

OptiPrep™ Mini-Review MM01

Analysis of plasma lipoproteins – a bibliography

- ◆ This OptiPrep™ Mini-Review contains a brief summary of the methodology for the isolation and analysis of these particles (Section 1); the main aim of this Mini-Review however is to provide, in Section 2, a comprehensive list of references that report the use of OptiPrep™ for the fractionation of VLDL, LDL and HDL and also LDL and HDL sub-classes. The reference list (Section 1c) at the end of Section 1 applies only to this section.

1. Methodological review

1a. Separation and analysis of VLDL, LDL and HDL

Although ultracentrifugation is regarded as the “gold standard” method for the fractionation of plasma lipoproteins, the traditional method of sequential flotation by incrementally increasing the density of the plasma with KBr to provide sequentially VLDL, LDL and HDL is technically simple but excessively tedious (requiring approx. 3 days). The alternative approach involves the use of either discontinuous or continuous KBr/NaCl gradients; these gradients are technically very difficult to produce and handle. Detailed descriptions of the methodologies can be found in references 1-5. Moreover use of some add-on analytical techniques often necessitates removal of the salt by dialysis, adding up to 12 h to the procedure. Moreover, the use of high salt concentrations may cause the loss of certain surface apoproteins from lipoproteins.

The introduction of self-generated gradients of iodixanol in 1996 [6,7] solved many of the problems associated with earlier technology. A simple one step centrifugation for 3 h that resolves VLDL, LDL and HDL, avoiding the use of technically-difficult salt gradients is summarized in Figure 1. Chylomicron-free plasma is simply mixed with OptiPrep™, transferred to tube for a near-vertical rotor; overlaid with a little saline to fill the tube and centrifuged for 3 h. During the centrifugation the shallow resolving gradient is formed and the lipoproteins move to their banding density. The gradient may be collected as shown in Figure 1 by tube puncture or by aspiration from the meniscus.

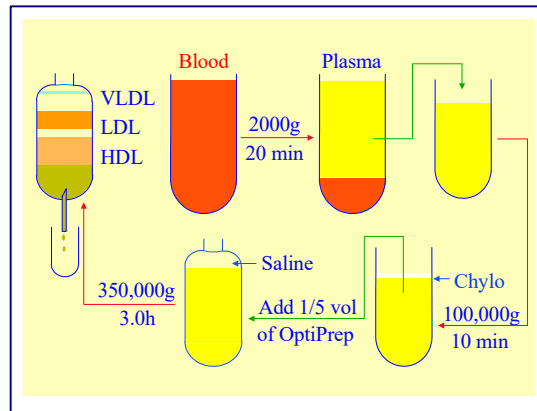


Figure 1: Fractionation of plasma lipoproteins in a self-generated iodixanol gradient from chylomicron-free plasma

1b. Separation and analysis of LDL subclasses

By a small modulation in the starting format, the gradient may be adapted to the fractionation of LDL subclasses; the plasma is adjusted to 12% (w/v) iodixanol (as recommended in refs 6 and 7) but it is overlaid by a solution of 9% (w/v) iodixanol. In a small volume near-vertical rotor such as the Beckman TLN100 the volumes of plasma/12% iodixanol and 9% iodixanol are equal [8]. In the larger volume NVT65 the volumes of 3 ml and 8 ml respectively allow a better resolution of the denser LDL from the HDL [9] and the low density region of the gradient is more shallow, allowing a greater linear separation of the LDL subclasses. In Figure 2 the (3ml + 8 ml) configuration is shown in conjunction with the use of a Coomassie blue stained plasma sample; this allows a density profile of the LDL band to be produced by scanning a digital photograph of the tube assessed without unloading the gradient or assaying the fractions for cholesterol and/or triacylglycerol.

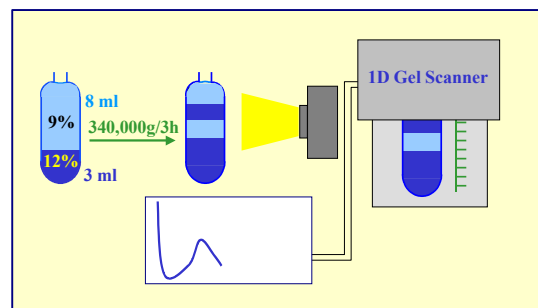


Figure 2: Fractionation and analysis of Coomassie-blue stained plasma lipoproteins in a self-generated iodixanol gradient

- ◆ This strategy has been adapted to the analysis of HDL subclasses in a Sudan black stained plasma [10]
- ◆ Detailed protocols for the purification and analysis of the VLDL, LDL and HDL and for the analysis of LDL subclasses (Application Sheets M07 and M08 respectively) may be accessed from the Axis-Shield OptiPrep™ Applications CD or from the following website: www.axis-shield-density-gradient-media.com, click on “Methodology” then “Macromolecules” to open up the “Macromolecules and Macromolecular Complex Index”. Other OptiPrep™ Application Sheets on the preparation of self-generated gradients and harvesting of gradients may also be accessed from the top of the Index.

1c. References

1. Mackness, M. and Durrington, P.N. (1992) *Lipoprotein separation and analysis for clinical studies* In: *Lipoprotein Analysis: A Practical Approach* (eds. Converse, C.A. and Skinner, E.R.) IRL Press at Oxford University, Oxford, UK, pp 1-42
2. Lindren, F.T., Jensen, L.C. and Hatch, F.T. (1979) *Isolation and quantitative analysis of serum lipoproteins* In: *Blood lipids and lipoproteins, quantitation, composition and metabolism* (ed. Nelson, G.J.) R.E. Krieger Publishing Co. Huntington, NY, pp181-274
3. Chapman, M., Goldstein, J., Lagrange, D. and Laplaud P.M. (1986) *A density gradient ultracentrifugation procedure for the isolation of the major lipoprotein classes from human serum* J. Lipid Res., **22**, 339-358
4. Kelley, J.L. and Kruski, A.W. (1986) *Density gradient ultracentrifugation of serum lipoproteins in a swinging bucket rotor* Methods Enzymol., **128**, 170-181
5. Hinton, R.H., Al-Tamer, Y., Mallinson, A. and Marks, V. (1974) *The use of density gradient centrifugation for the separation of serum lipoproteins* Clin. Chim. Acta, **53**, 355-360
6. Graham, J.M., Higgins, J.A. and Gillot, T. (1995) *A new method for the rapid separation of plasma lipoproteins* Atherosclerosis, **115 (Supp. 1)**, S123
7. Graham, J., Higgins, J. A., Gillott, T., Taylor, T., Wilkinson, J., Ford, T. and Billington, D. (1996) *A novel method for the rapid separation of plasma lipoproteins using self-generated gradients of iodixanol* Atherosclerosis, **124**, 125-135
8. Sawle, A., Higgins, M.K., Olivant, M.P. and Higgins, J.A. (2002) *A rapid single-step centrifugation method for determination of HDL, LDL, and VLDL cholesterol, and TG, and identification of predominant LDL subclass* J. Lipid Res., **43**, 335-343
9. Davies, I.G., Graham, J.M. and Griffin, B.A. (2003) *Rapid separation of LDL subclasses by iodixanol gradient ultracentrifugation* Clin. Chem., **49**, 1865-1872
10. Harman, N.L., Davies, I.G. and Griffin, B.A. (2007) *Separation of the principal HDL subclasses by iodixanol gradient ultracentrifugation* Atherosclerosis, **194**, 283

