

Total Protein Normalization: Publications List



V3 Western Workflow™

Bulletin 6349

Methodology Papers

Total Protein Loading Control vs. Housekeeping Protein Loading Control

Moritz CP et al. (2014).

Epicocconone staining: A powerful loading control for western blots.
Proteomics14, 162–168.

Eaton SL et al. (2013).

Total protein analysis as a reliable loading control for quantitative fluorescent western blotting.
PLoS One 8, e72457.

Gilda JE and Gomes AV (2013).

Stain-free total protein staining is a superior loading control to β -actin for western blots.
Anal Biochem 440,186–188.

Colella AD et al. (2012).

Comparison of stain-free gels with traditional immunoblot loading control methodology.
Anal Biochem 430, 108–110.

Lanoix D et al. (2012).

Stability of reference proteins in human placenta: general protein stains are the benchmark.
Placenta 33, 151–156.

Suzuki O et al. (2011).

Use of sample mixtures for standard curve creation in quantitative western blots.
J Exp Anim 60, 193–196.

Welinder C and Ekblad L (2011).

Coomassie staining as loading control in western blot analysis.
J Proteome Res 10, 1416–1419.

Hagiwara M et al. (2010).

Application of SYPRO Ruby- and Flamingo-stained polyacrylamide gels to western blot analysis.
Anal Biochem 397, 262–264.

Romero-Calvo I et al. (2010).

Reversible Ponceau staining as a loading control alternative to actin in western blots.
Anal Biochem 401, 318–320.

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Aldridge GM et al. (2008).

The use of total protein stains as loading controls: an alternative to high-abundance single-protein controls in semi-quantitative immunoblotting.

J Neurosci Methods 172, 250–254.

**Selected Research Papers from JBC, PNAS, MCB, and JCS
Applying Total Protein Loading Control (e.g. Coomassie) in Western Blotting**

Gene Regulation — Genetics, Epigenetics, Cell Biology, Neuroscience, Developmental Biology

Furuya F et al. (2013).

Ligand-bound thyroid hormone receptor contributes to reprogramming of pancreatic acinar cells into insulin-producing cells.

J Biol Chem 288, 16155–16166.

Harmel J et al. (2013).

The leucine-rich pentatricopeptide repeat-containing protein (LRPPRC) does not activate transcription in mammalian mitochondria.

J Biol Chem 288, 15510–15519.

Popova EY et al. (2013).

Developmentally regulated linker histone H1c promotes heterochromatin condensation and mediates structural integrity of rod photoreceptors in mouse retina.

J Biol Chem 288, 17895–17907.

Bryant JM et al. (2012).

The linker histone plays a dual role during gametogenesis in *Saccharomyces cerevisiae*.

Mol Cell Biol 32, 2771–2783.

Cui CY et al. (2012).

Forkhead transcription factor FoxA1 regulates sweat secretion through Bestrophin 2 anion channel and Na-K-Cl cotransporter 1.

Proc Natl Acad Sci USA 109, 1199–1203.

Gu S et al. (2012).

Basic helix-loop-helix transcription factor Twist1 inhibits transactivator function of master chondrogenic regulator Sox9.

J Biol Chem 287, 21082–21092.

Song X et al. (2012).

Synergistic and multidimensional regulation of plasminogen activator inhibitor type 1 expression by transforming growth factor type β and epidermal growth factor.

J Biol Chem 287,12520–12528.

Ahmady E et al. (2011).

Identification of a novel muscle A-type lamin-interacting protein (MLIP).

J Biol Chem 286, 19702–19713.

Anderson ER et al. (2011).

Intestinal hypoxia-inducible factor-2 α (HIF-2 α) is critical for efficient erythropoiesis.
J Biol Chem 286,19533–19540.

Banerjee D et al. (2011).

Preferential repair of oxidized base damage in the transcribed genes of mammalian cells.
J Biol Chem 286, 6006–6016.

Dixit A et al. (2011).

Dynamics of the T4 bacteriophage DNA packasome motor: endonuclease VII resolvase release of arrested Y-DNA substrates.
J Biol Chem 286, 18878–18889.

Krishnan V et al. (2011).

Histone H4 lysine 16 hypoacetylation is associated with defective DNA repair and premature senescence in Zmpste24-deficient mice.
Proc Natl Acad Sci USA 108, 12325–12330.

Kumar GR et al. (2011).

Importin α -mediated nuclear import of cytoplasmic poly(A) binding protein occurs as a direct consequence of cytoplasmic mRNA depletion.
Mol Cell Biol 31, 3113–3125.

