References

Description

Arthos, J, Cicala, C, Martinelli, E, Macleod, K, Ryk, D. V, Wei, D, Xiao, Z, Veenstra, T. D, Conrad, T. P, Lempicki, R. A, Mclaughlin, S, Pascuccio, M, Gopaul, R, Mcnally, J, Cruz, C. C, Censoplano, N, Chung, E, Reitano, K. N, Kottilil, S, Goode, D. J, & Fauci, A. S. (2008) Hiv-1 envelope protein binds to and signals through integrin alpha4beta7, the gut mucosal homing receptor for peripheral t cells. Nat Immunol 9, 301–9.

Ballweber, L, Robinson, B, Kreger, A, Fialkow, M, Lentz, G, McElrath, M. J, & Hladik, F. (2011) Vaginal langerhans cells nonproductively transporting hiv-1 mediate infection of t cells. J Virol 85, 13443–7.

Berzi, A, Reina, J. J, Ottria, R, Sutkeviciute, I, Antonazzo, P, Sanchez-Navarro, M, Chabrol, E, Biasin, M, Trabattoni, D, Cetin, I, Rojo, J, Fieschi, F, Bernardi, A, & Clerici, M. (2012) A glycomimetic compound inhibits dc-sign-mediated hiv infection in cellular and cervical explant models. AIDS (London, England) 26, 127–137.

Bogoevska, V, Nollau, P, Lucka, L, Grunow, D, Klampe, B, Uotila, L. M, Samsen, A, Gahmberg, C. G, & Wagener, C. (2007) Dc-sign binds icam-3 isolated from peripheral human leukocytes through lewis x residues. Glycobiology 17, 324–33.

Burleigh, L, Lozach, P.-Y, Schiffer, C, Staropoli, I, Pezo, V, Porrot, F, Canque, B, Virelizier, J.-L, Arenzana-Seisdedos, F, & Amara, A. (2006) Infection of dendritic cells (dcs), not dc-sign mediated internalization of human immunodeficiency virus, is required for long-term transfer of virus to t cells. J Virol 80, 2949–57.

Cambi, A, de Lange, F, van Maarseveen, N. M, Nijhuis, M, Joosten, B, van Dijk, E. M. H. P, de Bakker, B. I, Fransen, J. A. M, Bovee-Geurts, P. H. M, van Leeuwen, F. N, Hulst, N. F. V, & Figdor, C. G. (2004) Microdomains of the c-type lectin dc-sign are portals for virus entry into dendritic cells. J Cell Biol 164, 145–55.

Cambi, A, Koopman, M, & Figdor, C. G. (2005) How c-type lectins detect pathogens. Cellular microbiology 7, 481–8.

Cambi, A, Beeren, I, Joosten, B, Fransen, J. A, & Figdor, C. G. (2009) The c-type lectin dc-sign internalizes soluble antigens and hiv-1 virions via a clathrin-dependent mechanism. Eur J Immunol 39, 1923–8.

Cameron, P. U, Freudenthal, P. S, Barker, J. M, Gezelter, S, Inaba, K, & Steinman, R. M. (1992) Dendritic cells exposed to human immunodeficiency virus type-1 transmit a vigorous cytopathic infection to cd4+ t cells. Science 257, 383–7.

Chatwell, L, Holla, A, Kaufer, B. B, & Skerra, A. (2008) The carbohydrate recognition domain of

langerin reveals high structural similarity with the one of dc-sign but an additional, calciumin dependent sugar-binding site. Mol Immunol 45, 1981–94.

Cicala, C, Martinelli, E, McNally, J. P, Goode, D. J, Gopaul, R, Hiatt, J, Jelicic, K, Kottilil, S, Macleod, K, O'Shea, A, Patel, N, Ryk, D. V, Wei, D, Pascuccio, M, Yi, L, McKinnon, L, Izulla, P, Kimani, J, Kaul, R, Fauci, A. S, & Arthos, J. (2009) The integrin alpha4beta7 forms a complex with cell-surface cd4 and defines a t-cell subset that is highly susceptible to infection by hiv-1. Proc Natl Acad Sci USA 106, 20877–82.

Cunningham, A. L, Carbone, F, & Geijtenbeek, T. B. H. (2008) Langerhans cells and viral immunity. Eur. J. Immunol. 38, 2377–85.

