OptiPrep™ Mini-Review MC02

Mononuclear cells, monocytes and polymorphonuclear leukocytes: a bibliographical review

- This Mini-Review divides the published papers into **cell type and (where necessary) method type and/or source, species** and **research topic**; within each group references are listed alphabetically according to first author.
- A companion Mini-Review (MC01) is a methodological review of iodixanol gradient technology for purifying all mononuclear cells from blood and tissues.

1 Monocytes

1a From a leukocyte-rich plasma (discontinuous flotation gradient)

Note that monocytes are also prepared from mononuclear cell preparations (see Section 2) by antibody-bead negative selection

1a-1 Human

Adherence (to endothelial cells)

AbdAlla, S., Lother, H., Langer, A., el Faramawy, Y. and Quitterer, U. (2004) *Factor XIIIA transglutaminase crosslinks AT_1 receptor dimers of monocytes at the onset of atherosclerosis* Cell, **119**, 343-354

Aspinall, A.I., Curbishley, S.M., Lalor, P.F., Weston, C.J., Blahova, M., Liaskou, E., Adams, R.M., Holt, A.P. and Adams, D.H. (2010) *CX3CR1 and vascular adhesion protein-1-dependent recruitment of CD161 monocytes across human liver sinusoidal endothelium* Hepatology, **51**, 2030-2039

Belcher, J.D., Marker, P.H., Weber, J.P., Hebbel, R.P. and Vercellotti, G.M. (2000) *Activated monocytes in sickle cell disease: potential role in the activation of vascular endothelium and vaso-occlusion* Blood, **96**, 2451-2459

Blomqvist, H.M. and Olsson, A.G. (2003) *Monocyte chemoattractant protein-1 and CC-chemokine receptor-2 in severe hypercholesterolaemia* Scand. J. Clin. Lab. Invest., **63**, 513-520

Brevig, T., Holst, B., Ademovic, Z., Rozlosnik, N., Rohrmann, J.H., Larsen, N.B., Hansen, O.C. and Kingshott, P. (2005) *The recognition of adsorbed and denatured proteins of different topographics by β_2 integrins and effects on leukocyte adhesion and activation* Biomaterials, **26**, 3039-3053

Crosley, L.K., Bashir, S., Nicol, F., Arthur, J.R., Hesketh, J.E. and Sneddon, A.A. (2013) *The single-nucleotide polymorphism (GPX4c718t) in the glutathione peroxidase 4 gene influences endothelial cell function: Interaction with selenium and fatty acids* Mol. Nutr. Food Res., **57**, 2185–2194

Del Conde, I., Nabi, F., Tonda, R., Thiagarajan, P., Lopez, J.A. and Kleiman, N.S. (2005) *Effect of P-selectin on phosphatidylserine exposure and surface-dependent thrombin generation on monocytes* Arterioscler. Thromb. Vasc. Biol., **25**, 1065-1070

Ferreira, A.M., Isaacs, H., Hayflick, J.S., Rogers, K.A. and Sandig, M. (2006) *The p110δ isoform of PI3K differentially regulates β1 and β2 integrin-mediated monocyte adhesion and spreading and modulates diapedesis* Microcirculation, **13**, 439-456

Galettis, A., Campbell, S., Morris, J.M., Jackson, C.J., Twigg, S.M. and Gallery, E.D.M. (2004) *Monocyte adhesion to decidual endothelial cells is increased in pregnancies complicated by type 1 diabetes but not by gestational diabetes* Diabetes Care, **27**, 2514-2515

Humphries, J., Gossage, J.A., Modarai, B., Burnand, K.G., Sisson, T.H., Murdoch, C. and Smith, A. (2009) *Monocyte urokinase-type plasminogen activator up-regulation reduces thrombus size in a model of venous thrombosis* J. Vasc. Surg., **50**, 1127-1134