2. Bibliography

Section 2a lists references reporting studies on plasma lipoproteins and is subdivided alphabetically into animal species (e.g. **2a-1 Black bear**). The majority of papers are concerned with human plasma lipoproteins (**2a-5**); this section is subdivided into those concerned with major lipoprotein classes (**2a-5-1**), HDL subclasses (**2a-5-2**) and LDL subclasses (**2a-5-3**). Within Sections **2a-5-1** and **2a-5-2**, references are further divided according to **research topic**, listed alphabetically. A reference may appear in two or more of these research topic subsections. **Section 2b** lists references reporting the analysis of lipoproteins from sources other than plasma. Within all sections references are listed alphabetically according to **first author** and chronologically for multiple papers from the same first author. **Key words in reference titles are also highlighted in blue.**

2a Plasma lipoproteins

2a-1 Black bear

Frank, N., Elliott, S.B., Allin, S.B. and Ramsay, E.C. (2006) *Blood lipid concentrations and lipoprotein patterns in captive and wild American black bears (Ursus americanus)* Am. J. Vet. Res., **67**, 335-341

2a-2 Bovine

Gardner, R.S., Ogden, N.H., Cripps, P.J. and Billington, D. (2003) *Separation of bovine plasma lipoproteins by a rapid ultracentrifugation method* J. Comp. Path., **128**, 15-23

2a-3 Fish

Aas, G.H., Bjerkeng, B., Storebakken, T. and Ruyter, B. (1999) *Blood appearance, metabolic transformation and plasma transport proteins of ¹⁴C-astaxanthin in Atlantic salmon (Salmo salar L.)* Fish Physiol. Biochem., **21**, 325-334

Aursnes, I.A.S., Gjoen, T. and Rishovd, A-L. (2009) *Effect of hyperthermia on plasma lipids and gene expression in Atlantic Cod (Gadus Morhua I.)* Toxicol. Lett., **189S**, S192

Magnoni, L. and Weber, J-M. (2007) *Endurance swimming activates trout lipoprotein lipase: plasma lipids as a fuel for muscle* J. Exp. Biol., **210**, 4016-4023

Prindiville, J.S., Mennigen, J.A., Zamora, J.M., Moon, T.W. and Weber, J-M. (2011) *The fibrinolytic drug gemfibrozil disrupts lipoprotein metabolism in rainbow trout* Toxicol. Appl. Pharmacol., **251**, 201–208

2a-4 Hamster

Bennett, A.J., Kendrick, J.S., Anderton, K.L., Higgins, J.A. and White, D.A. (1997) *Effect of dietary fish oil or sunflower oil on plasma lipoproteins and hepatic gene expression in the hamster* Atherosclerosis, **130** (Suppl. 1), S24

2a-5 Human

2a-5-1 HDL/LDL/VLDL

Acrolein effects

Conklin, D.J., Barski, O.A., Lesgards, J-F., Juvan, P., Rezen, T., Rozman, D., Prough, R.A., Vladykovskaya, E., Liu, S-Q., Srivastava, S. and Bhatnagar, A. (2010) *Acrolein consumption induces systemic dyslipidemia and lipoprotein modification* Toxicol. Appl. Pharmacol., **243**, 1–12

Apolipoprotein(a)

Oliveira, C., Fournier, C., Descamps, V., Morel, V., Scipione, C.A., Romagnuolo, R., Koschinsky, M.L., Boullier, A., Marcelo, P. et al (2017) *Apolipoprotein(a) inhibits hepatitis C virus entry through interaction with infectious particles* Hepatology, **65**, 1851-1864

Apolipoprotein B100

Mason, R.P., Sherratt, S.C.R. and Jacob, R.F. (2016) *Eicosapentaenoic acid inhibits oxidation of apoB-containing lipoprotein particles of different size in vitro when administered alone or in combination with atorvastatin active metabolite compared with other triglyceride-lowering agents* J. Cardiovasc. Pharmacol., **68**, 33–40

Rabbani, N., Chittari, M.V., Bodmer, C.W., Zehnder, D., Ceriello, A. and Thornalley, P.J. (2010) *Increased glycation and oxidative damage to apolipoprotein B100 of LDL cholesterol in patients with type 2 diabetes and effect of metformin* Diabetes, **59**, 1038–1045

Astaxanthin

Coral-Hinojosa, G.N., Ytrestøyl, T., Ruyter, B. and Bjerkeng, B. (2004) *Plasma appearance of unesterified astaxanthin geometrical E/Z and optical R/S isomers in men given single doses of a mixture of optical 3 and 3'R/S isomers of astaxanthin fatty acyl diesters* Comp. Biochem. Biophys. Part C, **139**, 99-110

Osterlie, M., Bjerkeng, B. and Liaaen-Jensen, S. (2000) *Plasma appearance and distribution of astaxanthin E/Z and R/S isomers in plasma lipoproteins of men after single dose administration of astaxanthin* J. Nutr. Biochem., **11**, 482-490

Atherosclerosis risk

Bassendine, M., Nielsen, S. and Neely, D. (2016) *Hepatitis C virus (HCV) and atherosclerosis risk: a role for low-density immune complexes?* Atherosclerosis, **252**, e206

Bacteriochlorophylls, in

Dandler, J., Wilhelm, B. and Scheer, H. (2010) *Distribution of chlorophyll- and bacteriochlorophyll-derived photosensitizers in human blood plasma* Photochem. Photobiol., **86**, 182–193

Dandler, J., Wilhelm, B. and Scheer, H. (2010) *Photochemistry of bacteriochlorophylls in human blood plasma: Pigment stability and light-induced modifications of lipoproteins* Photochem. Photobiol., **86**, 331–341

CD36, binding to

Alkhatatbeh, M.J., Mhaidat, N.M., Enjeti, A.K., Lincz, L.F. and Thorne, R.F. (2011) *The putative diabetic plasma marker, soluble CD36, is non-cleaved, non-soluble and entirely associated with microparticles* J. Thromb. Haemost., **9**, 844–851

Diabetes Type 1

Ceriello, A., Kumar, S., Piconi, L., Esposito, K. and Giugliano, D. (2007) *Simultaneous control of hyperglycemia and oxidative stress normalizes endothelial function in type 1 diabetes* Diabet. Care **30**, 649-654

Ceriello, A., Piconi, L., Esposito, K. and Giugliano, D. (2007) *Telmisartan shows an equivalent effect of vitamin C in further improving endothelial dysfunction after glycemia normalization in type 1 diabetes* Diabet. Care, **30**, 1694-1698