Curtis, B. M, Scharnowske, S, &Watson, A. J. (1992) Sequence and expression of a membrane associated c-type lectin that exhibits cd4-independent binding of human immunodeficiency virus envelope glycoprotein gp120. Proc Natl Acad Sci USA 89, 8356–60.

Dam, T. K & Brewer, C. F. (2010) Lectins as pattern recognition molecules : the effects of epitope density in innate immunity. Glycobiology 20, 270–9.

de Bakker, B. I, de Lange, F, Cambi, A, Korterik, J. P, van Dijk, E. M. H. P, Hulst, N. F. V, Figdor, C. G, & Garcia-Parajo, M. F. (2007) Nanoscale organization of the pathogen receptor dc-sign mapped by single-molecule high-resolution fluorescence microscopy. ChemPhysChem 8, 1473–80.

de Jong, M. A. W. P, Vriend, L. E. M, Theelen, B, Taylor, M. E, Fluitsma, D, Boekhout, T, & Geijtenbeek, T. B. H. (2010) C-type lectin langerin is a beta-glucan receptor on human langerhans cells that recognizes opportunistic and pathogenic fungi. Mol Immunol 47, 1216–25.

de Jong, M. A. W. P, de Witte, L, Taylor, M. E, & Geijtenbeek, T. B. H. (2010) Herpes simplex virus type 2 enhances hiv-1 susceptibility by affecting langerhans cell function. J Immunol 185, 1633–41.

de Witte, L, Nabatov, A, Pion, M, Fluitsma, D, de Jong, M. A. W. P, de Gruijl, T, Piguet, V, van Kooyk, Y, & Geijtenbeek, T. B. H. (2007) Langerin is a natural barrier to hiv-1 transmission by langerhans cells. Nat Med 13, 367–71.

de Witte, L, Nabatov, A, & Geijtenbeek, T. B. H. (2008) Distinct roles for dc-sign+-dendritic cells and langerhans cells in hiv-1 transmission. Trends Mol Med 14, 12–9.

Drickamer, K. (1999) C-type lectin-like domains. Current Opinion in Structural Biology 9, 585–90.

Engering, A, Geijtenbeek, T. B. H, van Vliet, S. J, Wijers, M, van Liempt, E, Demaurex, N, Lanzavecchia, A, Fransen, J, Figdor, C. G, Piguet, V, & van Kooyk, Y. (2002) The dendritic cell-specific adhesion receptor dc-sign internalizes antigen for presentation to t cells. J Immunol 168, 2118–26.

Engering, A, Geijtenbeek, T. B. H, & van Kooyk, Y. (2002) Immune escape through c-type lectins on dendritic cells. Trends Immunol 23, 480–5.

Feinberg, H, Powlesland, A. S, Taylor, M. E, & Weis, W. I. (2010) Trimeric structure of langerin. J Biol Chem 285, 13285–93.

Felts, R. L, Narayan, K, Estes, J. D, Shi, D, Trubey, C. M, Fu, J, Hartnell, L. M, Ruthel, G. T, Schneider, D. K, Nagashima, K, Bess, J. W, Bavari, S, Lowekamp, B. C, Bliss, D, Lifson, J. D, & Subramaniam, S. (2010) 3d visualization of hiv transfer at the virological synapse between dendritic cells and t cells. Proc Natl Acad Sci USA 107, 13336–41.

Feinberg, H, Mitchell, D. A, Drickamer, K, & Weis, W. I. (2001) Structural basis for selective recognition of oligosaccharides by dc-sign and dc-signr. Science 294, 2163–6.

Feinberg, H, Guo, Y, Mitchell, D. A, Drickamer, K, & Weis, W. I. (2005) Extended neck regions stabilize tetramers of the receptors dc-sign and dc-signr. J Biol Chem 280, 1327–35.

Feinberg, H, Taylor, M. E, Razi, N, Mcbride, R, Knirel, Y. A, Graham, S. A, Drickamer, K, & Weis, W. I. (2011) Structural basis for langerin recognition of diverse pathogen and mammalian glycans through a single binding site. Journal of Molecular Biology 405, 1027–39.