Ohlsson, S., Hellmark, T., Pieters, K., Sturfelt, G., Wieslander, J. and Segelmark, M. (2005) *Increased monocyte transciption of the proteinase 3 gene in small vessel vasculitis* Clin. Exp. Immunol., **141**, 174-182

Ronald, J.A., Ionescu, C.V., Rogers, K.A. and Sandig, M. (2001) *Differential regulation of transendothelial migration of THP-1 cells by ICAM-1/LFA-1 and VCAM-1/VLA-4* J. Leukoc. Biol., **70**, 601-609

Schwartz, B.R., Karsan, A., Bombeli, T. and Harlan, J.M. (1999) *A novel β_1 integrin-dependent mechanism of leukocyte adherence to apoptotic cells* J. Immunol., **162**, 4842-4848

Sneddon, A.A., McLeod, E., Wahle, K.W.J. and Arthur, J.R. (2006) *Cytokine-induced monocyte adhesion to endothelial cells involves platelet-activating factor: Suppression by conjugated linoleic acid* Biochim. Biophys. Acta, **1761**, 793-801

Ward, J.R., Francis, S.E., Marsden, L., Suddason, T., Lord, G.M., Dower, S.K., Crossman, D.C. and Sabroe, I. (2009) *A central role for monocytes in Toll-like receptor-mediated activation of the vasculature* Immunology, **128**, 58–68
Zimmermann, H., Weston, C.J., Curbishley, S.M. and Adams, D.H.(2012) *The role of vascular-adhesion-protein 1 (vap-1) in mediating monocyte migration across inflamed hepatic sinusoidal endothelium* Gut, **61**, A124

Angiogenic/immune responses

Agostini, L., Martinon, F., Burns, K., McDermott, M.F., Hawkins, P.N. and Tschopp, J. (2004) *NALP3 forms an IL-1β-processing inflammasome with increased activity in Muckle-Wells autoinflammatory disorder* Immunity, **20**, 319-325
Aittomaki, S., Pesu, M., Groner, B., Janne, O.A., Palvimo, J.J. and Silvennoinen, O. (2000) *Cooperation among Stat1, glucocorticoid receptor, and PU.1 in transcriptional activation of the high-affinity Fcγ receptor I in monocytes* J. Immunol., **164**, 5689-5697
Ammons, M.C.B., Siemsen, D.W., Nelson-Overton, L.K., Quinn, M.T. and Gauss, K.A. (2007) *Binding of pleomorphic adenoma gene-like 2 to the tumor necrosis factor (TNF)-α-responsive region of the NCF2 promoter regulates $p67^{phox}$ expression and NADPH oxidase activity* J. Biol. Chem., **282**, 17941-17952
Cousins, S.W., Espinosa-Heidelmann, D.G. and Csaky, K.G. (2004) *Monocyte activation in patients with age-related macular degeneration* Arch. Ophthalmol., 122, 1013-1018
Filion, L.G., Matusevicius, D., Graziani-Bowering, G.M., Kumar, A. and Freedman, M. (2003) *Monocyte-derived IL12, CD86 (B7-2) and CD40L expression in relapsing and progressive multiple sclerosis* Clin. Immunol., **106** 127-138
Filion, L.G., Graziani-Bowering, G., Matusevicius, D. and Freedman, M.S. (2003) *Monocyte-derived cytokines in multiple sclerosis* Clin. Exp. Immunol., **131**, 324-334
Hong, G., Davis, B., Khatoon, N., Baker, S.F. and Brown J. (2003) *PPARγ-dependent anti-flammatory action of rosiglitazone in human monocytes: suppression of TNF α secretion is not mediated by PTEN regulation* Biochem. Biophys. Res. Commun., **303**, 782-787
Li, C-Y., Chou, T-C., Lee, C-H., Tsai, C-S., Loh, S-H. and Wong, C-S. (2003) *Adrenaline inhibits lipopolysaccharide-induced macrophage inflammatory protein-1 α in human monocytes: the role of β-receptors* Anesth. Analg., **96**, 518-523
Lommatzsch, M., Schloetcke, K., Klotz, J., Schuhbaeck, K., Zingler, D., Zingler, C., Schulte-Herbruggen, O., Gill, H., Schuff-Werner, P. and Virchow, J.C. (2005) *Brain-derived neurotrophic factor in platelets and airflow limitation in asthma* Am. J. Respir. Crit. Care Med., **171**, 115-120
Miller, L.A., Li, C and Hyde, D.M. (2000) *Expression of the HML-1 epitope on human monocytes is independent of αE integrin mRNA* Inflammation, **24**, 195-205
Ohlsson, S., Wieslander, J. and Segelmark, M. (2004) *Circulating cytokine profile in anti-neutrophilic cytoplasmatic autoantibody-associated vasculitis: prediction of outcome* Mediators Inflamm., **13**, 275-283
Scott, C., Bonner, J., Min, D., Boughton, P., Stokes, R., Cha, K.M., Walters, S.N., Maslowski, K., Sierro, F., Grey, S.T., Twigg, S., McLennan, S. and Gunton, J.E. (2014) *Reduction of ARNT in myeloid cells causes immune suppression and delayed wound healing* Am. J. Physiol. Cell. Physiol., **307**, C349–C357
Xue, M., March, L., Sambrook, P.N., Fukudome, K. and Jackson, C.J. (2007) *Endothelial protein C receptor is overexpressed in rheumatoid arthritis (RA) synovium and mediates the anti-inflammatory effects if activated protein C in RA monocytes* Ann. Rheum. Dis., **66**, 1574-1580

