



Phagocytosis References

GENERAL BEAD SELECTION & PHAGOCYTOSIS RATES

Thiele L, Diederichs JE, Reszka R, Merkle HP, Walter E. (2003) **Competitive adsorption of serum proteins at microparticles affects phagocytosis by dendritic cells.** *Biomaterials*; 24(8):1409-18. (1µm Polybead® and Fluoresbrite® Carboxylate microspheres)

Ahsan F, Rivas IP, Khan MA, Torres Suarez AI. (2002) **Targeting to macrophages: role of physicochemical properties of particulate carriers--liposomes and microspheres--on the phagocytosis by macrophages.** *J Controlled Release*; 79:29-40.

Thiele L, Rothen-Rutishauser B, Jilek S, Wunderli-Allenspach H, Merkle HP, Walter E. (2001) **Evaluation of particle uptake in human blood monocyte-derived cells in vitro. Does phagocytosis activity of dendritic cells measure up with macrophages?** *J Controlled Release*; 76:59-71.

Koval M, Preiter K, Adles C, Stahl PD, Steinberg TH. (1998) **Size of IgG-opsonized particles determines macrophage response during internalization.** *Exp Cell Res*; 242(1):265-73. (0.2-0.3µm Polybead® microspheres; trypan blue quenching)

Tabata Y, Ikada Y. (1988) **Effect of the size and surface charge of polymer microspheres on their phagocytosis by macrophage.** *Biomaterials*; 9(4):356-62.

MONOCYTES

Gu BJ, Duce JA, Valova VA, Wong B, Bush AI, Petrou S, Wiley JS. (2012) **P2X7 receptor-mediated scavenger activity of mononuclear phagocytes toward non-opsonized particles and apoptotic cells is inhibited by serum glycoproteins but remains active in cerebrospinal fluid.** *Journal of Biological Chemistry*. May 18;287:17318-30. (1µm Fluoresbrite® YG microspheres)

Dumrese C, Slomianka L, Ziegler U, Choi SS, Kalia A, Fulurija A, Lu W, Berg DE, Benghezal M, Marshall B, Mittl PR. (2009) **The secreted Helicobacter cysteine-rich protein A causes adherence of human monocytes and differentiation into a macrophage-like phenotype.** *FEBS Lett*. May 19;583(10):1637-43. (1µm green fluorescent beads)

Savard M, Bélanger C, Tardif M, Gourde P, Flamand L, Gosselin J. (2000) **Infection of primary human monocytes by Epstein-Barr virus.** *Journal of Virology*;74(6):2612-9. (2µm Fluoresbrite® YG Carboxylate microspheres)

MACROPHAGES

Jay SM, Skokos EA, Zeng J, Knox K, Kyriakides TR. (2010) **Macrophage fusion leading to foreign body giant cell formation persists under phagocytic stimulation by microspheres in in vitro and in vivo in mouse models.** *J Biomed Mater Res A*. April;93(1):189-99. (3µm Fluoresbrite® YG microspheres)

Takahashi T, Kinoshita M, Shono S, Habu Y, Ogura T, Seki S, Kazama T. (2010) **The effect of ketamine anesthesia on the immune function of mice with postoperative Septicemia.** *Anesthesia & Analgesia*. Oct; 111(4):1051-8. (75nm Fluoresbrite® YG Carboxylate microspheres)

Steinberg BE, Scott CC, Grinstein S. (2007) **High-throughput assays of phagocytosis, phagosome maturation, and bacterial invasion.** *Am J Physiol Cell Physiol*;292:C945-52. (3µm and 8µm undyed PS beads from Bangs)

Ablin J, Verbovetski I, Trahtenberg U, Metzger S, Mevorach D. (2005) **Quinidine and procainamide inhibit murine macrophage uptake of apoptic and necrotic cells: A novel contributing mechanism of drug-induced-lupus.** *Apoptosis*; 10(5):1009-18. (1µm green fluorescent beads)

