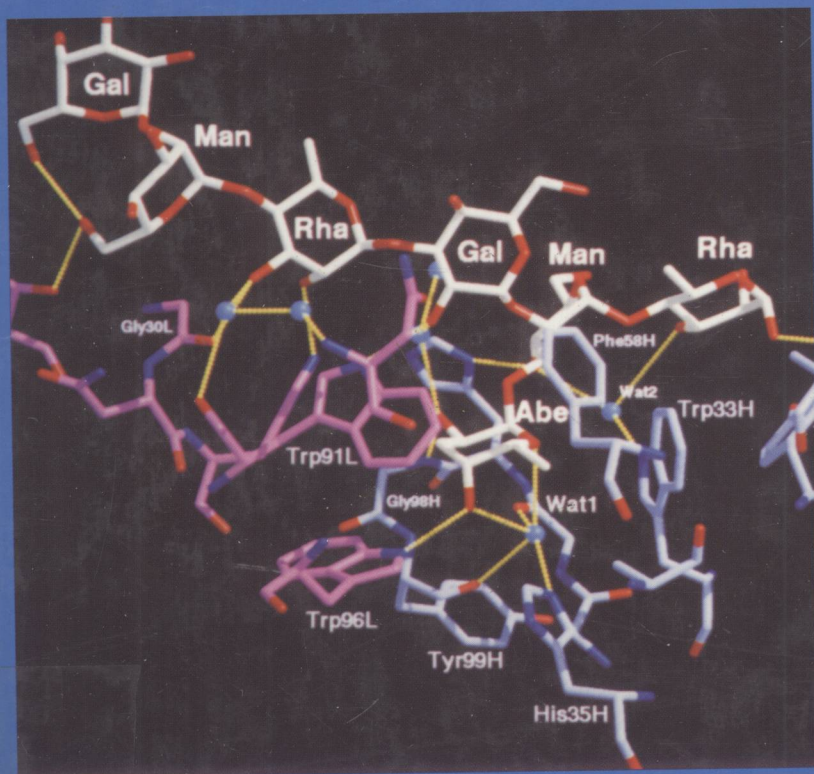


B. Ernst, G. W. Hart, P. Sinaÿ

Carbohydrates in Chemistry and Biology

Part II: Biology of Saccharides

Vol. 3



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Beat Ernst, Gerald W. Hart, Pierre Sinay

Carbohydrates in Chemistry and Biology

Part II Biology of Saccharides

Vol. 3 Biosynthesis and Degradation
of Glycoconjugates



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Introduction to Volumes 3 and 4

Glycobiology is among the most rapidly growing and exciting fields of biochemistry. Due to the complexities of carbohydrate chemistry and structure, our understanding of the structural/functional relationships of glycoconjugates has lagged behind research on proteins or nucleic acids. Only within the past few years, have the tools needed to understand the functions of complex glycoconjugates begun to emerge. Major advances in analytical chemistry, molecular biology and genetics, and organismic biology have spawned a remarkable growth in our appreciation of the important roles that glycans play in a myriad of biological systems and organisms. In fact, it is now clear that virtually every major disease afflicting mankind (ranging from infectious diseases, cancer, cardiovascular disorders, immune dysfunctions, or developmental disorders) directly involve glycoconjugates.

Part II of CARBOHYDRATES IN CHEMISTRY AND BIOLOGY is designed to be a valuable resource tool to both the expert in glycosciences as well as to the larger number of researchers in other biological, chemical or biomedical disciplines where a knowledge of glycoconjugates is now known to be required. Each of the chapters in Part II are written by an expert in the specific topic, and are designed to be a short, readable overview of the state-of-the-art in the specific topic, with key references provided as a gateway to more in-depth study.

Volume III begins by focusing on sugar nucleotide metabolism and the transferases which are the key biosynthetic enzymes for glycans. Next, the chapters review the state of our knowledge on the biosynthesis and processing of each of the major types of glycans. Volume III concludes by reviewing glycosidases and the degradation of complex glycoconjugates

Volume IV of the series begins with chapters on the state of our knowledge of carbohydrate binding proteins, lectins, and then presents a systematic set of reviews on the biological functions of each major class of glycoconjugate. Finally, Volume IV ends with several reviews on the functions of specific glycans in development and ends with several reviews on the key roles that glycans play in specific major diseases.

VI *Introduction to Volumes 3 and 4*

The CARBOHYDRATES IN CHEMISTRY AND BIOLOGY provides the most comprehensive and up-to-date compilation of information on the fields of glycochemistry and glycobiology available today. The series not only provides an expert overview of the entire field, but also serves as a valuable reference tool to both established investigators and students in many disciplines.