Bacterial interactions

Brown, M.J., Russo, B.C., O'Dee, D.M., Schmitt, D.M. and Nau, G.J. (2014) *The contribution of the glycine cleavage system to the pathogenesis of Francisella tularensis* Microb. Infect., **16**, 300-309
Horzempa, J., Tarwacki, D.M., Carlson Jr., P.E., Robinson, C.M. and Nau, G.J. (2008) *Characterization and application of a glucose-repressible promoter in Francisella tularensis* Appl. Envir. Microbiol., **74**, 2161-2170
Horzempa, J., Carlson Jr, P.E., O'Dee, D.M., Shanks, R.M.Q. and Naum G.J. (2008) *Global transcriptional response to mammalian temperature provides new insight into Francisella tularensis pathogenesis* BMC Microbiol., **8**: 172
Jung, J-Y., Gleave Parson, M., Kraft, J.D., Lyda, L., Kobe, B., Davis, C., Robinson, J., Pena, M.O.M. and Robinson, C.M. (2016) *Elevated interleukin-27 levels in human neonatal macrophages regulate indoleamine dioxygenase in a STAT-1 and STAT-3-dependent manner* Immunology, **149**, 35–47
Mancilla-Herrera I., Alvarado-Moreno, J.A., Cérbulo-Vázquez, A., Prieto-Chávez, J.L., Ferat-Osorio, E., López-Macías, C., Estrada-Parra, S., Isibasi, A. and Arriaga-Pizano, L. (2015) *Activated endothelial cells limit inflammatory response, but increase chemoattractant potential and bacterial clearance by human monocytes* Cell Biol. Int., **39**, 721–732

Martins, R., Maier, J., Gorki, A-D., Huber, K.V.M., Sharif, O., Starkl, P., Saluzzo, S., Quattrone, F., Gawish, R., Lakovits, K., Aichinger, M.C. et al (2016) *Heme drives hemolysis-induced susceptibility to infection via disruption of phagocyte functions* Nat. Immunol., **17**, 1361-1372
Roberts, L.L. and Robinson, C.M. (2014) *Mycobacterium tuberculosis infection of human dendritic cells decreases integrin expression, adhesion and migration to chemokines* Immunology, **141**, 39–51
Robinson, C.M., Jung, J-Y. and Nau, G.J. (2012) *Interferon-γ, tumor necrosis factor, and interleukin-18 cooperate to control growth of Mycobacterium tuberculosis in human macrophages* Cytokine, **60**, 233–241