Motohashi H et al. (2011).

Molecular determinants for small Maf protein control of platelet production.
Mol Cell Biol 31, 151–162.

Su LH et al. (2011).

A novel E2F-like protein involved in transcriptional activation of cyst wall protein genes in *Giardia lamblia*.
J Biol Chem 286, 34101–34120.

Yan J et al. (2011).

Perturbation of BRD4 protein function by BRD4-NUT protein abrogates cellular differentiation in NUT midline carcinoma.
J Biol Chem 286, 27663–27675.

Zhang S et al. (2011).

Modification of histones by sugar β -N-acetylglucosamine (GlcNAc) occurs on multiple residues, including histone H3 serine 10, and is cell cycle-regulated.
J Biol Chem 286, 37483–37495.

Mastushita-Sakai T et al. (2010).

Drosophila Orb2 targets genes involved in neuronal growth, synapse formation, and protein turnover.
Proc Natl Acad Sci USA 107, 11987–11992.

Sansregret L et al. (2010).

Hyperphosphorylation by cyclin B/CDK1 in mitosis resets CUX1 DNA binding clock at each cell cycle.
J Biol Chem 285, 32834–32843.

Selvanathan SP et al. (2010).

Schizosaccharomyces pombe Dss1p is a DNA damage checkpoint protein that recruits Rad24p, Cdc25p, and Rae1p to DNA double-strand breaks.
J Biol Chem 285, 14122–14133.

Wang YT et al. (2010).

A novel Pax-like protein involved in transcriptional activation of cyst wall protein genes in *Giardia lamblia*.
J Biol Chem 285, 32213–32226.

Minig V et al. (2009).

Identification of DDB2 protein as a transcriptional regulator of constitutive SOD2 gene expression in human breast cancer cells.
J Biol Chem 284, 14165–14176.

Pan YJ et al. (2009).

A novel WRKY-like protein involved in transcriptional activation of cyst wall protein genes in *Giardia lamblia*.
J Biol Chem 284, 17975–17988.

Wang GL et al. (2008).

HDAC1 promotes liver proliferation in young mice via interactions with C/EBP β .
J Biol Chem 283, 26179–26187.

Zofall M and Grewal SI (2007).

HULC, a histone H2B ubiquitinating complex, modulates heterochromatin independent of histone methylation in fission yeast.
J Biol Chem 282, 14065–14072.

Woodhall DL et al. (2006).

Human Daxx-mediated repression of human cytomegalovirus gene expression correlates with a repressive chromatin structure around the major immediate early promoter.
J Biol Chem 281, 37652–37660.

Signal Transduction – Neurobiology, Microbiology, Disease Mechanism, Cell Biology

Cho CC et al. (2012).

Regulation of a Myb transcription factor by cyclin-dependent kinase 2 in *Giardia lamblia*.
J Biol Chem 287, 3733–3750.

Linn DE et al. (2012).

Differential regulation of androgen receptor by PIM-1 kinases via phosphorylation-dependent recruitment of distinct ubiquitin E3 ligases.
J Biol Chem 287, 22959–22968.

Lisa-Santamaría P et al. (2012).

The protein factor-arrest 11 (Far11) is essential for the toxicity of human caspase-10 in yeast and participates in the regulation of autophagy and the DNA damage signaling.
J Biol Chem 287, 29636–29647.

Mir SU et al. (2012).

Neutrophil gelatinase-associated lipocalin (NGAL) expression is dependent on the tumor-associated sigma-2 receptor S2RPgrmc1.
J Biol Chem 287, 14494–14501.

Neasta J et al. (2012).

Direct interaction between scaffolding proteins RACK1 and 14-3-3 ζ regulates brain-derived neurotrophic factor (BDNF) transcription.
J Biol Chem 287, 322–336.

Panina S et al. (2012).

Significance of calcium binding, tyrosine phosphorylation, and lysine trimethylation for the essential function of calmodulin in vertebrate cells analyzed in a novel gene replacement system.
J Biol Chem 287, 18173–18181.

Ray RM et al. (2012).

Amino acids regulate expression of antizyme-1 to modulate ornithine decarboxylase activity.
J Biol Chem 287, 3674–3690.

Butcher AJ et al. (2011).

Differential G-protein-coupled receptor phosphorylation provides evidence for a signaling bar code.
J Biol Chem 286, 11506–11518.

Pullen L and Bolon DN (2011).

