OptiPrep™ Reference List RS09

Lipid-rich membranes from non-mammalian sources

The companion **OptiPrep™ Reference List RS06 "Lipid-rich detergent-resistant domains (mammalian sources) "** contains a brief summary of the methodology for the isolation of these plasma membrane domains in addition to the complete reference list of the published papers. Strategies used for invertebrate cells, plant cells, algae, fungi and protozoa are broadly similar. This Reference List is thus confined to the provision of a bibliography of published papers concerned with this diverse group of organisms.

Detailed description of the OptiPrep™ methodology (see **Application Sheets S32 and S33**) can be found via the releveant OptiPrep™ Application Sheets Index on the following website: www.Optiprep.com (click on "Methodology", then "Organelles and Subcellular Membranes") and scroll down the Index.

Papers have been divided into **organism or cell type (listed alphabetically)** and additionally, when required, into **research topic**. Within each group papers are listed alphabetically according to **first author**. When a paper reports the study of more than one cell type, reference to that paper will appear under multiple cell headings. A paper may also appear under two or more research topic headings.

- Part(s) of the titles are highlighted in blue to facilitate identification of particular research topic(s)
- **For "Yeast" see "Fungi".**

1. Amphibia

Bates, R.C., Fees, C.P., Holland, W.L., Winger, C.C., Batbayar, K., Ancar, R., Bergren, T., Petcoff, D. and Stith, B.J. (2014) *Activation of Src and release of intracellular calcium by phosphatidic acid during Xenopus laevis fertilization* Dev. Biol., **386**, 165-180

2. Bacteria

Borrelia burgdorferi

Coleman, J.L., Toledo, A. and Benach, J.L. (2016) *Borrelia burgdorferi HtrA: evidence for twofold proteolysis of outer membrane protein p66* Mol. Microbiol., **99**, 135–150

LaRocca, T.J., Crowley, J.T., Cusack, B.J., Pathak, P., et al (2010) *Cholesterol lipids of Borrelia burgdorferi form lipid rafts and are required for the bactericidal activity of a complement-independent antibody* Cell Host Microbe **8**, 331–342

Toledo, A., Crowley, J.T., Coleman, J.L., LaRocca, T.J., et al (2014) *Selective association of outer surface lipoproteins with the lipid rafts of Borrelia burgdorferi* mBio, **5**: e00899-14

Toledo, A., Pérez, A., Coleman, J.L. and Benach, J. L. (2015) *The lipid raft proteome of Borrelia burgdorferi* Proteomics, **15**, 3662–3675

Escherichia coli

Guzman-Flores, J.E., Alvarez, A.F., Poggio, S., Gavilanes-Ruiz, M. and Georgellis, D. (2017) *Isolation of detergent-resistant membranes (DRMs) from Escherichia coli* Anal. Biochem., **518**, 1-8

Guzmán-Flores, J.E., Steinemann-Hernández, L., González de la Vara, L.E., Gavilanes-Ruiz, M., Romeo, T., Alvarez, A.F. and Georgellis, D. (2019) *Proteomic analysis of Escherichia coli detergent-resistant membranes (DRM)* PLoS One, **14**: e0223794

3. Chicken embryo

Long, J., Tokhunts, R., Old, W.M., Houel, S., Rodgriguez-Blanco, J., Singh, S., Schilling, N., Capobianco, A.J., Ahn, N.G. and Robbins, D.J. (2015) *Identification of a family of fatty-acid-speciated sonic hedgehog proteins, whose members display differential biological properties* Cell Rep., **10**, 1280–1287

4. Coccolithophores

Rose, S.L., Fulton, J.M., Brown, C.M., Natale, F., Van Mooy, B.A.S. and Bidle, K.D. (2014) *Isolation and characterization of lipid rafts in Emiliania huxleyi: a role for membrane microdomains in host–virus interactions* Environ. Microbiol., **16**, 1150–1166

5. *Drosophila melanogaster*

Eroglu, C., Brügger, B., Wieland, F. and Sinning, I. (2003) *Glutamate-binding affinity of Drosophila metabotropic glutamate receptor is modulated by association with lipid rafts* Proc. Natl. Acad. Sci. USA, **100**, 10219-10224

Fernandez-Funez, P., Casas-Tinto, S., Zhang, Y., Gómez-Velazquez, M., et al (2009) *In vivo generation of neurotoxic prion protein: role for Hsp70 in accumulation of misfolded isoforms* PLoS One, **5**:e1000507

Goyal, G., Zheng, J., Adam, E., Steffes, G., Jain, M., Klavins, K. and Hummel, T. (2019) *Sphingolipid-dependent Dscam sorting regulates axon segregation* Nat. Comm., **10**: 813

Hebbar, S., Lee, E., Manna, M., Steinert, S., et al (2008) *A fluorescent sphingolipid binding domain peptide probe interacts with sphingolipids and cholesterol-dependent raft domains* J. Lipid Res. 49, 1077-1089

Hoehne, M., de Couet, H.G., Stuermer, C.A.O. and Fischbach, K-F. (2005) *Loss- and gain-of-function analysis of the lipid raft proteins reggie/flotillin in Drosphilia: they are posttranslationally regulated, and misexpression interferes with wing and eye development* Mol. Cell. Neurosci., **30**, 326-338

Rietveld, A., Neutz, S., Simons, K. and Eaton, S. (1999) *Association of sterol- and glycosylphosphatidyl-inositol-linked proteins with Drosophilia raft lipid microdomains* J. Biol. Chem., **274**, 12049-12054

Sanxaradis, P.D., Cronin, M.A., Rawat, S.S., Waro, G., et al (2007) *Light-induced recruitment of INAD-signaling complexes to detergent-resistant lipid rafts in Drosophila receptors* Mol Cell. Neurosci., **36**, 36-46

West, R.J.H., Briggs, L., Fjeldstad, M.P., Ribchester, R.R. and Sweeney, S.T. (2018) *Sphingolipids regulate neuromuscular synapse structure and function in Drosophila* J. Comp. Neurol., **526**, 1995–2009