Ceriello, A., Esposito, K., Ihnat, M., Thorpe, J. and Giugliano, D. (2009) *Long-term glycemic control influences the long-lasting effect of hyperglycemia on endothelial function in type 1 diabetes* J. Clin. Endocrinol. Metab., **94**, 2751-2756

Diabetes Type 2

Anderson, R.A., Evans, M., Ellis, G. R., Graham, J., Morris, K., Jackson, S. K., Lewis, M. J., Rees, A. and Frenneaux, M. P. (2001) *The relationships between post-prandial lipaemia, endothelial function and oxidative stress in healthy individuals and patients with type 2 diabetes* Atherosclerosis, **154**, 475-483

Anderson, R.A., Evans, L.M., Ellis, G.R., Khan, N., Morris, K., Jackson, S.K., Rees, A., Lewis, M.J. and Frenneaux, M.P. (2006) *Prolonged deterioration of endothelial dysfunction in response to postprandial lipaemia is attenuated by vitamin C in type 2 diabetes* Diabet. Med., **23**, 258-264

Anderson, R.A., Evans, L.M., Ellis, G.R., Khan, N., Morris, K., Jackson, S.K., Rees, A., Lewis, M.J. and Frenneaux, M.P. (2006) *Prolonged deterioration of endothelial dysfunction in response to postprandial lipaemia is attenuated by vitamin C in type 2 diabetes* Diabet. Med., **23**, 258-264

Englyst, N.A., Taube, J.M., Aitman, T.J., Baglin, T.P. and Byrne C.D. (2003) *A novel role for CD36 in VLDL-enhanced platelet activation* Diabetes, **52**, 1248-1255

Evans, L.M., Anderson, R.A., Davies, J.S., Ellis, G.R., Jackson, S.K., Graham, J., Lewis, M.J., Frenneaux, M.P. and Rees, A. (1999) *Ciprofibrate reduces the postprandial generation of triglyceride-rich lipoproteins and attenuates the associated endothelial dysfunction and oxidative stress in non-insulin dependent diabetes mellitus* Atherosclerosis Suppl **154**, 434

Evans, L.M., Anderson, R. A., Graham, J., Ellis, G. R., Morris, K., Davies, S., Jackson, S. K., Lewis, M. J., Frenneaux, M. P. and Rees, A. (2000) *Ciprofibrate therapy improves endothelial function and reduces postprandial lipemia and oxidative stress in type 2 diabetes mellitus* Circulation, **101**, 1773-1779

González, M., Heras, M., Rosales, R., Guardiola, M., Plana, N., Vallvé, J.C., Masana, L. and Ribalta, J. (2016) *Increased presence of remnant lipoprotein cholesterol in the HDL of diabetic subjects* Ann. Clin. Lab. Sci., **46**, 229-232

Neri, S., Calvagno, S., Mauceri, B., Misseri, M., Tsami, A., Vecchio, C., Mastrosimone, G., Di Pino, A., Maiorca, D., Judica, A., Romano, G., Rizzotto, A. and Signorelli, S.S. (2010) *Effects of antioxidants on postprandial oxidative stress and endothelial dysfunction in subjects with impaired glucose tolerance and Type 2 diabetes* Eur. J. Nutr., **49**, 409-416

Rabbani, N., Chittari, M.V., Bodmer, C.W., Zehnder, D., Ceriello, A. and Thornalley, P.J. (2010) *Increased glycation and oxidative damage to apolipoprotein B100 of LDL cholesterol in patients with type 2 diabetes and effect of metformin* Diabetes, **59**, 1038-1045

Sidhu, J.S., Cowan, D. and Kaski, J.C. (2004) *Effects of rosiglitazone on endothelial function in men with coronary artery disease without diabetes mellitus* Am. J. Cardiol., **94**, 151-156

Dietary supplements (fish oil)

Mason, R.P. and Sherratt, S.C.R. (2017) *Omega-3 fatty acid fish oil dietary supplements contain saturated fats and oxidized lipids that may interfere with their intended biological benefits* Biochem. Biophys. Res. Communications **483**, 425-429

Rytter, D., Schmidt, E.B., Bech, B.H., Christensen, J.H., Henriksen, T.B. and Olsen, S.F. (2011) *Fish oil supplementation during late pregnancy does not influence plasma lipids or lipoprotein levels in young adult offspring* Lipids, **46**, 1091-1099

Dietary supplements (garlic oil)

Dillon, S.A., Burmi, R.S., Lowe, G.M., Billington, D. and Rahman, K. (2002) *Antioxidant properties of aged garlic extract: an in vitro study incorporating human low density lipoprotein* Life Sci., **72**, 1538-1594

Zhang, X-H., Lowe, D., Giles, P., Fell, S., Board, A. R., Baughan, J. A., Connock, M. J. and Maslin, D. J. (2000) *A randomized trial of the effects of garlic oil upon coronary heart disease risk factors in trained male runners* Blood Coagulat. Fibrinolysis, **11**, 67-74

Ghrelin

Holmes, E., Davies, I., Lowe, G. and Ranganath, L. (2008) *Transport of ghrelin and obestatin in plasma* 77th Congr. Eur. Atheroscler. Soc., 2008, Istanbul, Abstr. PO6-37

Holmes, E., Davies, I., Lowe, G. and Ranganath, L.R. (2009) *Circulating ghrelin exists in both lipoprotein bound and free forms* Ann. Clin. Biochem., **46**, 514-516

Hedgehog proteins

Palm, W., Swierczynska, M.M., Kumari, V., Ehrhart-Bornstein, M., Bornstein, S.R. and Eaton, S. (2013) *Secretion and signaling activities of lipoprotein-associated hedgehog and non-sterol-modified hedgehog in flies and mammals* PLoS Biol., **11**: e1001505

Hypercholesterolemia

Ruiu, G., Pinach, S., Veglia, F., Gambino, R., Marena, S., Uberti, B., Alemanno, N., Burt, D., Pagano, G., and Cassader, M. (2009) *Phytosterol-enriched yogurt increases LDL affinity and reduces CD36 expression in polygenic hypercholesterolemia* Lipids, **44**, 153–160

Hyperglycemia

Ceriello, A.C., Taboga, C., Tonutti, L., Quagliaro, L., Piconi, L., Bais, B., Da Ros, R. and Motz, E. (2002) *Evidence for an independent and cumulative effect of postprandial hypertriglyceridemia and hyperglycemia on endothelial dysfunction and oxidative stress generation* Circulation, **106**, 1211-1218

Ceriello, A., Quagliaro, L., Piconi, L., Assaloni, R., Da Ros, R., Maier, A., Esposito, K. and Giugliano, D. (2004) *Effect of postprandial hypertriglyceridemia and hyperglycemia on circulating adhesion molecules and oxidative stress generation and the possible role of simvastatin treatment* Diabetes, **53**, 701-710