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Reichner JS, Fitzpatrick PA, Wakshull E, Albina JE. (2001) **Receptor-mediated phagocytosis of rat macrophages is regulated differentially for opsonized particles and non-opsonized particles containing beta-glucan.** *Immunology* Oct; 104(2):198-206. (3µm Fluoresbrite® YG microspheres)

Koval M, Preiter K, Adles C, Stahl PD, Steinberg TH. (1998) **Size of IgG-opsonized particles determines macrophage response during internalization.** *Exp Cell Res*; 242(1):265-73. (0.2µm - 3µm Polybead® microspheres, Trypan Blue quenching)

Tabata Y, Ikada Y. (1988) **Effect of the size and surface charge of polymer microspheres on their phagocytosis by macrophage.** *Biomaterials*; 9(4):356-62.

Steinkamp JA, Wilson JS, Saunders GC, Stewart CC. (1982) **Phagocytosis: flow cytometric quantitation with fluorescent microspheres.** *Science*; 215:64-66.

DENDRITIC CELLS

Wu Z, Rothwell L, Young JR, Kaufman J, Butter C, Kaiser P. (2010) **Generation and characterization of chicken bone marrow-derived dendritic cells.** *Immunology*. Jan;129(10):133-45. (0.5µm Fluoresbrite® YG Carboxylate microspheres)

Byrne SN, Halliday GM. (2003) **Phagocytosis by dendritic cells rather than MHC IIhigh macrophages is associated with skin tumour regression.** *Int J Cancer*. 106:736-44. (0.5µm Fluoresbrite® YG Carboxylate microspheres)

Thiele L, Diederichs JE, Reszka R, Merkle HP, Walter E. (2003) **Competitive adsorption of serum proteins at microparticles affects phagocytosis by dendritic cells.** *Biomaterials*; 24(8):1409-18. (1µm Polybead® and Fluoresbrite® Carboxylate microspheres)

Thiele L, Rothen-Rutishauser B, Jilek S, Wunderli-Allenspach H, Merkle HP, Walter E. (2001) **Evaluation of particle uptake in human blood monocyte-derived cells in vitro. Does phagocytosis activity of dendritic cells measure up with macrophages?** *Journal of Controlled Release*; 76:59-71. (1µm Fluoresbrite® and 4.5µm Polybead®, both surface-labeled with BSA-FITC)

NEUTROPHILS

Fleming JC, Bao G, Cepinskas G, Weaver LC. (2010) **Anti-α4 integrin antibody induces receptor internalization and does not impair the function of circulating neutrophilic leukocytes.** *Inflamm Res*, 59:647-57. (0.75µm Fluoresbrite® YG COOH)

Herant M, Heinrich V, Dembo M. (2005) **Mechanics of neutrophil phagocytosis: Behavior of the cortical tension.** *Journal of Cell Science*, 118(9): 1789-97. (2-10µm undyed Polybead®, opsonized)

Radsak MP, Hilf N, Singh-Jasuja H, Braedel S, Brossart P, Rammensee H-G, Schild H. (2003) **The heat shock protein Gp96 binds to human neutrophils and monocytes and stimulates effector functions.** *Blood*. April 1; 101(7):2810-15. (1µm Fluoresbrite® PC Red)

Ogle JD, Noel JG, Sramkoski RM, Ogle CK, Alexander JW. (1988) **Phagocytosis of opsonized fluorescent microspheres by human neutrophils.** *J Immunological Methods*. Nov. 25;115(1):17-29. (0.75µm Fluoresbrite® YG COOH)

ADHERENT CELLS

Dumrese C, Slomianka L, Ziegler U, Choi SS, Kalia A, Fulurija A, Lu W, Berg DE, Benghezal M, Marshall B, Mittl PR. (2009) **The secreted Helicobacter cysteine-rich protein A causes adherence of human monocytes and differentiation into a macrophage-like phenotype.** *FEBS Lett*. May 19;583(10):1637-43. (1µm green fluorescent beads)