Chemotaxis

Li, Y., Nishiura, H., Tokita, K., Kouike, Y., Taniguchi, C., Iwahara, M., Nishino, N., Hamad, Y., Asakawa, M. and Yamamoto, T. (2009) *Elastin peptide receptor-directed monocyte chemotactic polysaccharides derived from seaweed sporophyll and from infectious fungus* Microb. Pathog. **45**, 423–434
Magazine, H.I., Chang, J., Goumon, Y. and Stefano, G.B. (2000) *Rebound from nitric oxide inhibition triggers enhanced monocyte activation and chemotaxis* J. Immunol., **165**, 102-107
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Papaspyridonos, M., McNeill, E., de Bono, J.P., Smith, A., Burnand, K.G., Channon, K.M. and Greaves, D.R. (2008) *Galectin-3 is an amplifier of inflammation in atherosclerotic plaque progression through macrophage activation and monocyte chemoattraction* Arterioscler. Thromb. Vasc. Biol., **28**, 433-440
Ritter, U. and Moll, H. (2000) *Monocyte chemotactic protein-1 stimulates the killing of Leishmania major by human monocytes, acts synergistically with IFN-γ and is antagonized by IL-4* Eur. J. Immunol., **30**, 3111-3120

Cord blood

Kraft, J.D., Horzempa, J., Davis, C., Jung, J-Y., Pena, M.M.O. and Robinson, C.M. (2013) *Neonatal macrophages express elevated levels of interleukin-27 that oppose immune responses* Immunology, **139**, 484–493

Dendritic cell, derived

Alvarez, Y., Municio, C., Alonso, S., San Román, J.A., Sánchez Crespo, M. and Fernández, N. (2009) *Cyclooxygenase-2 iduced by zymosan in human monocyte-derived dendritic cells shows high stability, and its expression is enhanced by atorvastatin* J. Pharmacol. Exp. Ther., **329**, 987-994
Jung, J-Y., Roberts, L.L. and Robinson, C.M. (2015) *The presence of interleukin-27 during monocyte-derived dendritic cell differentiation promotes improved antigen processing and stimulation of T cells* Immunology, **144**, 649–660
Roberts, L.L. and Robinson, C.M. (2014) *Mycobacterium tuberculosis infection of human dendritic cells decreases integrin expression, adhesion and migration to chemokines* Immunology, **141**, 39–51
Valera, I., Fernández, N., García Trinidad, A., Alonso, S., Brown, G.D., Alonso, A. and Sánchez Crespo, M. (2008) *Costimulation of dectin-1 and DC-SIGN triggers the arachidonic acid cascade in human monocyte-derived dendritic cells* J. Immunol., **180**, 5727-5736

Drug delivery (liposomes)

Qin, J., Chen, D.W., Hu, H.Y., Cui, Q., Qiao, M.X. and Chen, B.Y. (2007) *Surface modification of RGD-liposomes for selective drug delivery to monocytes/neutrophils in brain* Chem. Pharm. Bull., **55**, 1192-1197
Qin, J., Chen, D.W., Hu, H.Y., Qiao, M.X., Zhao, X.L. and Chen, B.Y. (2007) *Body distribution of RGD-mediated liposomes in brain-targeting drug delivery* Yakugaku Zasshi, **127**, 1497-1501

Exercise effects

Périard, J.D., Ruell, P.A., Thompson, M.W. and Caillaud, C. (2015) *Moderate- and high-intensity exhaustive exercise in the heat induce a similar increase in monocyte Hsp72* Cell Stress Chaperones, **20**, 1037–1042
Wang, D., Cai, Ge. J. and Yin, L. (2015) *Brief exercises affect gene expression in circulating monocytes* Scand. J. Immunol., **82**, 429–435