Ceriello, A., Kumar, S., Piconi, L., Esposito, K. and Giugliano, D. (2007) *Simultaneous control of hyperglycemia and oxidative stress normalizes endothelial function in type 1 diabetes* Diabet. Care **30**, 649-654

Ceriello, A., Piconi, L., Esposito, K. and Giugliano, D. (2007) *Telmisartan shows an equivalent effect of vitamin C in further improving endothelial dysfunction after glycemia normalization in type 1 diabetes* Diabet. Care, **30**, 1694-1698

Ceriello, A., Esposito, K., Ihnat, M., Thorpe, J. and Giugliano, D. (2009) *Long-term glycemic control influences the long-lasting effect of hyperglycemia on endothelial function in type 1 diabetes* J. Clin. Endocrinol. Metab., **94**, 2751–2756

Hyperlipidemia

Ceriello, A.C., Taboga, C., Tonutti, L., Quagliaro, L., Piconi, L., Bais, B., Da Ros, R. and Motz, E. (2002) *Evidence for an independent and cumulative effect of postprandial hypertriglyceridemia and hyperglycemia on endothelial dysfunction and oxidative stress generation* Circulation, **106**, 1211-1218

Ceriello, A., Quagliaro, L., Piconi, L., Assaloni, R., Da Ros, R., Maier, A., Esposito, K. and Giugliano, D. (2004) *Effect of postprandial hypertriglyceridemia and hyperglycemia on circulating adhesion molecules and oxidative stress generation and the possible role of simvastatin treatment* Diabetes, **53**, 701-710

Hall, W.L., Jeanes, Y.M. and Lodge, J.K. (2005) *Hyperlipidemic subjects have reduced uptake of newly absorbed vitamin E into their plasma lipoproteins, erythrocytes, platelets, and lymphocytes, as studied by deuterium-labeled α -tocopherol biokinetics* J. Nutr., **135**, 58-63

Isotachopheresis

Inano, K., Tezuka, S., Miida, T. and Okada, M. (2000) *Capillary isotachopheretic analysis of serum lipoprotein using a carrier ampholyte as spacer ion* Ann. Clin. Biochem., **37**, 708-716

LCAT deficiency

Yee, M.S., Pavitt, D.V., Richmond, W., Cook, H.T., McLean, A.G., Valabhji, J. and Elkeles, R.S. (2009) *Changes in lipoprotein profile and urinary albumin excretion in familial LCAT deficiency with lipid lowering therapy* Atherosclerosis **205**, 528–532

LDL binding to amyloid β

Yeh, F.L., Wang, Y., Tom, I., Gonzalez, L.C. and Sheng, M. (2016) *TREM2 binds to apolipoproteins, including APOE and CLU/APOJ, and thereby facilitates uptake of amyloid-Beta by microglia* Neuron **91**, 328–340

LDL, lycopene levels

Chew, P.Y., Riley, L., Graham, D.L., Rahman, K. and Lowe, G.M. (2012) *Does lycopene offer human LDL any protection against myeloperoxidase activity?* Mol. Cell. Biochem., **361**, 181–187

Graham, D.L., Carail, M., Caris-Veyrat, C. and Lowe, G.M. (2010) *Cigarette smoke and human plasma lycopene depletion* Food Chem. Toxicol., **48**, 2413–2420

LDL oxidation

- Ganini, D.** and Mason, R.P. (2014) *Absence of an effect of vitamin E on protein and lipid radical formation during lipoperoxidation of LDL by lipoxygenase* Free Radic. Biol. Med., **76**, 61–68
- Helming, L.**, Winter, J. and Gordon, S. (2009) *The scavenger receptor CD36 plays a role in cytokine-induced macrophage fusion* J. Cell Sci., **122**, 453–459
- Jantan, I.** and Saputri, F.C. (2012) *Benzophenones and xanthones from Garcinia cantleyana var. cantleyana and their inhibitory activities on human low-density lipoprotein oxidation and platelet aggregation* Phytochemistry **80**, 58–63
- Nakano, E.**, Williamson, M.P., Williams, N.H. and Powers, H.J. (2004) *Copper-mediated LDL oxidation by homocysteine and related compounds depends largely on copper ligation* Biochim. Biophys. Acta, **1688**, 33–42
- Nakano, E.**, Taiwo, F.A., Nugent, D., Griffiths, H.R., Aldred, S., Paisi, M., Kwok, M., Bhatt, P., Hill, M.H.E., Moat, S. and Powers, H.J. (2005) *Downstream effects on human low density lipoprotein of homocysteine exported from endothelial cells in an in vitro system* J. Lipid Res., **46**, 484–493
- Rabbani, N.**, Chittari, M.V., Bodmer, C.W., Zehnder, D., Ceriello, A. and Thornalley, P.J. (2010) *Increased glycation and oxidative damage to apolipoprotein B100 of LDL cholesterol in patients with type 2 diabetes and effect of meformin* Diabetes, **59**, 1038–1045
- Saputri, F.C.** and Jantan, I. (2012) *Inhibitory activities of compounds from the twigs of Garcinia hombroniana Pierre on human low-density lipoprotein (LDL) oxidation and platelet aggregation* Phytother. Res. **26**: 1845–1850
- Shanmuganayagam, D.**, Beahm, M.R., Kuhns, M.A., Krueger, C.G., Reed, J.D. and Folts, J.D. (2012) *Differential effects of grape (Vitis vinifera) skin polyphenolics on human platelet aggregation and low-density lipoprotein oxidation* J. Agric. Food Chem., **60**, 5787–5794
- Wahab, N.A.**, Ahdan, R., Aufa, Z.A., Kong, K.W., Johar, M.H., Shariff, Z.M. and Ismail, A. (2015) *Nutritional values and bioactive components of under-utilised vegetables consumed by indigenous people in Malaysia* J. Sci. Food Agric., **95**, 2704–2711

LDL, binding to proprotein convertase subtilisin/kexin type-9

- Golder, M.**, Sarkar, S., Kosenko, T., McPherson, R. and Lagace, T.A. (2014) *Examination of factors affecting the association of PCSK9 with low-density lipoprotein particles in human plasma* Arterioscler. Thromb. Vasc. Biol., **34**, A433
- Kosenko, T.**, Golder, M., Leblond, G., Weng, W. and Lagace, T.A., (2013) *Low density lipoprotein binds to proprotein convertase subtilisin/kexin type-9 (PCSK9) in human plasma and inhibits PCSK9-mediated low density lipoprotein receptor degradation* J. Biol. Chem., **288**, 8279–8288
- Tavori, H.**, Christian, D., Minnier, J., Plubell, D., Shapiro, M.D., Yeang, C., Giunzioni, I., Croyal, M., Duell, P.B. et al (2016) *PCSK9 association with lipoprotein(a)* Circ. Res., **119**, 29–35