Zhai, L., Chaturvedi, D. and Cumberledge, S. (2004) *Drosophila Wnt-1 undergoes a hydrophobic modification and is targeted to lipid rafts, a process that requires porcupine* J. Biol. Chem., **279**, 33220-33227

6. Echinoderms

Loza-Huerta, A., Vera-Estrella, R., Darszon, A. and Beltrána, C. (2013) *Certain Strongylocentrotus purpuratus sperm mitochondrial proteins co-purify with low density detergent-insoluble membranes and are PKA or PKC-substrates possibly involved in sperm motility regulation* Biochim. Biophys. Acta, **1830**, 5305–5315

Vacquier, V.D., Loza-Huerta, A., García-Rincón, J., Darszon, A. and Beltrán, C. (2014) S*oluble adenylyl cyclase of sea urchin spermatozoa* Biochim. Biophys. Acta, **1842**, 2621–2628

7. Fish and fish embryo

Adachi, T., Sato, C. and Kitajima, K. (2007) *Membrane microdomain formation in crucial in epiboly during gastrulation of medaka* Biochem. Biophys. Res. Commun., **358**, 848-853

Adachi, T., Sato, C., Kishi, Y., Totani, K., et al, (2009) *Membrane microdomains from early gastrula embryos of medaka, Oryzias latipes, are a platform of E-cadherin- and carbohydrate-mediated cell–cell interactions during epiboly* Glycoconj. J. **26**, 285–299

Sezgin, E., Azbazdar, Y., Ng, X.W., The, C., Simons, K., Weidinger, G., Wohland, T., Eggeling, C. and Ozhan, G. (2017) *Binding of canonical Wnt ligands to their receptor complexes occurs in ordered plasma membrane environments* FEBS J., **284**, 2513–2526

Zehmer, J.K. and Hazel, J.R. (2003) *Plasma membrane rafts of rainbow trout are subject to thermal acclimation* J. Exp. Biol., **206**, 1657-1667

Zehmer, J.K. and Hazel, J.R. (2005) *Thermally induced changes in lipid composition of raft and non-raft regions of hepatocyte plasma membranes of rainbow trout* J. Exp. Biol., **208**, 4283-4290

8. Fungi

8-1. *Candida albicans*

Aeed, P.A., Sperry, A.E., Young, C.L., Nagiec, M.M., et al (2004) *Effect of membrane perturbants on the activity and phase distribution of inositol phosphorylceramide synthase; development of a novel assay* Biochemistry, **43**, 8483-8493

Insenser, M., Nombela, C., Molero, G. and Gil, C. (2006) *Proteomic analysis of detergent-resistant membranes from Candida albicans* Proteomics, **6,** Suppl. **1**., S74-S81

Martin, S.W. and Konopka, J.B. (2004) *Lipid raft polarization contributes to hyphal growth in Candida albicans* Eukary. Cell, **3**, 675-684

Ragni, E., Calderon, J., Fascio, U., Sipiczki, M., et al (2011) *Phr1p, a glycosylphosphatidylinsitol-anchored β(1,3)-glucanosyltransferase critical for hyphal wall formation, localizes to the apical growth sites and septa in Candida albicans* Fungal Genet. Biol., **48**, 793–805

Wang, L., Jia, Y., Tang, R-J., Xu, Z., Cao, Y-B., Jia, X-M. and Jiang, Y-Y. (2012) *Proteomic analysis of Rta2p-dependent raft-association of detergent-resistant membranes in Candida albicans* PLoS One, **7**: e37768

8-2. *Saccharomyces cerevisiae*

ABC transporters

Rockwell, N.C., Wolfger, H., Kuchler, K. and Thorner, J. (2009) *ABC transporter Pdr10 regulates the membrane microenvironment of Pdr12 in Saccharomyces cerevisiae* J Membr. Biol., **229**, 27–52

Acyl chains

Gaigg, B., Toulmay, A. and Scheiter, R. (2006) *Very long-chain fatty acid-containing lipids rather than sphingolipids per se are required for raft association and stable surface transport of newly synthesized plasma membrane ATPase in yeast* J. Biol. Chem., **281**, 34135-34145

Peng, Y., Tang, F. and Weisman, L.S. (2006) *Palmitoylation plays a role in targeting Vac8p to specific membrane subdomains* Traffic, **7**, 1378-1387

Tatzer, V., Zellnig, G., Kohlwein, S.D. and Schneiter, R. (2002) *Lipid-dependent subcellular relocalization of the acyl chain desaturase in yeast* Mol. Biol. Cell, **13**, 4429-4442

Actin organization

Aronova, S., Wedaman, K., Anderson, S., Yates, J., et al (2007) *Probing the membrane environment of the TOR kinases reveals functional interactions between TORC1, actin and membrane trafficking in Saccharomyces cerevisiae* Mol. Biol. Cell, **18**, 2779-2794

Balguerie, A., Bagnat, M., Bonneu, M., Aigle, M., et al (2002) *RVS161p and sphingolipids are required for actin repolarization following salt stress* Eukaryot. Cell, **1**, 1021-1031

Germann, M., Swain, E., Bergman, L. and Nickels, Jr. J.T. (2005) *Characterizing the sphingolipid signaling pathway that remediates defects associated with loss of the yeast amphiphysin-like orthologs, Rvs161p and Rvs167p* J. Biol. Chem., **280**, 4270-4278

Kishimoto, T., Yamamoto, T. and Tanaka, K. (2005) *Defects in structural integrity of ergosterol and the Cdc50p-Drs2p putative phospholipid translocase cause accumulation of endocytic membranes, onto which actin patches are assembled in yeast* Mol. Biol. Cell, **16**, 5592-5609

Proszynski, T.J., Klemm, R.W., Gravert, M., Hsu, P.P., et al (2005) *A genome-wide visual screen reveals a role for sphingolipids and ergosterol in cell surface delivery in yeast* Proc. Natl. Acad. Sci. USA, **102**, 17981-17986

Amino acid transport

Lauwers, E., Grossmann, G. and André, B. (2007) *Evidence for coupled biogenesis of yeast Gap1 permease and sphingolipids: essential role in transport activity and normal control by ubiqutination* Mol. Biol. Cell **18**, 3068-3080