Enforced N-domain proximity stimulates Hsp90 ATPase activity and is compatible with function in vivo.
J Biol Chem 286, 11091–11098.

Samant SA et al. (2011).

HDAC3-dependent reversible lysine acetylation of cardiac myosin heavy chain isoforms modulates their enzymatic and motor activity.
J Biol Chem 286, 5567–5577.

Furrer M et al. (2010).

Drosophila Myc interacts with host cell factor (dHCF) to activate transcription and control growth.
J Biol Chem 285, 39623–39636.

Derheimer FA et al. (2007).

RPA and ATR link transcriptional stress to p53.
Proc Natl Acad Sci USA 104,12778–12783.

Recklies AD et al. (2005).

Inflammatory cytokines induce production of CHI3L1 by articular chondrocytes.
J Biol Chem 280, 41213–41221.

Cell Biology – Cancer Research, Disease Mechanism, Membrane Biology

Hernández-Ortega S et al. (2013).

Defective in mitotic arrest 1 (Dma1) ubiquitin ligase controls G1 cyclin degradation.
J Biol Chem 288, 4704–4714.

Lee MH et al. (2013).

Tumor suppressor p16INK4a inhibits cancer cell growth by downregulating eEF1A2 through a direct interaction.
J Cell Sci 126,1744–1752.

Leidgens S et al. (2013).

Each member of the poly-r(C)-binding protein 1 (PCBP) family exhibits iron chaperone activity toward ferritin.
J Biol Chem 288, 17791–17802.

Basu R et al. (2012).

Loss of *Timp3* gene leads to abdominal aortic aneurysm formation in response to angiotensin II.
J Biol Chem 287, 44083–44096.

Delgehyr N et al. (2012).

Drosophila Mgr, a prefoldin subunit cooperating with von Hippel Lindau to regulate tubulin stability.
Proc Natl Acad Sci USA 109, 5729–5734.

Dhar S et al. (2012).

Insights into role of bromodomain, testis-specific (Brdt) in acetylated histone H4-dependent chromatin remodeling in mammalian spermiogenesis.
J Biol Chem 287, 6387–6405.

Hu H et al. (2012).

An orphan kinesin in trypanosomes cooperates with a kinetoplastid-specific kinesin to maintain cell morphology by regulating subpellicular microtubules.
J Cell Sci 125, 4126–4136.

Koch N et al (2012).

Abp1 utilizes the Arp2/3 complex activator Scar/WAVE in bristle development.
J Cell Sci 125, 3578–3589.

Krisko A et al. (2012).

Extreme anti-oxidant protection against ionizing radiation in bdelloid rotifers.
Proc Natl Acad Sci USA 109, 2354–2357.

Mathur V et al. (2012).

Localization of HET-S to the cell periphery, not to [Het-s] aggregates, is associated with [Het-s]–HET-S toxicity.
Mol Cell Biol 32, 139–153.

Ryan SD et al. (2012).

Up-regulation of the mitotic checkpoint component Mad1 causes chromosomal instability and resistance to microtubule poisons.
Proc Natl Acad Sci USA 109, E2205–E2214.

Dubielecka PM et al. (2011).

Essential role for Abi1 in embryonic survival and WAVE2 complex integrity.
Proc Natl Acad Sci USA 108, 7022–7027.

Liu Z et al. (2011).

α -Actinin-4 and CLP36 protein deficiencies contribute to podocyte defects in multiple human glomerulopathies.
J Biol Chem 286, 30795–30805.

Snider NT et al. (2011).

Keratin hypersumoylation alters filament dynamics and is a marker for human liver disease and keratin mutation.
J Biol Chem 286, 2273–2284.

Valapala M and Vishwanatha JK (2011).

Lipid raft endocytosis and exosomal transport facilitate extracellular trafficking of annexin A2.
J Biol Chem 286; 30911–30925.

Valdes JL et al. (2011).

Sorting nexin 27 protein regulates trafficking of a p21-activated kinase (PAK) interacting exchange factor (β -Pix)-G protein-coupled receptor kinase interacting protein (GIT) complex via a PDZ domain interaction.
J Biol Chem 286, 39403–39416.

Bedelbaeva K et al. (2010).

Lack of p21 expression links cell cycle control and appendage regeneration in mice.
Proc Natl Acad Sci USA 107, 5845–5850.

Benseñor LB et al. (2010).

Microtubule-mediated transport of the tumor-suppressor protein Merlin and its mutants.
Proc Natl Acad Sci USA 107, 7311–7316.

Braun NA et al. (2010).