LDL, surface lipid modification

- Sargis, R.M.** and Subbaiah, P.V. (2003) *Trans unsaturated fatty acids are less oxidizable than cis unsaturated fatty acids and protect endogenous lipids from oxidation in lipoproteins and lipid bilayers* Biochemistry, **42**, 11533–11543

Lipophilic endotoxin

- Rose, J.R.**, Mullarkey, M. A., Christ, W. J., Hawkins, L. D., Lynn, M., Kishi, Y., Wasan, K. M., Peteherych, K. and Rossignol, D. P. (2000) *Consequences of interaction of a lipophilic endotoxin antagonist with plasma lipoproteins* Antimicrob. Agents Chemother., **44**, 504–510

Lipoprotein apheresis

- Tavori, H.**, Giunzioni, I., Linton, M.F. and Fazio, S. (2013) *Loss of plasma proprotein convertase subtilisin/kexin 9 (PCSK9) after lipoprotein apheresis* Circ. Res., **113**, 1290–1295

LOX-1 receptor

- Vohra, R.S.**, Murphy, J.E., Walker, J.H., Homer-Vanniasinkam, S. and Ponnambalam, S. (2007) *Functional refolding of a recombinant C-type lectin-like domain containing intramolecular disulfide bonds* Protein Expr. Purif., **52**, 415–421

Lycopene, effects on LDL

- Chew, P.Y.**, Riley, L., Graham, D.L., Rahman, K. and Lowe, G.M. (2012) *Does lycopene offer human LDL any protection against myeloperoxidase activity?* Mol. Cell. Biochem., **361**, 181–187

Metabolic syndrome

Mah, E., Sapper, T.N., Chitchumroonchokchai, C., Failla, M.L., Schill, K.E., Clinton, S.K., Bobe, G., Traber, M.G. and Bruno, R.S. (2015) *α -Tocopherol bioavailability is lower in adults with metabolic syndrome regardless of dairy fat co-ingestion: a randomized, double-blind, crossover trial* Am. J. Clin. Nutr., **102**, 1070–80

Methodology

Billington, D., Maxwell, E., Graham, J.M. and Newland, P. (2007) *Large-scale preparation of human low- and high-density lipoproteins by density gradient centrifugation using iodixanol* Anal. Biochem., **367**, 137-139

Graham, J.M., Higgins, J.A. and Gillot, T. (1995) *A new method for the rapid separation of plasma lipoproteins* Atherosclerosis, **115 (Suppl)**, S123

Graham, J., Higgins, J. A., Gillott, T., Taylor, T., Wilkinson, J., Ford, T. and Billington, D. (1996) *A novel method for the rapid separation of plasma lipoproteins using self-generated gradients of iodixanol* Atherosclerosis, **124**, 125-135

Langlois, M.R. and Blaton, V.H. (2006) *Historical milestones in measurement of HDL-cholesterol: Impact on clinical and laboratory practice* Clin. Chim. Acta, **369**, 168-178

Patterson, B. W. (2002) *Methods for measuring lipid metabolism in vivo* Curr. Opin. Clin. Nutr. Metab. Care, **5**, 475-479

Yee, M.S., Pavitt, D.V., Tan, T., Venkatesan, S., Godsland, I.F., Richmond, W. and Johnston, D.G. (2008) *Lipoprotein separation in a novel iodixanol density gradient, for composition, density and phenotype analysis* J. Lipid Res., **49**, 1364-1371

Microparticles

Alkhatatbeh, M.J., Mhaidat, N.M., Enjeti, A.K., Lincz, L.F. and Thorne, R.F. (2011) *The putative diabetic plasma marker, soluble CD36, is non-cleaved, non-soluble and entirely associated with microparticles* J. Thromb. Haemost., **9**, 844–851

Mitotane binding

Kroiss, M., Plonné, D., Kendl, S., Schirmer, D., Ronchi, C.L., Schirbel, A., Zink, M., Lapa, C. et al (2016) *Association of mitotane with chylomicrons and serum lipoproteins: practical implications for treatment of adrenocortical carcinoma* Eur. J. Endocrinol., **174**, 343–353

Obestatin

Holmes, E., Davies, I., Lowe, G. and Ranganath, L. (2008) *Transport of ghrelin and obestatin in plasma* 77th Congr. Eur. Atheroscler. Soc., 2008, Istanbul, Abstr. PO6-37

Phytosterols

Ruiu, G., Pinach, S., Veglia, F., Gambino, R., Marena, S., Uberti, B., Alemanno, N., Burt, D., Pagano, G., and Cassader, M. (2009) *Phytosterol-enriched yogurt increases LDL affinity and reduces CD36 expression in polygenic hypercholesterolemia* Lipids, **44**, 153–160

Platelet activation by VLDL

Englyst, N.A., Taube, J.M., Aitman, T.J., Baglin, T.P. and Byrne C.D. (2003) *A novel role for CD36 in VLDL-enhanced platelet activation* Diabetes, **52**, 1248-1255

Porphyrin conjugates

Kralova, J., Synytsya, A., Pouckova, P., Koc, M., Dvorak, M. and Kral, V. (2006) *Novel porphyrin conjugates with a potent photodynamic antitumor effect: differential efficacy of mono- and bis- β -cyclodextrin derivatives* Photochem. Photobiol., **82**, 432-438

Postprandial lipaemia

Anderson, R.A., Evans, L. M., Ellis, G. R., Graham, J., Jackson, S. K., Lewis, M. J., Rees, A. and Frenneaux, M. P. (1999) *In healthy adults, postprandial lipaemia results in triglyceride enrichment of very low-density lipoprotein, enhanced oxidative stress and deterioration in endothelial function* Atherosclerosis Suppl **154**, 434

Anderson, R.A., Evans, M., Ellis, G. R., Graham, J., Morris, K., Jackson, S. K., Lewis, M. J., Rees, A. and Frenneaux, M. P. (2001) *The relationships between post-prandial lipaemia, endothelial function and oxidative stress in healthy individuals and patients with type 2 diabetes* Atherosclerosis, **154**, 475-483

Anderson, R.A., Evans, L.M., Ellis, G.R., Khan, N., Morris, K., Jackson, S.K., Rees, A., Lewis, M.J. and Frenneaux, M.P. (2006) *Prolonged deterioration of endothelial dysfunction in response to postprandial lipaemia is attenuated by vitamin C in type 2 diabetes* Diabet. Med., **23**, 258-264

Ceriello, A., Assaloni, R., Da Ros, R., Maier, A., Piconi, L., Quagliaro, L., Esposito, K. and Giugliano, D. (2005) *Effect of Atorvastatin and Irbesartan, alone and in combination, on postprandial endothelial dysfunction, oxidative stress, and inflammation in type 2 diabetic patients* Circulation, **111**, 2518-2524

Evans, L.M., Anderson, R.A., Davies, J.S., Ellis, G.R., Jackson, S.K., Graham, J., Lewis, M.J., Frenneaux, M.P. and Rees, A. (1999) *Ciprofibrate reduces the postprandial generation of triglyceride-rich lipoproteins and attenuates the associated endothelial dysfunction and oxidative stress in non-insulin dependent diabetes mellitus* Atherosclerosis Suppl **154**, 434