Heat-shock protein *see* Exercise effects

Immune responses *see* Angiogenic/immune responses

Inflammatory responses

Chaudhuri, N., Paiva, C., Donaldson, K., Duffin, R., Parker, L.C., Sabroe, I. (2010) *Diesel exhaust particles override natural injury-limiting pathways in the lung* Am. J. Physiol. Lung. Cell. Mol. Physiol. 299, L263–L271

Chaudhuri, N., Jary, H., Lea, S., Khan, N., Piddock, K.C., Dockrell, D.H., Donaldson, K., Duffin, R., Singh, D., Parker, L.C. and Sabroe, I. (2012) *Diesel exhaust particle exposure in vitro alters monocyte differentiation and function* PloS One, **7**: e51107

Chen, S.S.H., Jenkins, A.J. and Majewski, H. (2009) *Elevated plasma prostaglandins and acetylated histone in monocytes in Type 1 diabetes patients* Diabet. Med., **26**, 182–186

Digby, J.E., Martinez, F., Jefferson, A., Ruparelia, N., Chai, J., Wamil, M., Greaves, D,R, and Choudhury, R.P. (2012) *Anti-inflammatory effects of nicotinic acid in human monocytes are mediated by GPR109A dependent mechanisms* Arterioscler. Thromb. Vasc. Biol., **32**, 669-676

Mancilla-Herrera I., Alvarado-Moreno, J.A., Cérbulo-Vázquez, A., Prieto-Chávez, J.L., Ferat-Osorio, E., López-Macías, C., Estrada-Parra, S., Isibasi, A. and Arriaga-Pizano, L. (2015) *Activated endothelial cells limit inflammatory response, but increase chemoattractant potential and bacterial clearance by human monocytes* Cell Biol. Int., **39**, 721–732

Menu, P., Mayor, A., Zhou, R., Tardivel, A., Ichijo, H., Mori, K. and Tschopp, J. (2012) *ER stress activates the NLRP3 inflammasome via an UPR-independent pathway* Cell Death Dis., **3**: e261

Oo, Y.H., Weston, C.J., Lalor, P.F., Curbishley, S.M., Withers, D.R., Reynolds, G.M., Shetty, S. et al (2010) *Distinct roles for CCR4 and CXCR3 in the recruitment and positioning of regulatory T cells in the inflamed human liver* J. Immunol., **184**, 2886–2898

Papaspyridonos, M., McNeill, E., de Bono, J.P., Smith, A., Burnand, K.G., Channon, K.M. and Greaves, D.R. (2008) *Galectin-3 is an amplifier of inflammation in atherosclerotic plaque progression through macrophage activation and monocyte chemoattraction* Arterioscler. Thromb. Vasc. Biol., **28**, 433-440

Xue, M., March, L., Sambrook, P.N. and Jackson, C.J. (2007) *Differential regulation of matrix metalloproteinase 2 and matrix metalloproteinase 9 by activated protein C: Relevance to inflammation in rheumatoid arthritis* Arthritis Rheumatism, **56**, 2864-2874

Zimmermann, H., Weston, C.J., Curbishley, S.M. and Adams, D.H.(2012) *The role of vascular-adhesion-protein 1 (vap-1) in mediating monocyte migration across inflamed hepatic sinusoidal endothelium* Gut, **61**, A124

Leishmania

Ritter, U. and Moll, H. (2000) *Monocyte chemotactic protein-1 stimulates the killing of Leishmania major by human monocytes, acts synergistically with IFN-γ and is antagonized by IL-4* Eur. J. Immunol., **30**, 3111-3120

Leukapheresis samples, from

Akiyama, Y., Oshita, C., Kume, A., Iizuka, A., Miyata, H., Komiyama, M., Ashizawa, T., Yagoto, M. et al (2012) *α-Type-1 polarized dendritic cell-based vaccination in recurrent high-grade glioma: a phase I clinical trial* BMC Cancer, **12**: 623

Liver, recruitment to

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LPS induced responses

Creery, D., Angel, J.B., Aucoin, S., Weiss, W., Cameron, W.D., Diaz-Mitoma, F. and Kumar, A. (2002) *Nef protein of human immunodeficiency virus and lipopolysaccharide induce expression of CD14 on human monocytes through differential utilization of interleukin-10* Clin. Diagnost. Lab. Immunol., **9**, 1212-1221