IN VIVO

Jay SM, Skokos EA, Zeng J, Knox K, Kyriakides TR. (2010) **Macrophage fusion leading to foreign body giant cell formation persists under phagocytic stimulation by microspheres in in vitro and in vivo in mouse models.** *J Biomed Mater Res A*. April; 93(1):189-99. (3µm Fluoresbrite® YG)

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FLOW CYTOMETRIC DETECTION

Gu BJ, Duce JA, Valova VA, Wong B, Bush AI, Petrou S, Wiley JS. (2012) **P2X7 receptor-mediated scavenger activity of mononuclear phagocytes toward con-opsonized particles and apoptotic cells is inhibited by serum glycoproteins but remains active in cerebrospinal fluid.** *Journal of Biological Chemistry*. May 18;287:17318-30. (1µm Fluoresbrite® YG)

Haugland GT, Jakobsen RA, Vestvik N, Ulven K, Stokka L, Wergeland HI. (2012) **Phagocytosis and respiratory burst activity in Lump sucker (Cyclopterus lumpus L.) leukocytes analysed by flow cytometry.** *PLOS ONE*. Oct.; 7(10):e47909. (1µm Fluoresbrite® YG COOH)

Fleming JC, Bao G, Cepinskas G, Weaver LC. (2010) **Anti-α4 integrin antibody induces receptor internalization and does not impair the function of circulating neutrophilic leukocytes.** *Inflamm Res*, 59:647-57. (0.75µm Fluoresbrite® YG COOH)

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Savard M, Bélanger C, Tardif M, Gourde P, Flamand L, Gosselin J. (2000) **Infection of primary human monocytes by Epstein-Barr virus.** *Journal of Virology*; 74(6):2612-9. (2µm Fluoresbrite® YG Carboxylate microspheres)

Lehmann AK, Sørnes S, Halstensen A. (2000) Phagocytosis: **Measurement by flow cytometry.** *J Immunological Methods*; 243:229-42. (1µm Fluoresbrite® PC Red)

Steinkamp JA, Wilson JS, Saunders GC, Stewart CC. (1982) **Phagocytosis: Flow cytometric quantitation with fluorescent microspheres.** *Science*; 215:64-66.

OPSONIZED BEADS FOR PHAGOCYTOSIS

Blanchette CD, Woo Y-H, Thomas C, Shen N, Sulcheck TA, Hiddessen AL. (2009) **Decoupling internalization, acidification and phagosomal-lysosomal fusion during phagocytosis of In1A coated beads in epithelial cells.** *PLOS ONE*; 4(6):e6056 (2µm undyed PS-COOH beads from Bangs)

Dumrese C, Slomianka L, Ziegler U, Choi SS, Kalia A, Fulurija A, Lu W, Berg DE, Benghezal M, Marshall B, Mittl PR. (2009) **The secreted Helicobacter cysteine-rich protein A causes adherence of human monocytes and differentiation into a macrophage-like phenotype.** *FEBS Lett*. May 19;583(10):1637-43. (1µm green fluorescent beads)

Sulahian TH, Imrich A, DeLoid G, Winkler AR, Kobzik L. (2008) **Signaling pathways required for macrophage scavenger receptor-mediated phagocytosis: analysis by scanning cyometry.** *Respiratory Research*; 9:59. (1µm green fluorescent COOH)

Steinberg BE, Scott CC, Grinstein S. (2007) **High-throughput assays of phagocytosis, phagosome maturation, and bacterial invasion.** *Am J Physiol Cell Physiol*; 292:C945-52. (3µm and 8µm undyed PS beads from Bangs)

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Lehmann AK, Sørnes S, Halstensen A. (2000) **Phagocytosis: Measurement by flow cytometry.** *J Immunological Methods*; 243:229-42. (1µm Fluoresbrite® PC Red)