Frison, N, Taylor, M. E, Soilleux, E, Bousser, M.-T, Mayer, R, Monsigny, M, Drickamer, K, & Roche, A.-C. (2003) Oligolysine-based oligosaccharide clusters : selective recognition and endocytosis by the mannose receptor and dendritic cell-specific intercellular adhesion molecule 3 (icam-3)-grabbing nonintegrin. J Biol Chem 278, 23922–9.

García-Vallejo, J. J, van Liempt, E, da Costa Martins, P, Beckers, C, van het Hof, B, Gringhuis, S. I, Zwaginga, J.-J, van Dijk, W, Geijtenbeek, T. B. H, van Kooyk, Y, & van Die, I. (2008) Dc-sign mediates adhesion and rolling of dendritic cells on primary human umbilical vein endothelial cells through lewisy antigen expressed on icam-2. Mol Immunol 45, 2359–69.

Geijtenbeek, T. B, Krooshoop, D. J, Bleijs, D. A, van Vliet, S. J, van Duijnhoven, G. C, Grabovsky, V, Alon, R, Figdor, C. G, & van Kooyk, Y. (2000) Dc-sign-icam-2 interaction mediates dendritic cell trafficking. Nat Immunol 1, 353–7.

Geijtenbeek, T. B, Torensma, R, van Vliet, S. J, van Duijnhoven, G. C, Adema, G. J, van Kooyk, Y, & Figdor, C. G. (2000) Identification of dc-sign, a novel dendritic cell-specific icam-3 receptor that supports primary immune responses. Cell 100, 575–85.

Geijtenbeek, T. B. H & Gringhuis, S. I. (2009) Signalling through c-type lectin receptors : shaping immune responses. Nature Reviews Immunology 9, 465–79.

Geijtenbeek, T. B. H, den Dunnen, J, & Gringhuis, S. I. (2009) Pathogen recognition by dc-sign shapes adaptive immunity. Future Microbiol. 4, 879–90.

Geijtenbeek, T. B, Kwon, D. S, Torensma, R, van Vliet, S. J, van Duijnhoven, G. C, Middel, J, Cornelissen, I. L, Nottet, H. S, KewalRamani, V. N, Littman, D. R, Figdor, C. G, & van Kooyk, Y. (2000) Dc-sign, a dendritic cell-specific hiv-1-binding protein that enhances trans-infection of t cells. Cell 100, 587–97.

Girolomoni, G, Caux, C, Lebecque, S, Dezutter-Dambuyant, C, & Ricciardi-Castagnoli, P. (2002) Langerhans cells : still a fundamental paradigm for studying the immunobiology of dendritic cells. Trends Immunol 23, 6–8.

Granelli-Piperno, A, Pritsker, A, Pack, M, Shimeliovich, I, Arrighi, J.-F, Park, C. G, Trumpfheller, C, Piguet, V, Moran, T. M, & Steinman, R. M. (2005) Dendritic cell-specific intercellular adhesion molecule 3-grabbing nonintegrin/cd209 is abundant on macrophages in the normal human lymph node and is not required for dendritic cell stimulation of the mixed leukocyte reaction. J Immunol 175, 4265–73.

Gringhuis, S. I, van der Vlist, M, van den Berg, L. M, den Dunnen, J, Litjens, M, & Geijtenbeek, T. B. H. (2010) Hiv-1 exploits innate signaling by tlr8 and dc-sign for productive infection of dendritic cells. Nat Immunol 11, 419–26.

Gringhuis, S. I, den Dunnen, J, Litjens, M, van der Vlist, M, & Geijtenbeek, T. B. H. (2009) Carbohydrate-specific signaling through the dc-sign signalosome tailors immunity to mycobacterium tuberculosis, hiv-1 and helicobacter pylori. Nat Immunol 10, 1081–8.

Guo, Y, Feinberg, H, Conroy, E, Mitchell, D. A, Alvarez, R, Blixt, O, Taylor, M. E,Weis, W. I, & Drickamer, K. (2004) Structural basis for distinct ligand-binding and targeting properties of the receptors dc-sign and dc-signr. Nat Struct Mol Biol 11, 591–8.

Gurney, K. B, Elliott, J, Nassanian, H, Song, C, Soilleux, E, McGowan, I, Anton, P. A, & Lee, B. (2005) Binding and transfer of human immunodeficiency virus by dc-sign+ cells in human rectal mucosa. J Virol 79, 5762–73.