Widing, L., Bechensteen, A.G., Mirlashari, M.R., Vetlesen, A. and Kjeldsen-Kragh, J. (2007) *Evaluation of nonleukoreduced red blood cell transfusion units collected at delivery from the placenta* Transfusion **47**, 1481-1487

Macrophage differentiation/function

Alvarez, Y., Municio, C., Alonso, S., Sánchez Crespo, M. and Fernández, N. (2009) *The induction of IL-10 by zymosan in dendritic cells depends on CREB activation by the coactivators CREB-binding protein and TORC2 and autocrine PGE2* J. Immunol., **183**, 1471–1479

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Chaudhuri, N., Jary, H., Lea, S., Khan, N., Piddock, K.C., Dockrell, D.H., Donaldson, K., Duffin, R. et al (2012) *Diesel exhaust particle exposure in vitro alters monocyte differentiation and function* PloS One, **7**: e51107

Cousins, S.W., Espinosa-Heidelmann, D.G. and Csaky, K.G. (2004) *Monocyte activation in patients with age-related macular degeneration* Arch. Ophthalmol., **122**, 1013-1018
Jung, J-Y., Madan-Lala, R., Georgieva, M., Rengarajan, J., Sohaskey, C.D., Bange, F-C. and Robinson, C.M. (2013) *The intracellular environment of human macrophages that produce nitric oxide promotes growth of mycobacteria* Infect. Immun., **81**, 3198–3209
Jung, J-Y. and Robinson, C.M. (2014) *IL-12 and IL-27 regulate the phagolysosomal pathway in mycobacteria-infected human macrophages* Cell Commun. Signal., **12**: 16
Kraft, J.D., Horzempa, J., Davis, C., Jung, J-Y., Pena, M.M.O. and Robinson, C.M. (2013) *Neonatal macrophages express elevated levels of interleukin-27 that oppose immune responses* Immunology, **139**, 484–493
Liang, C-P., Han, S., Okamoto, H., Carnemolia, R., Tabas, I., Accili, D. and Tali, A.R. (2004) *Increased CD36 protein as a response to defective insulin signaling in macrophages* J. Clin. Invest., **113**, 764-773
Li, C-Y., Chou, T-C., Lee, C-H., Tsai, C-S., Loh, S-H. and Wong, C-S. (2003) *Adrenaline inhibits lipopolysaccharide-induced macrophage inflammatory protein-1α in human monocytes: the role of β-receptors* Anesth. Analg., **96**, 518-523
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Vosper, H., Patel, L., Graham, T.L., Khoudoli, G.A., Hill, A., Macphee, C.H., Pinto, I., Smith, S.A. et al (2001) *The peroxisome proliferator-activated receptor delta promotes lipid accumulation in human macrophages* J. Biol. Chem. **276**, 44258-4426

Metalloproteinases

Bao, W., Min, D., Twigg, S.M., Shackel, N.A., Warner, F.J., Yue D.K., McLennan, S.V. (2010) *Monocyte CD147 is induced by advanced glycation end products and high glucose concentration: possible role in diabetic complications* Am. J. Physiol. Cell Physiol., **299**, C1212–C121
Ludwig, A., Berkhout, T., Moores, K., Groot, P. and Chapman G. (2002) *Fractalkine is expressed by smooth muscle cells in response to IFN-γ and TFN-α and is modulated by metalloproteinase activity* J. Immunol., **168**, 604-612

Methodology

Graziani-Bowering, G.M., Graham, J. and Filion, L.G. (1997) *A quick, easy and inexpensive method for the isolation of human peripheral blood monocytes* J. Immunol. Methods, **207**, 157-168
Nutt, J.C., Willis, C.C., Morris, J.M. and Gallery, E.D.M. (2004) *Isolating pure populations of monocytes from the blood of pregnant women: comparison of flotation in iodixanol with elutriation* J. Immunol. Methods, **293**, 215-218