The yeast CLC protein counteracts vesicular acidification during iron starvation.
J Cell Sci 123, 2342–2350.

Orellana D et al. (2010).

Calmodulin controls liver proliferation via interactions with C/EBP β -LAP and C/EBP β -LIP.
J Biol Chem 285; 23444–23456.

Perrera C et al. (2010).

Identification of Myb-binding protein 1A (MYBBP1A) as a novel substrate for aurora B kinase.
J Biol Chem 285, 11775–11785.

Sevenich L et al. (2010).

Synergistic antitumor effects of combined cathepsin B and cathepsin Z deficiencies on breast cancer progression and metastasis in mice.
Proc Natl Acad Sci USA 107, 2497–2502.

Srikanth B et al. (2010).

O-GlcNAcylation determines the solubility, filament organization, and stability of keratins 8 and 18.
J Biol Chem 285, 34062–34071.

Meng J et al. (2005).

Androgens regulate the permeability of the blood-testis barrier.
Proc Natl Acad Sci USA 102, 16696–16700.

Ohira T et al. (2003).

WNT7a induces E-cadherin in lung cancer cells.
Proc Natl Acad Sci USA 100, 10429–10434.

Plant Biology

Tintor N et al. (2013).

Layered pattern receptor signaling via ethylene and endogenous elicitor peptides during *Arabidopsis* immunity to bacterial infection.
Proc Natl Acad Sci USA 110, 6211–6216.

Derrien B et al. (2012).

Degradation of the antiviral component ARGONAUTE1 by the autophagy pathway.
Proc Natl Acad Sci USA 109, 15942–15946.

Bos JI et al. (2010).

Phytophthora infestans effector AVR3a is essential for virulence and manipulates plant immunity by stabilizing host E3 ligase CMPG1.
Proc Natl Acad Sci USA 107, 9909–9914.

Chen X et al. (2010).

An ATPase promotes autophosphorylation of the pattern recognition receptor XA21 and inhibits XA21-mediated immunity.
Proc Natl Acad Sci USA 107, 8029–8034.

Ek-Ramos MJ et al. (2010).

The T-loop extension of the tomato protein kinase AvrPto-dependent Pto-interacting protein 3 (Adi3) directs nuclear localization for suppression of plant cell death.
J Biol Chem 285, 17584–17594.

Petutschnig EK et al. (2010).

The lysin motif receptor-like kinase (LysM-RLK) CERK1 is a major chitin-binding protein in *Arabidopsis thaliana* and subject to chitin-induced phosphorylation.
J Biol Chem 285, 28902–28911.

Cuellar WJ et al. (2009).

Elimination of antiviral defense by viral RNase III.
Proc Natl Acad Sci USA 106, 10354–10358.

Lahmy S et al. (2009).

PolV(PolIVb) function in RNA-directed DNA methylation requires the conserved active site and an additional plant-specific subunit.
Proc Natl Acad Sci USA 106, 941–946.

Azevedo J et al. (2008).

Intrplastidial trafficking of a phage-type RNA polymerase is mediated by a thylakoid RING-H2 protein.
Proc Natl Acad Sci USA 105, 9123–9128.

Kotzer AM et al. (2004).

AtRabF2b (Ara7) acts on the vacuolar trafficking pathway in tobacco leaf epidermal cells.
J Cell Sci 117, 6377–6389.

Muscle Research — Cardiovascular Disease, Skeletal Muscle

Nixon BR et al. (2012).

AMP-activated protein kinase phosphorylates cardiac troponin I at Ser-150 to increase myofilament calcium sensitivity and blunt PKA-dependent function.
J Biol Chem 287, 19136–19147.

Chang AN et al. (2010).

Cardiac myosin is a substrate for zipper-interacting protein kinase (ZIPK).
J Biol Chem 285, 5122–5126.

Gutiérrez J and Brandan E (2010).

A novel mechanism of sequestering fibroblast growth factor 2 by glypican in lipid rafts, allowing skeletal muscle differentiation.
Mol Cell Biol 30, 1634–1649.

Li D et al. (2010).

Sarcolemmal nNOS anchoring reveals a qualitative difference between dystrophin and utrophin.
J Cell Sci 123, 2008–2013.

O'Connor RS et al. (2007).

A combinatorial role for NFAT5 in both myoblast migration and differentiation during skeletal muscle myogenesis.
J Cell Sci 120, 149–159.

Peter AK et al. (2007).