Apoptosis

Büttner, S., Delay, C., Franssens, V., Bammens, T., et al (2010) *Synphilin-1 enhances α-synuclein aggregation in yeast and contributes to cellular stress and cell death in a Sir2-dependent manner* PloS One **5**: e13700

Ca^{2+}- CaM

Ana, B., Chen, Y., Li, B., Qin, G. and Tian, S. (2014) *Ca^{2+}–CaM regulating viability of Candida guilliermondii under oxidative stress by acting on detergent resistant membrane proteins* J. Proteom., **109**, 38–49

Cholesterol

Souza, C.M., Schwabe, T.M.E., Pichler, H., Ploier, B., et al (2011) *A stable yeast strain efficiently producing cholesterol instead of ergosterol is functional for tryptophan uptake, but not weak organic acid resistance* Metab. Eng., **13**, 555–569

Coenzyme Q uptake

Padilla-López, S., Jiménez-Hidalgo, M., Martín-Montalvo, A., Clarke, C.F., et al (2009) *Genetic evidence for the requirement of the endocytic pathway in the uptake of coenzyme Q6 in Saccharomyces cerevisiae* Biochim. Biophys. Acta **1788**, 1238–1248

Endocytosis

Kashiwazaki, J., Yamasaki, Y., Itadani, A., Teraguchi, E., et al (2011) *Endocytosis is essential for dynamic translocation of a syntaxin 1 orthologue during fission yeast meiosis* Mol. Biol. Cell, **22**, 3658-3670

Ergosterol

Bagnat, M. and Simons, K. (2002) *Cell surface polarization during yeast mating* Proc. Natl. Acad. Sci. USA, **99**, 14283-14188

Eisenkolb, M., Zenzmaier, C., Leitner, E., and Schneiter, R. (2002) *A specific structural requirement for ergosterol in long-chain fatty acid synthesis mutants important for maintaining raft domains in yeast* Mol. Biol. Cell, **13**, 4414-4428
Grossmann, G., Opekarova, M., Novakova, L., Stolz, J., et al (2006) *Lipid raft-based membrane compartmentation of a plant transport protein expressed in Saccharomyces cerevisiae* Eukary. Cell, **5**, 945-953
Iwaki, T., Iefuji, H., Hiraga, Y., Hosomi, A., et al (2008) *Multiple functions of ergosterol in the fission yeast Schizosaccharomyces pombe* Microbiology **154**, 830-841
Kishimoto, T., Yamamoto, T. and Tanaka, K. (2005) *Defects in structural integrity of ergosterol and the Cdc50p-Drs2p putative phospholipid translocase cause accumulation of endocytic membranes, onto which actin patches are assembled in yeast* Mol. Biol. Cell, **16**, 5592-5609
Li, Y. and Priz, W.A. (2004) *ATP-binding cassette (ABC) transporters mediate nonvesicular, raft-modulatd sterol movement from the plasma membrane to the endoplasmic reticulum* J. Biol. Chem., **279**, 45226-45234
Pasrija, R., Panwar, S.L. and Prasad, R. (2008) *Multidrug transporters CaCdr1p and CaMdr1p of Candida albicans display different lipid specificities: both ergosterol and sphingolipids are essential for targeting of CaCdr1p to membrane rafts* Antimicrob. Agents Chemother., **52, 694-704**
Pineau, L., Bonifait, L., Berjeaud, J-M., Alimardani-Theuil, P., et al (2008) *A lipid-mediated quality control process in the Golgi apparatus in yeast* Mol. Biol. Cell, **19**, 807-821
Proszynski, T.J., Klemm, R.W., Gravert, M., Hsu, P.P., et al (2005) *A genome-wide visual screen reveals a role for sphingolipids and ergosterol in cell surface delivery in yeast* Proc. Natl. Acad. Sci. USA, **102**, 17981-17986
Souza, C.M., Schwabe, T.M.E., Pichler, H., Ploier, B., et al (2011) *A stable yeast strain efficiently producing cholesterol instead of ergosterol is functional for tryptophan uptake, but not weak organic acid resistance* Metab. Eng., **13**, 555–569
Takeda, T. and Chang, F. (2005) *Role of fission yeast myosin I in organization of sterol-rich membrane domains* Curr. Biol., **15**, 1331-1336
Umebayashi, K. and Nakano, A. (2003) *Ergosterol is required for targeting of tryptophan permease to the yeast plasma membrane* J. Cell Biol., **161**, 1117-1131
Valachovic, M., Bareither, B.M., Alam Bhuiyan, M.S., Eckstein, J., et al (2006) *Cumulative mutations affecting sterol biosynthesis in the yeast Saccharomyces cerevisiae result in synthetic lethality that is suppressed by alterations in sphingolipid profiles* Genetics, **173**, 1893-1908

Glycophospholipids

Yoko-o, T., Ichikawa, D., Miyagishi, Y., Kato, A., Umemura, M., Takase, K., Ra, M., Ikeda, K., Taguchi, R. and Jigami Y. (2013) *Determination and physiological roles of the glycosylphosphatidylinositol lipid remodelling pathway in yeast* Mol. Microbiol., **88**, 140–155

GPI-proteins

Dupre, S. and Haguenauer-Tsapis, R. (2003) *Raft partitioning of the yeast uracil permease during trafficking along the endocytic pathway Traffic, **4**, 83-9*
Eisenkolb, M., Zenzmaier, C., Leitner, E., and Schneiter, R. (2002) *A specific structural requirement for ergosterol in long-chain fatty acid synthesis mutants important for maintaining raft domains in yeast* Mol. Biol. Cell, **13**, 4414-4428
Fujita, M., Umemura, M., Yoko-o, T. and Jigami, Y. (2006) *PER1 is required for GPI-Phospholipase A2 activity and involved in lipid remodeling of GPI-anchored proteins* Mol. Biol. Cell, **17**, 5253-5264
Okamoto, M., Yoko-o, T., Umemura, M., Nakayama, K-i., et al (2006) *Glycosylphosphatidyl-inositol-anchored proteins are required for the transport of detergent-resistant microdomain-associated membrane proteins Tat2p and Fur4p* J. Biol. Chem., **281**, 4013-4023
Sikorska, N., Lemus, L., Aguilera-Romero, A., Manzano-Lopez, J., Riezman, H., Muñiz, M. and Goder, V. (2016) *Limited ER quality control for GPI-anchored proteins* J. Cell Biol., **213**, 693–704
Umemura, M., Fujita, M., Yoko-o, T., Fukamizu, A, et al (2007) *Saccharomyces cerevisiae CWH43 is involved in the remodeling of the lipid moiety of GPI anchors to ceramides* Mol. Biol. Cell, **18**, 4304-4316