Transcription factors

Scott, C., Bonner, J., Min, D., Boughton, P., Stokes, R., Cha, K.M., Walters, S.N., Maslowski, K. et al (2014) *Reduction of ARNT in myeloid cells causes immune suppression and delayed wound healing* Am. J. Physiol. Cell. Physiol., **307**, C349–C357

Oxidation

Gauss, K.A., Bunger, P.L., Larson, T.C., Young, C.J., Nelson-Overton, L.K., Siemsen, D.W. and Quinn, M.T. (2005) *Identification of a novel tumor necrosis factor α-responsive region in the NCF2 promoter* J. Leukoc. Biol., **77**, 267-278
Gauss, K.A., Bunger, P.L., Crawford, M.A., McDermott, B.E., Swearingen, R., Nelson-Overton, L.K., Siemsen, D.W., Kobayashi, S.D., DeLeo, F.R. and Quinn, M.T. (2006) *Variants of the 5'-untranslated region of human NCF2: expression and translational efficiency* Gene, **366**, 169-179
VEGF transfection
Magazine, H.I., Chang, J., Goumon, Y. and Stefano, G.B. (2000) *Rebound from nitric oxide inhibition triggers enhanced monocyte activation and chemotaxis* J. Immunol., **165**, 102-107

Modarai, B., Humphries, J., Gossage, J.A., Waltham, M., Burnand, K.G., Kanaganayagam, G.S., Afuwape, A., Paleolog, E., Smith, A., Wadoodi, A. (2008) *Adenovirus-mediated VEGF gene therapy enhances venous thrombus recanalization and resolution* Arterioscler. Thromb. Vasc. Biol., **28**, 1752-1759

Thiosemicarbazones

Moreno-Rodríguez, A., Salazar-Schettino, P.M., Bautista, J.L., Hernández-Luis, F., Torrens, H., Guevara-Gómez, Y., Pina-Canseco, S. et al (2014) *In vitro antiparasitic activity of new thiosemicarbazones in strains of Trypanosoma cruzi* Eur. J. Medic. Chem., **87**, 23-29

Virus interactions

Chehadeh, W., Bouzidi, A., Alm, G., Wattré, P.and Hober, D. (2001) *Human antibodies isolated from plasma by affinity chromatography increase the coxsackievirus B4-induced synthesis of interferon-α by human peripheral blood mononuclear cells in vitro* J. Gen. Virol., **82**, 1899-1907

Creery, D., Angel, J.B., Aucoin, S., Weiss, W., Cameron, W.D., Diaz-Mitoma, F. and Kumar, A. (2002) *Nef protein of human immunodeficiency virus and lipopolysaccharide induce expression of CD14 on human monocytes through differential utilization of interleukin-10* Clin. Diagnost. Lab. Immunol., **9**, 1212-1221

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Mackewicz, C.E., Yuan, J., Tran, P., Diaz, L., Mack, E., Selsted, M.E. and Levy, J.A. (2003) *α-Defensins can have anti-HIV activity but are not CD8 cell anti-HIV factors* AIDS, **17**, F23-F32

Wound healing

Scott, C., Bonner, J., Min, D., Boughton, P., Stokes, R., Cha, K.M., Walters, S.N., Maslowski, K., Sierro, F., Grey, S.T., Twigg, S., McLennan, S. and Gunton, J.E. (2014) *Reduction of ARNT in myeloid cells causes immune suppression and delayed wound healing* Am. J. Physiol. Cell. Physiol., **307**, C349–C357

1a-2 Macaque

Tongaonkar, P., Tran, P., Roberts, K., Schaal, J., Osapay, G., Tran, D., Ouellette, A.J. and Selsted, M.E. (2011) *Rhesus macaque θ-defensin isoforms: expression, antimicrobial activities and demonstration of a prominent role in neutrophil granule microbicidal activities* J. Leukoc. Biol., **89**, 283–290