Gerald W. Hart, Ph.D.
DeLamar Professor and Director
Department of Biological Chemistry

Abbreviations Used in Volumes 3 and 4

A°	Angstrom
aa	amino acid
ACP	acyl carrier protein
AGP	arabinogalactan protein
<i>alg</i>	asparagine-linked glycosylation
APC	antigen-presenting cell
APP	acute phase protein
APS	adenosine phosphosulfate
AR	acrosome reaction
ARIS	acrosome reaction-inducing substance
ASGP-R	asialoglycoprotein receptor
Asn	asparagine
Asn GT	asparagine glucosyltransferase
BHK	baby hamster kidney
bFGF	basic fibroblast growth factor
BLAST	basic alignment search tool
BM	basement membrane
BMP	bis(monoacylglycero)phosphate
bp	base pair
CAM	cell adhesion molecule
CAT	chloramphenicol acetyltransferase
CCCP	carbonyl cyanide <i>m</i> -chlorophenylhydrazone
CD	cation dependent
CDGS	carbohydrate-deficient glycoprotein syndrome
CDTA	diaminocyclohexane tetraacetic acid
Cer	ceramide
CHO	Chinese hamster ovary
CI	cation independent
CMLN	calf mesenteric lymph node
CMP	cytosine monophosphate

LVIII *Abbreviations Used in Volumes 3 and 4*

CNS	central nervous system
CoA	coenzyme A
CRD	carbohydrate-recognition domain
CS	chondroitin sulfate
CSPG	chondroitin sulfate proteoglycan
CST	castanospermine
CTL	cytotoxic T cell
Da	Dalton
DAF	decay accelerating factor
DAG	diacylglucosamine
DBA	((strain D $\times$ strain B) $\times$ strain A) mice
DIG	detergent-insoluble glycolipid complex
DIM	1,4-dideoxy-1,4-imino-D-mannitol
DMJ	1-deoxymannojirimycin
DMSO	dimethyl sulfoxide
DNJ	deoxynojirimycin
Dol	dolichol
Dol-P	dolichyl phosphate
Dol-PP	dolichyl pyrophosphate
DP	degree of polymerization
DRM	detergent-resistant membrane
DS	dermatan sulfate
ECM	extracellular matrix
EDTA	ethylene diamine tetraacetic acid
EGF	epidermal growth factor
eIF	eukaryotic initiation factor
EM	electron microscopy
endo H	endo- β -N-acetylglucosaminidase H
EPGase	endopolygalacturonase
ER	endoplasmic reticulum
EST	expressed sequence tag
EtN	ethanolamine
EtN-P	ethanolamine phosphate
F	fusion protein
FAK	focal adhesion kinase
FCOE	fluorophore-coupled oligosaccharide electrophoresis
FGF	fibroblast growth factor
FSP	fucose sulfate polysaccharide
FTIR	Fourier transform infra-red (spectroscopy)
Fuc	fucose
FucT	fucosyltransferase
GA	Golgi apparatus
GAG	glycosaminoglycan
Gal	galactose
GalNAc	N-acetylgalactosamine
GalT	galactosyltransferase

GC	glucosyl ceramide
GC-MS	gas chromatography-mass spectrometry
GDP	guanosine diphosphate
GI	gastro-intestinal
GII	glucosidase II
Glc	glucose
GlcA	glucuronic acid
GlcN	glucosamine
GlcNAc	<i>N</i> -acetylglucosamine
GLUT	glucose transporter
GnT	<i>N</i> -acetylglucosaminyltransferase
GP	glycoprotein
GPI	glycosyl phosphatidylinositol
GRIFIN	galectin-related interfiber protein
GRP	glycine-rich protein
GSL	glycosphingolipid
GT	UDP-Glc:glycoprotein glucosyltransferase
GTA	human blood group A glycosyltransferase
GTB	human blood group B glycosyltransferase
HA	hyaluronic acid, hyaluronate
HAg	hemagglutinin
HAS	hyaluronate synthesizing enzyme
HBP	hexosamine biosynthetic pathway
HEMPAS	hereditary erythroblastic multinuclearity with a positive acidified-serum-lysis test (congenital dyserythropoietic anemia type II)
hCG	human chorionic gonadotropin
Hep	heparin
HEV	high endothelial venules
HIV	human immunodeficiency virus
HL	hepatic lectin
HMG	high mobility group (proteins)
HN	hemagglutinin-neuraminidase
HPLC	high performance liquid chromatography
HRGP	hydroxyproline-rich glycoprotein
HS	heparan sulfate
HSD	highly sulfated domain
HSPG	heparan sulfate proteoglycan
HUS	hemolytic uremic syndrome
ICAM	intercellular adhesion molecule
IduA	iduronic acid
IGF	insulin-like growth factor
Ig	immunoglobulin
IgSF	immunoglobulin superfamily of proteins
IL	interleukin
IPG	inositol phosphoglycan
IU	international unit