Hladik, F, Sakchalathorn, P, Ballweber, L, Lentz, G, Fialkow, M, Eschenbach, D, & McElrath, M. J. (2007) Initial events in establishing vaginal entry and infection by human immunodeficiency virus type-1. Immunity 26, 257–70

Hladik, F & McElrath, M. J. (2008) Setting the stage : host invasion by hiv. Nat Rev Immunol 8, 447–57.

Hladik, F & Hope, T. J. (2009) Hiv infection of the genital mucosa in women. Curr HIV/AIDS Rep 6, 20–8.

Hunger, R. E, Sieling, P. A, Ochoa, M. T, Sugaya, M, Burdick, A. E, Rea, T. H, Brennan, P. J, Belisle, J. T, Blauvelt, A, Porcelli, S. A, & Modlin, R. L. (2004) Langerhans cells utilize cd1a and langerin to efficiently present nonpeptide antigens to t cells. Journal of Clinical Investigation 113, 701–8.

Hussain, L. A & Lehner, T. (1995) Comparative investigation of langerhans' cells and potential receptors for hiv in oral, genitourinary and rectal epithelia. Immunology 85, 475–84.

Idoyaga, J, Suda, N, Suda, K, Park, C. G, & Steinman, R. M. (2009) Antibody to langerin/ cd207 localizes large numbers of cd8alpha+ dendritic cells to the marginal zone of mouse spleen. Proc Natl Acad Sci USA 106, 1524–9.

Itano, M. S, Neumann, A. K, Liu, P, Zhang, F, Gratton, E, Parak, W. J, Thompson, N. L, & Jacobson, K. (2011) Dc-sign and influenza hemagglutinin dynamics in plasma membrane

microdomains are markedly different. Biophys J 100, 2662–70.

Itano, M. S, Steinhauer, C, Schmied, J. J, Forthmann, C, Liu, P, Neumann, A. K, Thompson, N. L, Tinnefeld, P, & Jacobson, K. (2012) Super-resolution imaging of c-type lectin and influenza hemagglutinin nanodomains on plasma membranes using blink microscopy. Biophys J 102, 1534–42.

Koopman, M, Cambi, A, de Bakker, B. I, Joosten, B, Figdor, C. G, van Hulst, N. F, & Garcia-Parajo, M. F. (2004) Near-field scanning optical microscopy in liquid for high resolution single molecule detection on dendritic cells. FEBS Lett 573, 6–10.

Krutzik, S. R, Tan, B, Li, H, Ochoa, M. T, Liu, P. T, Sharfstein, S. E, Graeber, T. G, Sieling, P. A, Liu, Y.-J, Rea, T. H, Bloom, B. R, & Modlin, R. L. (2005) Tlr activation triggers the rapid differentiation of monocytes into macrophages and dendritic cells. Nat Med 11, 653–60.

Kwon, D. S, Gregorio, G, Bitton, N, Hendrickson, W. A, & Littman, D. R. (2002) Dc-signmediated internalization of hiv is required for trans-enhancement of t cell infection. Immunity 16, 135–44.

Lee, B, Leslie, G, Soilleux, E, O'doherty, U, Baik, S, Levroney, E, Flummerfelt, K, Swiggard, W, Coleman, N, Malim, M, & Doms, R. W. (2001) cis expression of dc-sign allows for more efficient entry of human and simian immunodeficiency viruses via cd4 and a coreceptor. J Virol 75, 12028–38.

Liu, P, Wang, X, Itano, M. S, Neumann, A. K, Jacobson, K, & Thompson, N. L. (2012) The formation and stability of dc-sign microdomains require its extracellular moiety. Traffic (Copenhagen, Denmark).

Ludwig, I. S, Geijtenbeek, T. B. H, & van Kooyk, Y. (2006) Two way communication between neutrophils and dendritic cells. Curr Opin Pharmacol 6, 408–13.

Lupas, A. (1996) Coiled coils : new structures and new functions. Trends Biochem Sci 21, 375–82.