QUENCHING FITC-LABELED BEADS WITH TRYPAN BLUE

Thiele L, Rothen-Rutishauser B, Jilek S, Wunderli-Allenspach H, Merkle HP, Walter E. (2001) **Evaluation of particle uptake in human blood monocyte-derived cells in vitro. Does phagocytosis activity of dendritic cells measure up with macrophages?** *Journal of Controlled Release*; 76:59-71. (1µm Fluoresbrite® and 4.5µm Polybead®, both surface-labeled with BSA-FITC)

Koval M, Preiter K, Adles C, Stahl PD, Steinberg TH. (1998) **Size of IgG-opsonized particles determines macrophage response during internalization.** *Exp Cell Res*; 242(1):265-73. (0.2µm - 3µm Polybead®, Trypan Blue quenching)

ALTERNATE METHODS FOR DISTINGUISHING PHAGOCYTOSED VS. UNINGESTED BEADS

Blanchette CD, Woo Y-H, Thomas C, Shen N, Sulcheck TA, Hiddessen AL. (2009) **Decoupling internalization, acidification and phagosomal-lysosomal fusion during phagocytosis of In1A coated beads in epithelial cells.** *PLoS ONE*; 4(6):e6056 (2µm undyed PC beads from Bangs) ***method:** opsonize beads with Alexa Fluor® (AF)488- or FITC-protein conjugates; perform phagocytosis studies; quench AF488 fluorescence with anti-AF488 antibody or distinguish uningested/ingested FITC-conjugate fluorescence by pH difference in environment inside/outside the phagosome in epithelial cells. ****contains detailed EDAC coupling procedure**

Sulahian TH, Imrich A, DeLoid G, Winkler AR, Kobzik L. (2008) **Signaling pathways required for macrophage scavenger receptor-mediated phagocytosis: analysis by scanning cyometry.** *Respiratory Research*; 9:59. (1µm green fluorescent COOH) *method: coat beads with biotin-BSA so that uningested beads can be labeled w/ SA-Texas Red to distinguish from ingested beads

Steinberg BE, Scott CC, Grinstein S. (2007) **High-throughput assays of phagocytosis, phagosome maturation, and bacterial invasion.** *Am J Physiol Cell Physiol*; 292:C945-52. (3µm and 8µm undyed PS beads from Bangs) *method: beads opsonized w/ Human IgG and labeled with Cy™3 anti-Human conjugate; after phagocytosis, uningested beads identified by staining with a Cy™5 anti-Human conjugate.

Ogle JD, Noel JG, Sramkoski RM, Ogle CK, Alexander JW. (1988) **Phagocytosis of opsonized fluorescent microspheres by human neutrophils.** *J Immunological Methods*. Nov. 25; 115(1):17-29. (0.75µm Fluoresbrite® YG COOH)

MICROGLIAL CELLS

Beutner C, Roy K, Linnartz B, Napoli I, Neumann. (2010) **Generation of microglial cells from mouse embryonic stem cells.** *Nature Protocols*;5:1481-94. (1µm PC Red - flow cytometric detection)

Skripuletz T, Miller E, Grote L, Gudi V, Pul R, Voss E, Skuljec J, Moharreggh-Khiabani D, Trebst C, Stangel M. (2011) **Lipopolysaccharide delays demyelination and promotes oligodendrocyte precursor proliferation in the central nervous system.** *Brain, Behavior, and Immunity*;25:1592-1606. (1µm carboxyl-modified fluorescent beads added to microglia cells at a ratio of 1:200 (cells:beads presumably))

Krabbe G, Matyash V, Pannasch U, Mamer L, Boddeke HWGM, Kettenmann H. (2012) **Activation of serotonin receptors promotes microglial injury-induced motility but attenuates phagocytic activity.** *Brain, Behavior, and Immunity*;26(3):419-28. (3µm YG COOH - confocal microscopy detection)