Growth properties

Bagnat, M. and Simons, K. (2002) *Cell surface polarization during yeast mating* Proc. Natl. Acad. Sci. USA, **99**, 14283-14188
Claret, S., Roumanie, O., Prouzet-Mauleon, V., Lefebvre, F., et al (2011) *Evidence for functional links between theRgd1-Rho3RhoGAPGTPasemodule and Tos2, a protein involved in polarized growth in Saccharomyces cerevisiae* FEMS Yeast Res., **11**, 179–191

Tani, M., Khara, A. and Igarashi, Y. (2006) *Rescue of cell growth by sphingosine with disruption of lipid microdomain formation in Saccharomyces cerevisiae deficient in sphingolipid biosynthesis* Biochem. J., **394**, 237-242

H^+-ATPase Pma1P

Bagnat, M., Chang, A. and Simons, K. (2001) *Plasma membrane proton ATPase Pma1p requires raft association for surface delivery in yeast* Mol. Biol. Cell, **12**, 4129-4138

Czyz, O., Bitew, T., Cuesta-Marban, A., McMaster, C.R., 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

Gaigg, B., Toulmay, A. and Scheiter, R. (2006) *Very long-chain fatty acid-containing lipids rather than sphingolipids per se are required for raft association and stable surface transport of newly synthesized plasma membrane ATPase in yeast* J. Biol. Chem., **281**, 34135-34145

Lee, M.C., Hamamoto, S. and Schekman, R. (2002) *Ceramide biosynthesis is required for the formation of the oligomeric* H^+ *-ATPase Pma1p in the yeast endoplasmic reticulum* J. Biol. Chem., **277**, 23395-23401

Liu, Y. and Chang, A. (2006) *Quality control of a mutant plasma membrane ATPase: ubiquitylation prevents cell-surface stability* J. Cell Sci., **119**, 360-369

Malinska, K., Malinsky, J., Opekarova, M and Tanner, W. (2003) *Visualization of protein compartmentation within the plasma membrane of living yeast cells* Mol. Biol. Cell., **14**, 4427-4436

Malinska, K., Malinsky, J., Opekarova, M. and Tanner, W. (2004) *Distribution of Can1p into stable domains reflects lateral protein segregation within the plasma membrane of living S. cerevisiae cells* J. Cell Sci., **117**, 6031-6041

Pizzirusso, M. and Chang, A. (2004) *Ubiquitin-mediated targeting of a mutant plasma membrane ATPase, Pma1-7, to the endosomal/vacuolar system in yeast* Mol. Biol. Cell, **15**, 2401-2409

Iron regulated transport

Tan, S., Zhang, P., Xiao, W., Feng, B., Chen, L-Y., Li, S., Li, P., Zhao, W-Z., Qi, X-T. and Yin, L-P. (2018) *TMD1 domain and CRAC motif determine the association and disassociation of MxIRT1 with detergent-resistant membranes* Traffic, **19**, 122–137

Membrane trafficking

Aronova, S., Wedaman, K., Anderson, S., Yates, J. et al (2007) *Probing the membrane environment of the TOR kinases reveals functional interactions between TORC1, actin and membrane trafficking in Saccharomyces cerevisiae* Mol. Biol. Cell, **18**, 2779-2794

Cuesta-Marbán, A., Botet, J., Czyz, O., Cacharro, L.M., et al (2013) *Drug uptake, lipid rafts, and vesicle trafficking modulate resistance to an anticancer lysophosphatidyl-choline analogue in yeast* J. Biol. Chem., **288**, 8405–8418

Czyz, O., Bitew, T., Cuesta-Marban, A., McMaster, C.R., 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

Watanabe, R., Castillon, G.A., Meury, A. and Riezman, H. (2008) *The presence of an ER exit signal determines the protein sorting upon ER exit in yeast* Biochem. J., **414**, 237-245

Zabrocki, P., Bastiaens, I., Delay, C., Bammens, T., Ghillebert, R., Pellens, K., De Virgilio, C., Van Leuven, F. and Winderickx, J. (2008) *Phosphorylation, lipid raft interaction and traffic of α-synuclein in a yeast model for Parkinson* Biochim. Biophys. Acta., **1783**, 1767-1780

Morphogenesis

Rolli, E., Ragni, E., Calderon, J., Porello, S., et al (2009) *Immobilization of the glycosylphosphatidylinositol-anchored Gas1 protein into the chitin ring and septum is required for proper morphogenesis in yeast* Mol. Biol. Cell, **20**, 4856–4870

Na^+/H^+ antiport

Mitsui, K., Hatakeyama, K., Matsushita, M. and Kanazawa, H. (2009) *Saccharomyces cerevisiae* Na^+/H^+ *antiporter Nha1p associates with lipid rafts and requires sphingolipid for stable localization to the plasma membrane* J. Biochem., **145**, 709–720

Oxidative stress

Ana, B., Chen, Y., Li, B., Qin, G., et al (2014) Ca^{2+} *–CaM regulating viability of Candida guilliermondii under oxidative stress by acting on detergent resistant membrane proteins* J. Proteom., **109**, 38–49

Phospholipids

Cuesta-Marbán, A., Botet, J., Czyz, O., Cacharro, L.M., et al (2013) *Drug uptake, lipid rafts, and vesicle trafficking modulate resistance to an anticancer lysophosphatidyl-choline analogue in yeast* J. Biol. Chem., **288**, 8405–8418

