved tryptophans
ZO-1	zonula occludens-1
2-DE	two-dimensional gel electrophoresis
2-DE/MS	two-dimensional gel electrophoresis/mass spectrometry
2D-PAGE	two-dimensional polyacrylamide gel electrophoresis

Acknowledgements

Chapter 2

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Chapter 3

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Chapter 8

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Chapter 9

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Chapter 10

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Chapter 14

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Chapter 18

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