Disrupted mechanical stability of the dystrophin-glycoprotein complex causes severe muscular dystrophy in sarcospan transgenic mice.
J Cell Sci 120, 996–1008.

Judge LM et al. (2006).

Dissecting the signaling and mechanical functions of the dystrophin-glycoprotein complex.
J Cell Sci 119, 1537–1546.

Timchenko NA et al. (2004).

Overexpression of CUG triplet repeat-binding protein, CUGBP1, in mice inhibits myogenesis.
J Biol Chem 279, 13129–13139.

Kavurma MM and Khachigian LM (2003).

Sp1 inhibits proliferation and induces apoptosis in vascular smooth muscle cells by repressing p21WAF1/Cip1 transcription and cyclin D1-Cdk4-p21WAF1/Cip1 complex formation.
J Biol Chem 278, 32537–32543.

Microbiology

Sharma P et al. (2013).

Role of pilus proteins in adherence and invasion of *Streptococcus agalactiae* to the lung and cervical epithelial cells.
J Biol Chem 288, 4023–4034.

Ram S et al. (2011).

Meningococcal group W-135 and Y capsular polysaccharides paradoxically enhance activation of the alternative pathway of complement.
J Biol Chem 286, 8297–8307.

Lipids — Membrane Biology, Metabolism, Molecular Basis of Disease

Czyz O et al. (2013).

Alteration of plasma membrane organization by an anticancer lysophosphatidylcholine analogue induces intracellular acidification and internalization of plasma membrane transporters in yeast.
J Biol Chem 288, 8419–8432.

Pidkovka N et al. (2013).

Epoxyeicosatrienoic acids (EETs) regulate epithelial sodium channel activity by extracellular signal-regulated kinase 1/2 (ERK1/2)-mediated phosphorylation.
J Biol Chem 288, 5223–5231.

Taschler U et al. (2011).

Monoglyceride lipase deficiency in mice impairs lipolysis and attenuates diet-induced insulin resistance.
J Biol Chem 286, 17467–17477.

Ashibe B et al. (2007).

Dual subcellular localization in the endoplasmic reticulum and peroxisomes and a vital role in protecting against oxidative stress of fatty aldehyde dehydrogenase are achieved by alternative splicing.
J Biol Chem 282, 20763–20773.

Enzymology – Membrane Biology, Protein Synthesis and Degradation

Doshi R et al. (2013.)

Molecular disruption of the power stroke in the ATP-binding cassette transport protein MsbA.
J Biol Chem 288, 6801–6813.

Ranganathan PN et al. (2012).

Discovery of a cytosolic/soluble ferroxidase in rodent enterocytes.
Proc Natl Acad Sci USA 109, 3564–3569.

Sojka D et al. (2012).

Characterization of gut-associated cathepsin D hemoglobinase from tick *Ixodes ricinus* (IrcD1).
J Biol Chem 287, 21152–21163.

Fernandes RJ et al. (2011).

A role for prolyl 3-hydroxylase 2 in post-translational modification of fibril-forming collagens.
J Biol Chem 286, 30662–30669.

Damme M et al. (2010).

Impaired lysosomal trimming of N-linked oligosaccharides leads to hyperglycosylation of native lysosomal proteins in mice with α -mannosidosis.
Mol Cell Biol 30, 273–283.

Xu XM et al. (2010).

Targeted insertion of cysteine by decoding UGA codons with mammalian selenocysteine machinery.
Proc Natl Acad Sci USA 107, 21430–21434.

Lee KS et al. (2009).

JNK/FOXO-mediated neuronal expression of fly homologue of peroxiredoxin II reduces oxidative stress and extends life span.
J Biol Chem 284, 29454–29461.

Glycobiology and Extracellular Matrices

Barnes J et al. (2011).

Extensive mannose phosphorylation on leukemia inhibitory factor (LIF) controls its extracellular levels by multiple mechanisms.
J Biol Chem 286, 24855–24864.

Madsen DH et al. (2011).

The non-phagocytic route of collagen uptake: A distinct degradation pathway.
J Biol Chem 286, 26996–27010.

Metabolism — Protein Synthesis and Degradation

Kasaikina MV et al. (2011).

Reduced utilization of selenium by naked mole rats due to a specific defect in GPx1 expression.
J Biol Chem 286, 17005–17014.

Radner FP et al. (2010).

Growth retardation, impaired triacylglycerol catabolism, hepatic steatosis, and lethal skin barrier defect in mice lacking comparative gene identification-58 (CGI-58).
J Biol Chem 285, 7300–7311.



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