Evans, L.M., Anderson, R. A., Graham, J., Ellis, G. R., Morris, K., Davies, S., Jackson, S. K., Lewis, M. J., Frenneaux, M. P. and Rees, A. (2000) *Ciprofibrate therapy improves endothelial function and reduces postprandial lipemia and oxidative stress in type 2 diabetes mellitus* Circulation, **101**, 1773-1779

Neri, S., Calvagno, S., Mauceri, B., Misseri, M., Tsami, A., Vecchio, C., Mastrosimone, G., Di Pino, A., Maiorca, D., Judica, A., Romano, G., Rizzotto, A. and Signorelli, S.S. (2010) *Effects of antioxidants on postprandial oxidative stress and endothelial dysfunction in subjects with impaired glucose tolerance and Type 2 diabetes* Eur. J. Nutr., **49**, 409–416

Proteomics

Sun, H-Y., Chen, S-F., Lai, M-D., Chang, T-T., Chen, T-L., Li, P-Y., Shieh, D-B. and Young, K-C. (2010) *Comparative proteomic profiling of plasma very-low-density and low-density lipoproteins* Clin. Chim. Acta, **411**, 336–344

Rosiglitazone in CAD

Sidhu, J.S., Cowan, D. and Kaski, J.C. (2004) *Effects of Rosiglitazone on endothelial function in men with coronary artery disease without diabetes mellitus* Am. J. Cardiol., **94**, 151-156

Selenoprotein, LDL association

Gao, Y., Pagnon, J., Feng, H.C., Konstanopoulos, N., Jowett, J.B.M., Wlader, K. and Collier, G.R. (2007) *Secretion of the glucose-regulated selenoprotein SEPS1 from hepatoma cells* Biochem. Biophys. Res. Commun., **356**, 636-641

Surfactant effects - perfluorooctanesulfonate and perfluorooctanoate

Butenhoff, J.L., Pieterman, E., Ehresman, D.J., Gorman, G.S., Olsen, G.W., Chang, S-C. and Princen, H.M.G. (2012) *Distribution of perfluorooctanesulfonate and perfluorooctanoate into human plasma lipoprotein fractions* Toxicol. Lett., **210**, 360– 365

Butenhoff, J.L., Pieterman, E.J., Ehresman, D.J., Olsen, G.W., Chang, S-C., Princen, H.M.G. (2012) *Distribution of perfluorooctanesulfonate and perfluorooctanoate into human plasma lipoprotein fractions over a wide range of concentrations* Reprod. Toxicol., **33** 1–29

Surfactant effects - Pneumocyte secretion

Damas, J.E. and Cake, M.H. (2011) *An albumin-associated PLA2-like activity inactivates surfactant phosphatidylcholine secreted from fetal type II pneumocytes* Am. J. Physiol. Lung Cell. Mol. Physiol., **301**, L966–L974

Telmisartan in Type 1 diabetes

Ceriello, A., Piconi, L., Esposito, K. and Giugliano, D. (2007) *Telmisartan shows an equivalent effect of vitamin C in further improving endothelial dysfunction after glycemia normalization in type 1 diabetes* Diabet. Care, **30**, 1694-1698

Vit E effects

Hall, W.L., Jeanes, Y.M. and Lodge, J.K. (2005) *Hyperlipidemic subjects have reduced uptake of newly absorbed vitamin E into their plasma lipoproteins, erythrocytes, platelets, and lymphocytes, as studied by deuterium-labeled α -tocopherol biokinetics* J. Nutr., **135**, 58-63

Mah, E., Sapper, T.N., Chitchumroonchokchai, C., Failla, M.L., Schill, K.E., Clinton, S.K., Bobe, G., Traber, M.G. and Bruno, R.S. (2015) *α -Tocopherol bioavailability is lower in adults with metabolic syndrome regardless of dairy fat co-ingestion: a randomized, double-blind, crossover trial* Am. J. Clin. Nutr., **102**, 1070–80

VLDL clearance

Deng, Y., Foley, E.M., Gonzales, J.C., Gordts, P.L., Li, Y. and Esko, J.D. (2012) *Shedding of syndecan-1 from human hepatocytes alters very low density lipoprotein clearance* Hepatology, **55**, 277-286

VLDL/hepatitis C interactions

Sun, H-Y., Lin, C-C., Lee, J-C., Wang, S-W., Cheng, P-N., Wu, I-C., Chang, T-T., Lai, M-D., Shieh, D-B., Young, K-C. (2013) *Very low-density lipoprotein/lipo-viro particles reverse lipoprotein lipase-mediated inhibition of hepatitis C virus infection via apolipoprotein C-III* Gut, **62**, 1193–1203

Xanthophyll delivery

Thomas, S.E. and Harrison, E.H. (2016) *Mechanisms of selective delivery of xanthophylls to retinal pigment epithelial cells by human lipoproteins* J. Lipid Res., **57**, 1865–1878

2a-5-2 HDL subclasses

Methodology

Harman, N.L., Davies, I.G. and Griffin, B.A. (2007) *Separation of the principal HDL subclasses by iodixanol gradient ultracentrifugation* Atherosclerosis, **194**, 283

Harman, N.L., Griffin, B.A. and Davies, I.G. (2013) *Separation of the principal HDL subclasses by iodixanol ultracentrifugation* J. Lipid Res., **54**, 2273-2281

2a-5-3 LDL subclasses

Algal triacylglycerols

Sanders, T.A.B., Gleason, K., Griffin, B. and Miller, G.J. (2006) *Influence of an algal triacylglycerol containing docosahexaenoic acid (22: 6n-3) and docosapentaenoic acid (22: 5n-6) on cardiovascular risk factors in healthy men and women* Br. J. Nutr., **95**, 525-531

Cardiovascular disease

Hirayama, S. and Miida, T. (2012) *Small dense LDL: An emerging risk factor for cardiovascular disease* Clin. Chim. Acta, **414**, 215–224

Carotenoids

Lowe, G.M., Bilton, R. F., Davies, I. G., Ford, T. C., Billington, D. and Young, A. J. (1999) *Carotenoid composition and antioxidant potential in subfractions of human low-density lipoprotein* Ann. Clin. Biochem., **36**, 323-332

Cholesterol, dietary

Harman, N.L., Leeds, A.R. and Griffin, B.A. (2008) *Increased dietary cholesterol does not increase plasma low density lipoprotein when accompanied by an energy-restricted diet and weight loss* Eur. J. Nutr., **47**, 287-293

Conjugated linoleic acid

Tricon, S., Burdge, G.C., Jones, E.L., Russell, J.L., El-Khazen, S., Moretti, E., Hall, W.L., Gerry, A.B., Leake, D.S., Grimble, R.F., Williams, C.M., Calder, P.C. and Yaqoob, P. (2006) *Effects of dairy products naturally enriched with cis-9, trans-11 conjugated linoleic acid on the blood lipid profile in healthy middle-aged men* Am. J. Clin. Nutr., **83**, 744-753