Czyz, O., Bitew, T., Cuesta-Marban, A., McMaster, C.R., 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

Kato, U., Emoto, K., Fredriksson, C., Nakamura, H., et al (2002) *A novel membrane protein, Ros3p, is required for phospholipid translocation across the plasma membrane in Saccharomyces cerevisiae* J. Biol. Chem., **277**, 37855-37862

Kishimoto, T., Yamamoto, T. and Tanaka, K. (2005) *Defects in structural integrity of ergosterol and the Cdc50p-Drs2p putative phospholipid translocase cause accumulation of endocytic membranes, onto which actin patches are assembled in yeast* Mol. Biol. Cell, **16**, 5592-5609

Kobayashi, T., Takematsu, H., Yamaji, T., Hiramoto, S., et al (2005) *Disturbance of sphingolipid biosynthesis abrogates the signaling of Mss4, phosphatidylinositol-4-phosphate 5-kinase, in yeast* J. Biol. Chem., **289**, 18087-18094

Noji, T., Yamamoto, T., Saito, K., Fujimura-Kamada, K., et al (2006) *Mutational analysis of the Lem3p-Dnf1p putative phospholipid-translocating P-type ATPase reveals novel regulatory roles for Lem3p and a carboxyl-terminal region of Dnf1p independent of the phospholipid-translocating activity of Dnf1p in yeast* Biochem. Biophys. Res. Commun., **344**, 323-331

Okamoto, M., Yoko-o, T., Umemura, M., Nakayama, K-i., et al (2006) *Glycosylphosphatidyl-inositol-anchored proteins are required for the transport of detergent-resistant microdomain-associated membrane proteins Tat2p and Fur4p* J. Biol. Chem., **281**, 4013-4023

Opekarova, M., Malinska, K., Novakova, L. and Tanner, W. (2005) *Differential effect of phosphatidyl-ethanolamine depletion on raft proteins. Further evidence for diversity of rafts in Saccharomyces cerevisiae* Biochim. Biophys. Acta, **1711**, 87-95

Pineau, L., Bonifait, L., Berjeaud, J-M., Alimardani-Theuil, P., et al (2008) *A lipid-mediated quality control process in the Golgi apparatus in yeast* Mol. Biol. Cell, **19**, 807-821

Takeda, T. and Chang, F. (2005) *Role of fission yeast myosin I in organization of sterol-rich membrane domains* Curr. Biol., **15**, 1331-1336

Takeda, T. and Chang, F. (2005) *Role of fission yeast myosin I in organization of sterol-rich membrane domains* Curr. Biol., **15**, 1331-1336

Zaremberg, V., Gajate, C., Cacharro, L.M., Mollinedo, F., et al (2005) *Cytotoxicity of an anti-cancer lysophospholipid through selective modification of lipid raft composition* J. Biol. Chem., **280**, 38047-38058

Protein localization

Bagnat, M., Keranen, S., Shevchenko, A., Shevchenko, A. and Simons, K (2000) *Lipid rafts function in biosynthetic delivery of proteins to the cell surface in yeast* Proc. Natl. Acad. Sci., USA, **97**, 3254-3259

Fujita, M., Umemura, M., Yoko-o, T. and Jigami, Y. (2006) *PER1 is required for GPI-Phospholipase A2 activity and involved in lipid remodeling of GPI-anchored proteins* Mol. Biol. Cell, **17**, 5253-5264

Grossmann, G., Opekarova, M., Novakova, L., Stolz, J., et al (2006) *Lipid raft-based membrane compartmentation of a plant transport protein expressed in Saccharomyces cerevisiae* Eukary. Cell, **5**, 945-953

Lauwers, E. and Andre, B. (2006) *Association of yeast transporters with detergent-resistant membranes correlates with their cell-surface location* Traffic, **7**, 1045-1059

Malinska, K., Malinsky, J., Opekarova, M and Tanner, W. (2003) *Visualization of protein compartmentation within the plasma membrane of living yeast cells* Mol. Biol. Cell., **14**, 4427-4436

Malinska, K., Malinsky, J., Opekarova, M. and Tanner, W. (2004) *Distribution of Can1p into stable domains reflects lateral protein segregation within the plasma membrane of living S. cerevisiae cells* J. Cell Sci., **117**, 6031-6041

Okamoto, M., Yoko-o, T., Umemura, M., Nakayama, K-i., et al (2006) *Glycosylphosphatidyl-inositol-anchored proteins are required for the transport of detergent-resistant microdomain-associated membrane proteins Tat2p and Fur4p* J. Biol. Chem., **281**, 4013-4023

Opekarova, M., Malinska, K., Novakova, L. and Tanner, W. (2005) *Differential effect of phosphatidyl-ethanolamine depletion on raft proteins. Further evidence for diversity of rafts in Saccharomyces cerevisiae* Biochim. Biophys. Acta, **1711**, 87-95

Peng, Y., Tang, F. and Weisman, L.S. (2006) *Palmitoylation plays a role in targeting Vac8p to specific membrane subdomains* Traffic, **7**, 1378-1387

Řičicová, M., Kučerova, H., Váchová, L. and Palková, Z. (2007) *Association of putative ammonium exporters Ato with depergent-resistant compartments of plasma membrane during yeast colony development: pH affects Ato1p localization in patches* Biochim. Biophys. Acta, **1768**, 1170-1178

Takeda, T. and Chang, F. (2005) *Role of fission yeast myosin I in organization of sterol-rich membrane domains* Curr. Biol., **15**, 1331-1336

