MOLECULAR BIOLOGY
INTELLIGENCE
UNIT

Calreticulin

Second Edition

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ABBREVIATIONS

Å	Ångstrom
AAB	autoantibody(s)
ACE	angiotensin converting enzyme
ALLM	acetyl-leu-leu-norleucinal
ALLnL	acetyl-leu-leu-methional
Ang	angiotensin
ATP	adenosine triphosphate
β2m	β2-microglobulin
BAE	bovine aortic endothelial
BAPTA-AM	1,2-bis(2-aminophenoxy) ethane-N,N,N,N'-tetraacetic acid-AM
BiP	binding protein
BiP	immunoglobulin-heavy-chain-binding protein
BSA	bovine serum albumin
C1q	first subcomponent of complement 1
C319A	mutant form of myeloperoxidase with the cysteine at codon 319 replaced by alanine
$[Ca^{2+}]_{cyt}$	cytosolic Ca^{2+} concentration
$[Ca^{2+}]_{ER}$	endoplasmic reticulum luminal Ca^{2+} concentration
Ca	calcium
Ca^{2+}	calcium
cADPR	cyclic ADP-ribose
CAS	castanospermine
cC1qR	collagenous tail C1q receptor
CD	circular dichroism
$CD8^+$	cluster of differentiation marker 8-positive cells (T lymphocytes which recognize MHC class I antigens)
cGMP	guanosine 3',5'-cyclic monophosphate
CHO	chinese hamster ovary
CICR	Ca^{2+} induced Ca^{2+} release
CK2	casein kinase 2
CMG	calmegin
CN	calcineurin
CNX	calnexin
CON A	concanavalin A
COOH	carboxyl
CRT	calreticulin
CRT-1	*C. elegans* calreticulin protein
crt-1	*C. elegans* calreticulin gene
CS	citrate synthase
CTL	cytotoxic T cell
DBD	DNA binding domain
Dex	dexamethasone
DHPR	dihydropyridine receptor
DNJ	deoxynojirimycin
EBV	Epstein-Barr virus
ECM	extracellular matrix
EDTA	ethylene diamine tetra-acetic acid (disodium salt)
EGTA	ethylene glycol-bis (?-aminoethyl ether)-N,N', N',N' –tetraacetic acid
Endo H	endoglycosidase H
eNOS	endothelial nitric oxide synthase
ER	endoplasmic reticulum
ERAD	ER-associated degradation
ERK	extracellular signal-regulated kinase
ERO	endoplasmic reticulum over load
ES	excretory-secretory
ETE	electron transfer control element
FACS	fluorescence-activated cell sorting
FAD	flavin adenine dinucleotide / familial Alzheimer's disease
FBHE	fetal bovine heart endothelial cells
FGF	fibroblast growth factor
FMN	flavin mononucleotide
gC1qR	globular head C1q receptor
GFP	green fluorescent protein

Glc	glucose
GlcNAc	N-acetyl glucosamine
GPCRs	G-protein coupled receptors
GR	glucocorticoid receptor
Gr	granzyme
GRP	glucose-regulated proteins
GST	glutathione S-transferase
GT	UDP-glc:glycoprotein glucosyltransferase
H chain	heavy chain of class I histocompatibility molecule
HA	hemagglutinin
HACBP	high affinity calcium-binding protein
HBD	heparin binding domain
HBV	hepatitis B virus
HC	class I heavy chain
HOCl	hypochlorous acid
Hsp	heat shock protein
HUVEC	human umbilical vein endothelial cells
IFN-γ	interferon
$InsP_3$	inositol 1,4,5-trisphosphate
IP	immunoprecipitation
IP-10	IFN-γ inducible protein-10
IP_3	inositol 1,4,5 trisphosphate
IP_3R	inositol 1,4,5 trisphosphate receptor
IRM	interference reflection microscopy
KO	knockout
LdCR	*Leishmania donovani* calreticulin
LE	lupus erythematosus
LMP	latency membrane protein
LRP	LDL receptor related protein
LTP	long term potentiation
MBL	mannose binding lectin (also sometimes called MBP for mannose binding protein)
MBP	maltose binding protein
MEC-4	Na^{2+} degenerin channel
MEF	mouse embryonic fibroblasts
MHC	major histocompatibility complex
Mig	monokine induced by IFN-γ
MMP	mitochondrial membrane permeabilization
MPO	myeloperoxidase
mPTP	mitochondrial permeability transition pore
Mr	relative molecular mass
mu	map unit
MW	molecular weight
NAADP	nicotinic acid adenine dinucleotide phosphate
NES	nuclear export signal
NFAT	nuclear factor of activated T-cells
NIDDM	non-insulin-dependent diabetes mellitus
NK	natural killer (lymphocyte)
NLS	nuclear localization signal
NMR	nuclear magnetic resonance
NMR	nuclear magnetic resonance spectroscopy
NO	nitric oxide
NOS	nitric oxide synthase
NPC	nuclear pore complex
NR	nuclear receptor
PAGE	polyacrylamide gel electrophoresis
PCL/PLD	phosphlipase C/D