Coronary angiography

Toft-Petersen, A.P., Tilsted, H.H., Aarøe, J., Rasmussen, K., Christensen, T., Griffin, B.A., Aarstrup, I.V., Andreasen, A. and Schmidt, E.B. (2011) *Small dense LDL particles - a predictor of coronary artery disease evaluated by invasive and CT-based techniques: a case-control study* Lipids Health Disease **10**: 21

Dietary effects

Harman, N.L., Leeds, A.R. and Griffin, B.A. (2008) *Increased dietary cholesterol does not increase plasma low density lipoprotein when accompanied by an energy-restricted diet and weight loss* Eur. J. Nutr., **47**, 287-293

Isherwood, C., Wong, M., Jones, W.S., Davies, I.G. and Griffin, B.A. (2010) *Lack of effect of cold water prawns on plasma cholesterol and lipoproteins in normo-lipidaemic men* Cell. Mol. Biol. **56**, 52-58

Jebb, S.A., Lovegrove, J.A., Griffin, B.A., Frost, G.S., Moore, C.S., Chatfield, M.D., Bluck, L.J., Williams, C.M. and Sanders, T.A.B. (2010) *Effect of changing the amount and type of fat and carbohydrate on insulin sensitivity and cardiovascular risk: the RISCK (Reading, Imperial, Surrey, Cambridge, and Kings) trial* Am. J. Clin. Nutr., **92**, 748–58

Endothelial dysfunction

Rasmussen, J.G., Eschen, R.B., Aardestrup, I.V., Dethlefsen, C., Griffin, B.A. and Schmidt, E.B. (2009) *Flow-mediated vasodilatation: variation and interrelationships with plasma lipids and lipoproteins* Scand., J. Clin. Lab. Invest., **69**, 156-160

Fatty acid type

Griffin, M.D., Sanders, T.A.B., Davies, I.G., Morgan, L.M., Millward, D.J., Lewis, F., Slaughter, S., Cooper, J.A., Miller, G.J. and Griffin, B.A. (2006) *Effects of altering the ratio of dietary n-6 to n-3 fatty acids on insulin sensitivity, lipoprotein size and postprandial lipemia in men and postmenopausal women aged 45-70 y: the OPTILIP study* Am. J. Clin. Nutr., **84**, 1290-1298

Jebb, S.A., Lovegrove, J.A., Griffin, B.A., Frost, G.S., Moore, C.S., Chatfield, M.D., Bluck, L.J., Williams, C.M. and Sanders, T.A.B. (2010) *Effect of changing the amount and type of fat and carbohydrate on insulin sensitivity and cardiovascular risk: the RISCK (Reading, Imperial, Surrey, Cambridge, and Kings) trial* Am. J. Clin. Nutr., **92**, 748–58

Insulin sensitivity

Jebb, S.A., Lovegrove, J.A., Griffin, B.A., Frost, G.S., Moore, C.S., Chatfield, M.D., Bluck, L.J., Williams, C.M. and Sanders, T.A.B. (2010) *Effect of changing the amount and type of fat and carbohydrate on insulin sensitivity and cardiovascular risk: the RISCK (Reading, Imperial, Surrey, Cambridge, and Kings) trial* Am. J. Clin. Nutr., **92**, 748–58

Isoflavone effects

Hall, W.L., Vafeiadou, K., Hallund, J., Bugel, S., Reimann, M., Koebnick, C., Zunft, H-J. F., Ferrari, M., Branca, F., Dadd, T., Talbot, D., Powell, J., Minihane, A-M., Cassidy, A., Nilsson, M., Dahlman-Wright, K., Gustafsson, J-A. and Williams, C.M. (2006) *Soy-isoflavone-enriched foods and markers of lipid and glucose metabolism in postmenopausal women: interactions with genotype and equol production* Am. J. Clin. Nutr., **83**, 592-600

Methodology

Chung, M., Lichtenstein, A.H., Ip, S., Lau, J. and Balk, E.M. (2009) *Comparability of methods for LDL subfraction determination: A systematic review* Atherosclerosis **205**, 342–348

Davies, I.G. and Griffin, B.A. (2001) *Rapid identification of LDL subclass phenotypes by iodixanol gradient centrifugation* Atherosclerosis, **159**, 249

Davies, I.G., Graham, J.M. and Griffin, B.A. (2003) *Rapid separation of LDL subclasses by iodixanol gradient ultracentrifugation* Clin. Chem., **49**, 1865-1872

Sawle, A., Higgins, M.K., Olivant, M.P., and Higgins, J.A (2002) *A rapid single-step centrifugation method for determination of HDL, LDL, and VLDL cholesterol, and TG, and identification of predominant LDL subclass* J. Lipid Res., **43**, 335-343

Mitotane binding

Kroiss, M., Plonné, D., Kendl, S., Schirmer, D., Ronchi, C.L., Schirbel, A., Zink, M., Lapa, C. et al (2016) *Association of mitotane with chylomicrons and serum lipoproteins: practical implications for treatment of adrenocortical carcinoma* Eur. J. Endocrinol., **174**, 343–353

Obesity/triglycerides/weight loss

Hobkirk, J.P., King, R.F., Davies, I., Harman, N., Gately, P., Pemberton, P., Smith, A., Barth, J.H. and Carroll, S. (2014) *The metabolic inter-relationships between changes in waist circumference, triglycerides, insulin sensitivity and small, dense low-density lipoprotein particles with acute weight loss in clinically obese children and adolescents* Pediatr. Obes., **9**, 209–217

Renal disease

Sørensen, G.V.B., Svensson, M., Strandhave, C., Schmidt, E.B., Jørgensen, K.A. and Christensen, J.H. (2015) *The effect of n-3 fatty acids on small dense low-density lipoproteins in patients with end-stage renal disease: a randomized placebo-controlled intervention study* J. Renal Nutr., **25**, 376-380

Simvastatin effects

Hörl, G., Froehlich, H.F., Ferstl, U., Ledinski, G., Binder, J., Cvirn, G., Stojakovic, T., Trauner, M., Koidl, C. et al (2016) *Simvastatin efficiently lowers small LDL-IgG immune complex levels: a therapeutic quality beyond the lipid-lowering effect* PLoS One, 11: e0148210

Thai population, in

Kulanuwat, S., Tungtrongchitr, R., Billington, D. and Davies, I.G. (2015) *Prevalence of plasma small dense LDL is increased in obesity in a Thai population* Lipids Health Dis., 14: 30

2a-6 Mouse

Chylomicron assembly

Kendrick, J.S., Chan, L., and Higgins, J.A. (2001) *Superior role of apolipoprotein B48 over apolipoprotein B100 in chylomicron assembly and fat absorption: an investigation of apobec-1 knock-out and wild-type mice* Biochem. J., 356, 821-827