Sphingolipids

Bagnat, M. and Simons, K. (2002) *Cell surface polarization during yeast mating* Proc. Natl. Acad. Sci. USA, **99**, 14283-14188
Balguerie, A., Bagnat, M., Bonneu, M., Aigle, M., et al (2002) *RVS161p and sphingolipids are required for actin repolarization following salt stress* Eukaryot. Cell, **1**, 1021-1031
Dupre, S. and Haguenauer-Tsapis, R. (2003) *Raft partitioning of the yeast uracil permease during trafficking along the endocytic pathway* Traffic, **4**, 83-96
Eisenkolb, M., Zenzmaier, C., Leitner, E., and Schneiter, R. (2002) *A specific structural requirement for ergosterol in long-chain fatty acid synthesis mutants important for maintaining raft domains in yeast* Mol. Biol. Cell, **13**, 4414-4428
Ferreira, C. and Lucas, C. (2008) *The yeast O-acyltransferase Gup1p interferes in lipid metabolism with direct consequences on the sphingolipid-sterol-ordered domains integrity/assembly* Biochim. Biophys. Acta, **1778**, 2648-2653
Fröhlich, F., Moreira, K., Aguilar, P.S., Hubner, N.C., et al (2009) *A genome-wide screen for genes affecting eisosomes reveals Nce102 function in sphingolipid signaling* J. Cell Biol., **185**, 1227–1242
Gaigg, B., Toulmay, A. and Scheiter, R. (2006) *Very long-chain fatty acid-containing lipids rather than sphingolipids per se are required for raft association and stable surface transport of newly synthesized plasma membrane ATPase in yeast* J. Biol. Chem., **281**, 34135-34145
García-Marqués, S., Randez-Gil, F., Dupont, S., Garre, E. and Prieto, J.A. (2016) *Sng1 associates with Nce102 to regulate the yeast Pkh–Ypk signaling module in response to sphingolipid status* Biochim. Biophys. Acta, **1863**, 1319–1333
Germann, M., Swain, E., Bergman, L. and Nickels, Jr. J.T. (2005) *Characterizing the sphingolipid signaling pathway that remediates defects associated with loss of the yeast amphiphysin-like orthologs, Rvs161p and Rvs167p* J. Biol. Chem., **280**, 4270-4278
Grossmann, G., Opekarova, M., Novakova, L., Stolz, J., et al (2006) *Lipid raft-based membrane compartmentation of a plant transport protein expressed in Saccharomyces cerevisiae* Eukary. Cell, **5**, 945-953
Idkowiak-Baldys, J., Grilley, M.M. and Takemoto, J.Y. (2004) *Sphingolipid C4 hydroxylation influences properties of yeast detergent-insoluble glycolipid-enriched membranes* FEBS Lett., **569**, 272-276
Kobayashi, T., Takematsu, H., Yamaji, T., Hiramoto, S., et al (2005) *Disturbance of sphingolipid biosynthesis abrogates the signaling of Mss4, phosphatidylinositol-4-phosphate 5-kinase, in yeast* J. Biol. Chem., **289**, 18087-18094
Lauwers, E., Grossmann, G. and André, B. (2007) *Evidence for coupled biogenesis of yeast Gap1 permease and sphingolipids: essential role in transport activity and normal control by ubiquitination* Mol. Biol. Cell **18**, 3068-3080
Lee, M.C., Hamamoto, S. and Schekman, R. (2002) *Ceramide biosynthesis is required for the formation of the oligomeric H^+ -ATPase Pma1p in the yeast endoplasmic reticulum* J. Biol. Chem., **277**, 23395-23401
Mitsui, K., Hatakeyama, K., Matsushita, M. and Kanazawa, H. (2009) *Saccharomyces cerevisiae Na^+/H^+ antiporter Nha1p associates with lipid rafts and requires sphingolipid for stable localization to the plasma membrane* J. Biochem., **145**, 709–720
Pasrija, R., Panwar, S.L. and Prasad, R. (2008) *Multidrug transporters CaCdr1p and CaMdr1p of Candida albicans display different lipid specificities: both ergosterol and sphingolipids are essential for targeting of CaCdr1p to membrane rafts* Antimicrob. Agents Chemother., **52, 694-704**
Proszynski, T.J., Klemm, R.W., Gravert, M., Hsu, P.P., et al (2005) *A genome-wide visual screen reveals a role for sphingolipids and ergosterol in cell surface delivery in yeast* Proc. Natl. Acad. Sci. USA, **102**, 17981-17986
Tani, M., Khara, A. and Igarashi, Y. (2006) *Rescue of cell growth by sphingosine with disruption of lipid microdomain formation in Saccharomyces cerevisiae deficient in sphingolipid biosynthesis* Biochem. J., **394**, 237-242
Tanigawa, M., Kihara, A., Terashima, M., Takahara, T. et al (2012) *Sphingolipids regulate the yeast high-osmolarity glycerol response pathway* Mol. Cell. Biol., **32**, 2861-2870
Valachovic, M., Bareither, B.M., Alam Bhuiyan, M.S., Eckstein, J., et al (2006) *Cumulative mutations affecting sterol biosynthesis in the yeast Saccharomyces cerevisiae result in synthetic lethality that is suppressed by alterations in sphingolipid profiles* Genetics, **173**, 1893-1908

α-Synuclein

Büttner, S., Delay, C., Franssens, V., Bammens, T., et al (2010) *Synphilin-1 enhances α-synuclein aggregation in yeast and contributes to cellular stress and cell death in a Sir2-dependent manner* PloS One **5**: e13700

Thioredoxin

Takeuchi, Y., Nomura, W., Ohdate, T., Tamasu, S., et al (2007) *Release of thioredoxin from Saccharomyces cerevisiae with environmental stimuli: solubilization of thioredoxin with ethanol* Appl. Microbiol. Biotechnol., **75**, 1393-1399

Tryptophan transport

Abe, F. and Iida, H. (2003) *Pressure-induced differential regulation of the two tryptophan permeases Tat1 and Tat2 by ubiquitin ligase Rsp5 and its binding proteins, Bu11 and Bu12* Mol. Cell. Biol., **23**, 7566-7584

Daicho, K., Makino, N., Hiraki, T., Ueno, M., Uritani, M., Abe, F. and Ushimaru, T. (2009) *Sorting defects of the tryptophan permease Tat2 in an erg2 yeast mutant* FEMS Microbiol. Lett., **298**, 218-227

Hiraki, T. and Abe, F. (2010) *Overexpression of Sna3 stabilizes tryptophan permease Tat2, potentially competing for the WW domain of Rsp5 ubiquitin ligase with its binding protein Bul1* FEBS Lett., **584**, 55–60