1a-3 Murine

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2 Mononuclear cells (barrier sedimentation gradient)

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2a-2 Blood (chicken)

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2a-5 Blood (human)

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2a-8 Blood (rodent)

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2b Semen (human)

Semen (human)

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2c Tissues

Bone marrow

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Brain

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Heart

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Intestine

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Liver

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Spleen

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3 Mononuclear cells (mixer flotation)

3a-1 Blood (human and non-human primates)

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DiJoseph, J.F., Dougher, M.M., Kalyandrug, L.B., Armellino, D.C., Boghaert, E.R., Hamann, P.R., Moran, J.K. and Damle, N.K. (2006) *Antitumor efficacy of a combination of CMC-544 (inotuzumab ozogamicin), a CD22-targeted cytotoxic immunoconjugate of calicheamicin, and rituximab against non-Hodgkin's B-cell lymphoma* Clin. Cancer Res., **12**, 242-249

Grace, P.M., Fabisiak, T.J., Green-Fulgham, S.M., Anderson, N.D., Strand, K.A., Kwilasz, A.J. Galer, E.L., Walker, F.R., Greenwood, B.N. et al (2016) *Prior voluntary wheel running attenuates neuropathic pain* Pain, **157**, 2012–2023

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3a-4 Cord blood

Elias, M., Choudhury, N. and Smit Sibinga, CTh. (2003) *Cord blood from collection to expansion: Feasibility in a regional blood bank* Indian J. Padiatr., **70**, 327-336

3a-5 Tissues

Bone marrow

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Liver

Au-Yeung, B.B. and Fowell, D.J. (2007) *A key role for Itk in both IFNγ and IL-4 production by NKT cells* J. Immunol., **179**, 111-119
Cabrera, M., Pewe, L.L., Harty, J.T. and Frevert, U. (2013) *In vivo CD8+ T cell dynamics in the liver of Plasmodium yoelii immunized and infected mice* PloS One, **8**: e70842
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Lung
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Spleen
DiJoseph, J.F., Dougher, M.M., Kalyandrug, L.B., Armellino, D.C., Boghaert, E.R., Hamann, P.R., Moran, J.K. and Damle, N.K. (2006) *Antitumor efficacy of a combination of CMC-544 (inotuzumab ozogamicin), a CD22-targeted cytotoxic immunoconjugate of calicheamicin, and rituximab against non-Hodgkin's B-cell lymphoma* Clin. Cancer Res., **12**, 242-249
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4 Mononuclear cells (barrier flotation)
4a Human blood
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De Roos, B., Duthie, S.J., Polley, A.C.J., Mulholland, F., Bouwman, F.G., Heim, C., Rucklidge, G.J., Johnson, I.T., Mariman, E.C., Daniel, H. and Elliott, R.M. (2008) *Proteomic methodological recommendations for studies involving human plasma, platelets and peripheral blood mononuclear cells* J. Proteome Res., **7**, 2280-2290
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4b Tissues (mouse)
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5 Polymorphonuclear leukocytes (granulocytes)
5a Bovine peripheral blood
Wang, J., Zhou, X., Pan, B., Wang, H., Shi, F., Gan, W., Yang, L. et al (2013) *Expression pattern of interferon-inducible transcriptional genes in neutrophils during bovine tuberculosis infection DNA* Cell Biol., **32**, 480-486
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5b Guinea pig peripheral blood
Takahashi, M., Jeevan, A., Sawant, K., Mc Murray, D.N. and Yoshimura, T. (2007) *Cloning and characterization of guinea pig CXCR1* Mol. Immunol., **44**, 878-888

5c Human peripheral blood

Barbour, T.D., Ling, G.S., Ruseva, M.M., Fossati-Jimack, L., Cook, H.T., Botto, M. and Pickering, M.C. (2016) *Complement receptor 3 mediates renal protection in experimental C3 glomerulopathy* Kidney Int., **89**, 823–832

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