Gasoline emissions

Lund, A.K., Knuckles, T.L., Akata, C.O., Shohet, R., McDonald, J.D., Gigliotti, A., Seagrave, J.C. and Campen, M.J. (2007) *Gasoline exhaust emissions induce vascular remodeling pathways involved in atherosclerosis* Toxicol. Sci., 95, 485-494

HDL, brevetoxin association

Woofter, R.T., Spiess, P.C. and Ramsdell, J.S. (2005) *Distribution of brevetoxin (PbTx-3) in mouse plasma: association with high-density lipoprotein* Environ. Health Perspect., 113, 1491-1496

LDL Receptor

Tavori, H., Fan, D., Blakemore, J.L., Yancey, P.G., Ding, L., Linton, M.F., Fazio, S. (2013) *Serum proprotein convertase subtilisin/kexin type 9 and cell surface low-density lipoprotein receptor evidence for a reciprocal regulation* Circulation, 127, 2403-2413

VLDL assembly

Hesse, D., Radloff, K., Jaschke, A., Lagerpusch, M., Chung, B., Tailleux, A., Staels, B. and Schürmann, A. (2014) *Hepatic trans-Golgi action coordinated by the GTPase ARFRP1 is crucial for lipoprotein lipidation and assembly* J. Lipid Res., 55, 41–52

VLDL, liver injury

Bergheim, I., Guo, L., Davis, M.A., Lambert, J.C., Beier, J.I., Duveau, I., Luyendyk, J.P., Roth, R.A. and Arteel, G.E. (2006) *Metformin prevents alcohol-induced liver injury in the mouse: critical role of plasminogen activator inhibitor-1* Gastroenterology, 130, 2099-2112

2a-7 Porcine

Soler, L., Molenaar, A., Merola, N., Eckersall, P.D., Gutiérrez, A., Cerón, J.J., Mulero, V. and Niewold, T.A. (2012) *Why working with porcine circulating serum amyloid A is a pig of a job* J. Theoret. Biol., 317, 119–125

2a-8 Rabbit

Cartwright, I.J. and Higgins, J.A. (2001) *Direct evidence for a in the lumen of the smooth endoplasmic reticulum of rabbit two-step assembly of ApoB48-containing lipoproteins enterocytes* J. Biol. Chem, 276, 48048-48057

Wilkinson J., Higgins, J.A., Fitzsimmons, C. and Bowyer, D.E. (1998) *Dietary fish oils modify the assembly of VLDL and expression of the LDL receptor in rabbit liver* Arterioscler. Thromb. Vasc. Biol., 18, 1490-1497

Wilsie, L.C., Chanchani, S., Navaratna, D. and Orlando, R.A. (2005) *Cell surface heparan sulfate proteoglycans contribute to intracellular lipid accumulation in adipocytes* Lipids Health Dis., 4, 1-15

Wilsie, L.C., Gonzales, A.M. and Orlando, R.A. (2006) *Syndecan-1 mediates internalization of apoE-VLDL through a low density lipoprotein receptor-related protein (LRP)-independent, non-clathrin-mediated pathway* Lipids Health Dis., 5:23

2a-9 Rat

Blanchard, H., Boulier-Monthéan, N., Legrand, P. and Pédrone, F. (2014) *The 51 kDa FADS3 is secreted in the ECM of hepatocytes and blood in rat* J.Cell. Biochem., **115**, 199–207

2b Lipoproteins from non-plasma sources

2b-1 Caco-2 cells

Bateman, P.A., Jackson, K.G., Maitin, V., Yaqoob, P. and Williams, C.M. (2007) *Differences in cell morphology, lipid and apo B secretory capacity in caco-2 cells following long-term treatment with saturated and monounsaturated fatty acids* Biochim. Biophys. Acta, **1771**, 475-485

Jackson, K.G., Bateman, P.A., Yaqoob, P. and Williams, C.M. (2009) *Impact of saturated, poly-unsaturated and monounsaturated fatty acid-rich micelles on lipoprotein synthesis and secretion in Caco-2 cells* Lipids, **44**, 1081–1089

Yao, M., McClements, D.J., Zhao, F., Craig, R.W. and Xiao, H. (2017) *Controlling the gastrointestinal fate of nutraceutical and pharmaceutical-enriched lipid nanoparticles: From mixed micelles to chylomicrons* NanoImpact, **5**, 13–21

2b-2 Drosophila

Brankatschk, M. and Eaton, S. (2010) *Lipoprotein particles cross the blood–brain barrier in Drosophila* J. Neurosci., **30**, 10441–10447

Eugster, C., Panáková, D., Mahmoud, A. and Eaton, S. (2007) *Lipoprotein-heparan sulfate interactions in the Hh pathway* Devel. Cell, **13**, 57-71

Palm, W., Sampaio, J.L., Brankatschk, M., Carvalho, M., Mahmoud, A., Shevchenko, A. and Eaton, S. (2012) *Lipoproteins in Drosophila melanogaster—assembly, function, and influence on tissue lipid composition* PLoS Genet., **8**: e1002828

2b-3 Hepatocytes

Jammart, B., Zoulim, F. and Durantel, D. (2011) *Lipoprotein secretion profiles and VLDL production in hepatocyte cell lines* J.Hepatol., **54**, S318

Jammart, B., Michelet, M., Pécheur, E-I., Parent, R., Bartosch, B., Zoulim, F. and Durante, D. (2013) *Very-low-density lipoprotein (VLDL)-producing and hepatitis C virus-replicating HepG2 cells secrete no more lipoviroparticles than VLDL-deficient Huh7.5 cells* J. Virol., **87**, 5065–5080

Lee, E.M., Alsagheir, A., Wu, X., Hammack, C., McLauchlan, J., Watanabe, N., Wakita, T., Kneteman, N.M., Douglas, D.N. and Tang, H. (2016) *Hepatitis C virus-induced degradation of cell death-inducing DFFA-like effector B leads to hepatic lipid dysregulation* J. Virol., **90**, 4174-4185

2b-4 Ovinefollicular/oviductal fluid

Berneic, N.C., Gadella, B.M., deGraaf, S.P. and Leahy, T. (2016) *Isolation of high density lipoproteins in ovine follicular and oviductal fluid* Animal Reprod. Sci., **169**, 122-123

2b-5 Polychaete

Schenk, S., Harris, J.R. and Hoeger, U. (2006) *A discoidal lipoprotein from the coelomic fluid of the polychaete Nereis virens* Comp. Biochem. Physiol., Part B, **143**, 236-243

Schenk, S. and Hoeger, U. (2010) *Lipid accumulation and metabolism in polychaete spermatogenesis: role of the large discoidal lipoprotein* Mol. Reprod. Dev., **77**, 710–719

Mini-Review MM01: 5th edition, October 2017

Alere Technologies AS

Axis-Shield Density Gradient Media
is a brand of Alere Technologies AS