Souza, C.M., Schwabe, T.M.E., Pichler, H., Ploier, B., Leitner, E., Guan, X.L., Wenke, M.R., Riezman, I. and Riezman, H. (2011) *A stable yeast strain efficiently producing cholesterol instead of ergosterol is functional for tryptophan uptake, but not weak organic acid resistance* Metab. Eng., **13**, 555–569

Umebayashi, K. and Nakano, A. (2003) *Ergosterol is required for targeting of tryptophan permease to the yeast plasma membrane* J. Cell Biol., **161**, 1117-1131

Ubiquitin

Abe, F. and Iida, H. (2003) *Pressure-induced differential regulation of the two tryptophan permeases Tat1 and Tat2 by ubiquitin ligase Rsp5 and its binding proteins, Bu11 and Bu12* Mol. Cell. Biol., **23**, 7566-7584

Kinner, A. and Kölling, R. (2003) *The yeast deubiquitinating enzyme Ubp16 is anchored to the outer mitochondrial membrane* FEBS Lett., **549**, 135-140

Lauwers, E. and Andre, B. (2006) *Association of yeast transporters with detergent-resistant membranes correlates with their cell-surface location* Traffic, **7**, 1045-1059

Lauwers, E., Grossmann, G. and André, B. (2007) *Evidence for coupled biogenesis of yeast Gap1 permease and sphingolipids: essential role in transport activity and normal control by ubiqutination* Mol. Biol. Cell **18**, 3068-3080

Pizzirusso, M. and Chang, A. (2004) *Ubiquitin-mediated targeting of a mutant plasma membrane ATPase, Pma1-7, to the endosomal/vacuolar system in yeast* Mol. Biol. Cell, **15**, 2401-2409

Uracil transport

Dupre, S. and Haguenauer-Tsapis, R. (2003) *Raft partitioning of the yeast uracil permease during trafficking along the endocytic pathway* Traffic, **4**, 83-96

Hearn, J.D., Lester, R.L. and Dickson, R.C. (2003) *The uracil transporter Fur4p associates with lipid rafts* J. Biol. Chem., **278**, 3679-3686

Okamoto, M., Yoko-o, T., Umemura, M., Nakayama, K-i. and Jigami, Y. (2006) *Glycosylphosphatidyl-inositol-anchored proteins are required for the transport pg detergent-resistant microdomain-associated membrane proteins Tat2p and Fur4p* J. Biol. Chem., **281**, 4013-4023

Viral replication studies

Zhang, J., Zhang, Z., Chukkapalli, V., Nchoutmboube, J.A., Li, J., Randall, G., Belov, G.A. and Wang, X. (2016) *Positive-strand RNA viruses stimulate host phosphatidylcholine synthesis at viral replication sites* Proc. Natl. Acad. Sci. USA, **113**, E1064–E1073

9. Insect larva brush border

Bayyareddy, K., Zhu, X., Orlando, R. and Adang, M.J. (2012) *Proteome analysis of Cry4Ba toxin-interacting Aedes aegypti lipid rafts using geLC-MS/MS* J. Proteome Res., **11**, 5843-5855

Bravo, A., Gomez, I., Conde, J., Munoz-Garay, C., Sanchez, J., Miranda, R., Zhuang, M., Gill, S.S. and Soberon, M. (2004) *Oligomerization triggers binding of a Bacillus thuringiensis Cry1Ab pore-forming toxin to aminopeptidase N receptor leading to insertion into membrane microdomains* Biochim. Biophys. Acta, **1667**, 38-46

Ito, T., Bando, H. and Asano, S-i. (2006) *Activation process of the mosquitocidal δ-endotoxin Cry39A produced by Bacillus thuringiensis subsp. aizawai BUN1-14 and binding property to Anopheles stephensi BBMV* J. Invert. Pathol., **93**, 29-35

Liu, J-G., Yang, A-Z., Shen, X-H., Hua, B-G., Shi, G-L. (2011) *Specific binding of activated Vip3Aa10 to Helicoverpa armigera brush border membrane vesicles results in pore formation* J. Invertebr. Pathol., **108**, 92–97

10. Plant tissue

Belugin, B.V., Zhestkova, I.M. and Trofimova, M.S. (2011) *Affinity of PIP-aquaporins to sterol-enriched domains in plasma membrane of the cells of etiolated pea seedlings* Biochemistry (Moscow) Suppl. Series A: Membr. Cell Biol., **5**, 56–63

Carmona-Salazar, L., El Hafidi, M., Enríquez-Arredondo, C., Vázquez-Vázquez, C., González de la Vara, L.E. and Gavilanes-Ruíz, M. (2011) *Isolation of detergent-resistant membranes from plant photosynthetic and non-photosynthetic tissues* Anal. Biochem., **417**, 220–227

Carmona-Salazar, L., El Hafidi, M., Gutierrez-Najera, N., Noyola-Martinez, L., Gonzalez-Solis, A. and Gavilanes-Ruiz, M. (2015) *Fatty acid profiles from the plasma membrane and detergent resistant membranes of two plant species* Phytochemistry, **109**, 25–35

Han, B., Yang, N., Pu, H. and Wang, T. (2018) *Quantitative proteomics and cytology of rice pollen sterol-rich membrane domains reveals pre-established cell polarity cues in mature pollen* J. Proteome Res., **17**, 1532−1546

Liu, P., Li, R-L., Zhang, L., Wang, Q-L., Niehaus, K., Baluška, F., Šamaj, J. and Lin, J-X. (2009) *Lipid microdomain polarization is required for NADPH oxidase-dependent ROS signaling in Picea meyeri pollen tube tip growth* Plant J., **60**, 303–313

Moscatelli, A., Gagliardi, A., Maneta-Peyret, L., Bini, L., Stroppa, N., Onelli, E., Landi, C., Scali, M., Idilli, A.I. and Moreau, P. (2015) *Characterisation of detergent-insoluble membranes in pollen tubes of Nicotiana tabacum* Biol. Open **4**, 378–399