K	kinase enzyme activity coefficient
kb	kilobase (thousand base pairs)
kDa	kiloDalton
Kdn	2-keto-3-deoxy-nononic acid, formally 5-desamino-5-hydroxy-neuraminic acid
Kdo	2-keto-3-deoxy-D- <i>manno</i> -octulosonic acid
K_{eq}	kinase enzyme activity coefficient, at equilibrium
K_i	kinase enzyme activity coefficient, for inhibition
KIF	kifunensine
K_m	kinase enzyme activity coefficient, for structural modification(s)
KS	keratan sulfate
KSPG	keratan sulfate proteoglycan
LacAm	lactosamine
LacNAc	<i>N</i> -acetylactosamine
LAD	leucocyte adhesion deficiency
LAMP	lysosomal associated membrane protein
LBP	lipopolysaccharide-binding protein
Le ^a , Le ^x	Lewis a, Lewis x determinants
Leu	leucine
LNP	lectin and nucleotide phosphohydrolase
LPS	lipopolysaccharaide
LRP	lipoprotein receptor-related protein
LRR	leucine-rich repeat (amino acid/protein)
Lys	lysine
mAb	monoclonal antibody
MAd	mucosal addressin
MAG	myelin-associated glycoprotein
MALDI-TOF	matrix-assisted-laser desorption ionization time of flight mass spectrometry
Man	mannose
MAP	microtubule-associated protein
MASP	MBP-associated serine protease
MBL	mannose-binding lectin
MBP	mannose-binding protein
Man-T	mannosyltransferase
MCD	macular corneal dystrophy
MDBK	Madin—Darby bovine kidney (cells)
MDCK	Madin—Darby canine kidney (cells)
MHC	major histocompatibility complex
mol.wt.	molecular weight
MPR	mannose 6-phosphate receptor
MPS	mucopolysaccharidosis
M_r	apparent molecular weight
MSD	multiple sulfatase deficiency, Austin disease
NA	<i>N</i> -acetylated disaccharide unit
NAc	<i>N</i> -acetyl

nAChR	nicotinic acetylcholine receptor
NAm	neuraminidase
NANA	<i>N</i> -acetylneuraminic acid
NCAM	neural cell adhesion molecule
NDP	nucleoside-diphosphate
NDST	<i>N</i> -deacetylase/ <i>N</i> -sulfotransferase
NEM	<i>N</i> -ethylmaleimide
NGF	nerve growth factor
NIH	National Institutes of Health
NK	natural killer
NMR	nuclear magnetic resonance
NS	<i>N</i> -sulfated disaccharide unit
ORF	open reading frame
OST	<i>N</i> -oligosaccharyltransferase
P	phosphate
PAMP	pathogen-associated molecular pattern
PAPS	phosphoadenosine phosphosulfate
PARP	procyclic acidic repetitive protein
PBL	peripheral blood leucocytes
PCR	polymerase chain reaction
PDGF	platelet-derived growth factor
PDI	protein disulfide isomerase
PEP	phosphoenolpyruvate
PG	phosphatidylglycerol
PGM	phosphoglucomutase
PI	phosphatidylinositol
<i>p</i> NP- α -Man	<i>p</i> -nitrophenyl- α -D-mannoside
PNS	peripheral nervous system
PRP	proline-rich protein
PSA	polysialic acid
PSGL-1	P-selectin glycoprotein ligand-1
PTG	peptidoglycan
RA	retinoic acid
RAr	rheumatoid arthritis
RACE	rapid amplification of cDNA ends
rER	rough endoplasmic reticulum
RHAMM	receptor for hyaluronan-mediated motility
RT-PCR	reverse transcription polymerase chain reaction
SA	sialyl
SAP	saposin
SAT	sialyltransferase
SBA	soybean agglutinin
SDS-PAGE	sodium dodecylsulfate-polyacrylamide gel electrophoresis
Se	secretor enzyme
Ser	serine
SGC	sulfogalactosyl ceramide

LXII *Abbreviations Used in Volumes 3 and 4*

SGG	sulfogalactosyl glycerolipid
SGGL	sulfoglucuronyl glycolipid
SGLT	sodium-glucose transporter
sia	sialic acid
sLe ^a , sle ^x	sialylated Lewis a, sialylated Lewis x determinants
SLRP	small leucine-rich proteoglycan
SMC	sialomucin complex
ST	sulfurotransferase
SV	synaptic vesicle-associated protein
SW	swainsonine
TCR	T cell receptor
TGF	transforming growth factor
TGN	<i>trans</i> Golgi network
Thr	threonine
tlc	thin layer chromatography
TM	transmembrane
t-PA	tissue plasminogen activator factor
UDP	uranyl diphosphate
UDP-Gal	UDP- α -D-galactose
UMD	unmodified domain
UMP	uranyl monophosphate
UTP	uranyl triphosphate
UV	ultraviolet
VC	vitelline coat
VE	vitelline envelope
VL	vitelline layer
VSG	variant surface glycoprotein
VSV	vascular stomatis virus
VT	verotoxin
vWF	von Willebrand factor
<i>WBP</i>	wheat germ agglutinin binding protein
Xyl	xylose
ZP	zona pellucida

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