PCR	polymerase chain reaction
PDI	protein disulfide isomerase
PDK	proline directed kinase
PI3K	phosphoinositide 3-kinase
PIP3	phosphatidylinositol 3,4,5-triphosphate
PKC	protein kinase C
PKG	cyclic GMP-dependent protein kinase
PKI	protein kinase inhibitor
PLC	phospholipase C
PMNs	polymorphonuclear neutrophils
PS	phosphatidylserine
PTX	pertussis toxin
QC	quality control
R569W	mutant form of myeloperoxidase with the arginine at codon 569 replaced by tryptophan
rbc=s	red blood cells
RNAse	ribonuclease
RyR	ryanodine receptor
SAcP	secretory acid phosphatase
SCLE	subacute cutaneous lupus erythematosus
SERCA	sacroplasmic/endoplasmic reticulum calcium ATPase; $[Ca^{2+}]_{cyt}$, and $[Ca^{2+}]_{ER}$, cytosolic and ER free Ca^{2+} concentration, respectively
SjS	Sjogren's syndrome
SLE	systemic lupus erythematosus
SP	mammalian semiperm-eabilized cell system
SP-A	surfactant protein A
SP-D	surfactant protein D
SPR	surface plasmon resonance
SR	sarcoplasmic reticulum
T	thymically processed lymphocyte
T134K	threonine to lysine class I heavy chain point mutant at position 134
TAP	transporter associated with Antigen Processing
TCR	T cell receptor
TM	transmembrane
TROSY	transverse relaxation-optimized spectroscopy
TSP	thrombospondin
UGGT	UDP-glucose glycoprotein: glucosyltransferase
UPR	unfolded protein response
UV	ultraviolet
VDAC	voltage dependent anion channel
VEGF	vascular endothelial growth factor
VSV	vesicular stomatitis virus
VSVG	vesicular stomatitis virus G protein
WT	wild type
Y173C	mutant form of myeloperoxidase with the tyrosine at codon 173 replaced by cysteine.
$\Delta\Psi_m$	mitochondrial membrane potential

PREFACE

Calreticulin has been first identified and characterized over 30 years ago as a soluble calcium-binding protein of skeletal muscle sarcoplasmic reticulum. It took over 20 years before it was realized that the protein is in fact a key calcium-binding chaperone of endoplasmic reticulum, a major calcium storage organelle in non-muscle cells. Today calreticulin is considered one of the best markers for the endoplasmic reticulum. The cDNA encoding calreticulin was isolated in 1989, and it was then recognized that the protein plays an important role in virtually every aspect of cell biology. The first edition of calreticulin book was published in 1996. This new edition focuses on the latest discoveries on calreticulin, calnexin (an integral membrane protein similar to calreticulin) and other endoplasmic reticulum proteins. Findings described in the book identify calreticulin and other ER proteins as important molecules involved in many diseases, including protein folding disorders, cardiac pathologies, cancer and autoimmunity. The effects of calreticulin in the modulation of cellular calcium homeostasis have profound effects on many cellular functions. Cell surface calreticulin becomes an important player in modulation of many different pathologies. Gene knockout studies on different animal models point out the critical role of calreticulin in organogenesis and other developmental pathways. Lastly, the structural studies on calreticulin and calnexin revealed a highly unusual three-dimensional arrangement for these chaperones. These observations will undoubtedly have a profound impact on the future studies of other endoplasmic reticulum proteins. The book raises many intriguing questions about calreticulin, calnexin and the endoplasmic reticulum, and gives a unique opportunity to realize the significance of these calcium-binding chaperones.

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