Nagano, M., Ishikawa, T., Fujiwara, M./, Fukao, Y., Kawano, Y. Kawai-Yamada, M. and Shimamoto, K. (2016) *Plasma membrane microdomains are essential for Rac1-RbohB/H-mediated immunity in rice* Plant Cell, **28**, 1966–1983

Ohta, D. and Mizutani, M. (2012) *Sterol C22-desaturase and its biological roles* In Isoprenoid Synthesis in Plants and Microorganisms: New Concepts and Experimental Approaches (eds. Bach, T.J. and Rohmer, M.) Springer Science+Business Media New York, pp 381-391

Šamajová, O., Takác, T., von Wangenheim, D., Stelzer, E. and Šamaj, J. (2012) *Update on methods and techniques to study endocytosis in plants* In Endocytosis in Plants (ed. Šamaj, J.) Springer-Verlag Berlin Heidelberg, pp 1-36

11. Protozoa

11-1. *Giardia*

De Chatterjee, A., Mendez, T.L., Roychowdhury, S. and Dasa, S. (2015) *The assembly of GM1 glycolipid- and cholesterol-enriched raft-like membrane microdomains is important for Giardial encystation* Infect. Immun. **83**, 2030-2042

11-2. *Leishmania*

Denny, P.W., Field, M.C. and Smith, D.F. (2001) *GPI-anchored proteins and glycoconjugates segregate into lipid rafts in Kinetoplastida* FEBS Lett., **491**, 148-153

Dermine. J-F., Goyette, G., Houde, M., Turco, S.J., et al (2005) *Leishmania donovani lipophosphoglycan disrupts phagosome microdomains in J774 macrophages* Cell. Microbiol., **7**, 1263-1270

Fridberg, A., Buchanan, K.T. and Engman, D.M. (2007) *Flagellar membrane trafficking in kinetoplastids* Parasitol. Res., **100**, 205-212

Sen, S., Roy, K., Mukherjee, S., Mukhopadhyay, R. and Roy, S. (2011) *Restoration of IFNγR subunit assembly, IFNγ signaling and parasite clearance in Leishmania donovani infected macrophages: role of membrane cholesterol* PloS Pathog., **7**: e1002229

Yao, C., Donelson, J.E. and Wilson, M.E. (2003) *The major surface protease (MSP or GP63) of Leishmania sp. Biosynthesis, regulation of expression and function* Mol. Biol. Parasitol., **132**, 1-16

11-3. *Trypanosoma*

De Paulo Martins, V., Okura, M., Maric, D., Engman, D.M., Vieira, M., Docampo, R. and Moreno, S.N.J. (2010) *Acylation-dependent export of Trypanosoma cruzi phosphoinositide-specific phospholipase C to the outer surface of amastigotes* J. Biol. Chem., **285**, 30906-30917

Emmer, B.T., Souther, C., Toriello, K.M., Olson, C.L., Epting, C.L. and Engman, D.M. (2009) *Identification of a palmitoyl acyltransferase required for protein sorting to the flagellar membrane* J. Cell Sci., **122**, 867-874

Fridberg, A., Buchanan, K.T. and Engman, D.M. (2007) *Flagellar membrane trafficking in kinetoplastids* Parasitol. Res., **100**, 205-212

Fridberg, A., Olson, C.L., Nakayasu, E.S., Tyler, K.M., Almeida, I.C. and Engman, D.M. (2008) *Sphingolipid synthesis is necessary for kinetoplast segregation and cytokinesis in Trypanosoma brucei* J. Cell Sci., **121**, 522-535

Lantos, A.B., Carlevaro, G., Araoz, B., Diaz, P.R., de los Milagros Camara, M., Buscaglia, C.A., Bossi, M., Yu, H., Chen, X. et al (2016) *Sialic acid glycobiology unveils Trypanosoma cruzi trypomastigote membrane physiology* PloS Pathog., **12**, e1005559
Maric, D., McGwire, B.S., Buchanan, K.T., Olson, C.L., Emmer, B.T., Epting, C.L. and Engman, D.M. (2011) *Molecular determinants of ciliary membrane localization of Trypanosoma cruzi flagellar calcium-binding protein* J. Biol. Chem., **286**, 33109–33117
Maric, D., Olson, C.L., Xu, X., Ames, J.B. and Engman, D.M. (2015) *Calcium-dependent membrane association of a flagellar calcium sensor does not require calcium binding* Mol. Biochem. Parasitol., **201**, 72–75
Mucci, J., Lantos, A.B., Buscaglia, C,A,m Leguizamón, M.S. and Campetella, O. (2017) *The Trypanosoma cruzi surface, a nanoscale patchwork quilt* Trends Parasitol., **33**, 102-112
Niyogi, S., Mucci, J., Campetella, O. and Docampo, R. (2014) *Rab11 regulates trafficking of trans-sialidase to the plasma membrane through the contractile vacuole complex of Trypanosoma cruzi* PLOS Pathog., **10**: e1004224
Sharma, A.I., Olson, C.L., Mamede, J.I., Gazos-Lopes, F., Epting, C.L., Almeida, I.C. and Engman, D.M. (2017) *Sterol targeting drugs reveal life cycle stage-specific differences in trypanosome lipid rafts* Sci. Rep., **7**: 9105
Tyler, K.M., Fridberg, A., Toriello, K.M., Olson, C.L., Cieslak, J.A., Hazlett, T.L. and Engman, D.M. (2009) *Flagellar membrane localization via association with lipid rafts* J. Cell Sci., **122**, 859-866

12. Rice pollen grains

Han, B., Yang, N., Pu, H. and Wang, T. (2018) *Quantitative proteomics and cytology of rice pollen sterol-rich membrane domains reveals pre-established cell polarity cues in mature pollen* J. Proteome Res., **17**, 1532−1546

13. *Xenopus* sperm

Bates, R.C., Fees, C.P., Holland, W.L., Winger, C.C., Batbayar, K., Ancar, R., Bergren, T., Petcoff, D. and Stith, B.J. (2014) *Activation of Src and release of intracellular calcium by phosphatidic acid during Xenopus laevis fertilization* Dev. Biol., **386**, 165-180

OptiPrep™ Reference List RS09; 8th edition, January 2020