Martinez, O, Brackenridge, S, El-Idrissi, M. E.-A, & Prabhakar, B. S. (2005) Dc-sign, but not sdc-sign, can modulate il-2 production from pma- and anti-cd3-stimulated primary human cd4 t cells. Int Immunol 17, 769–78.

Menon, S, Rosenberg, K, Graham, S. A,Ward, E. M, Taylor, M. E, Drickamer, K, & Leckband, D. E. (2009) Binding-site geometry and flexibility in dc-sign demonstrated with surface force measurements. Proc Natl Acad Sci USA 106, 11524–9.

Melikyan, G. B. (2008) Common principles and intermediates of viral protein-mediated fusion : the hiv-1 paradigm. Retrovirology 5, 111.

Mitchell, D. A, Fadden, A. J, & Drickamer, K. (2001) A novel mechanism of carbohydrate recognition by the c-type lectins dc-sign and dc-signr. subunit organization and binding to multivalent ligands. J Biol Chem 276, 28939–45.

Miyauchi, K, Kim, Y, Latinovic, O, Morozov, V, & Melikyan, G. B. (2009) Hiv enters cells via endocytosis and dynamin-dependent fusion with endosomes. Cell 137, 433–44.

Mummidi, S, Catano, G, Lam, L, Hoefle, A, Telles, V, Begum, K, Jimenez, F, Ahuja, S. S, & Ahuja, S.

K. (2001) Extensive repertoire of membrane-bound and soluble dendritic cell-specific icam-3-grabbing nonintegrin 1 (dc-sign1) and dc-sign2 isoforms. inter-individual variation in expression of dc-sign transcripts. J Biol Chem 276, 33196–212.

Neumann, A. K, Thompson, N. L, & Jacobson, K. (2008) Distribution and lateral mobility of dc-sign on immature dendritic cells–implications for pathogen uptake. Journal of Cell Science, 121, 634–43.

Orloff, G. M, Orloff, S. L, Kennedy, M. S, Maddon, P. J, & McDougal, J. S. (1991) Penetrationof cd4 t cells by hiv-1. the cd4 receptor does not internalize with hiv, and cd4-related signal transduction events are not required for entry. J Immunol 146, 2578–87.

Plazolles, N, Humbert, J.-M, Vachot, L, Verrier, B, Hocke, C, & Halary, F. (2011) Pivotal advance : The promotion of soluble dc-sign release by inflammatory signals and its enhancement of cytomegalovirus-mediated cis-infection of myeloid dendritic cells. J Leukoc Biol 89, 329–42.

Pöhlmann, S, Baribaud, F, & Doms, R. W. (2001) Dc-sign and dc-signr : helping hands for hiv. Trends Immunol 22, 643–6.

Pope, M, Betjes, M. G, Romani, N, Hirmand, H, Cameron, P. U, Hoffman, L, Gezelter, S, Schuler, G, & Steinman, R. M. (1994) Conjugates of dendritic cells and memory t lymphocytes from skin facilitate productive infection with hiv-1. Cell 78, 389–98.

Romani, N, Clausen, B. E, & Stoitzner, P. (2010) Langerhans cells and more : langerinexpressing dendritic cell subsets in the skin. Immunological Reviews 234, 120–41.

Rappocciolo, G, Piazza, P, Fuller, C. L, Reinhart, T. A, Watkins, S. C, Rowe, D. T, Jais, M, Gupta, P, & Rinaldo, C. R. (2006) Dc-sign on b lymphocytes is required for transmission of hiv-1 to t lymphocytes. PLoS Pathog 2, e70.

Sabatte, J, Faigle, W, Ceballos, A, Morelle, W, Rodrígues, C. R, Lenicov, F. R, Thépaut, M, Fieschi, F, Malchiodi, E, Fernández, M, Arenzana-Seisdedos, F, Lortat-Jacob, H, Michalski, J.-C, Geffner, J, & Amigorena, S. (2011) Semen clusterin is a novel dc-sign ligand. The Journal of Immunology 187, 5299–309.

Saphire, A. C, Bobardt, M. D, Zhang, Z, David, G, & Gallay, P. A. (2001) Syndecans serve as attachment receptors for human immunodeficiency virus type 1 on macrophages. Journal of Virology 75, 9187–200.

Sattin, S, Daghetti, A, Thépaut, M, Berzi, A, Sánchez-Navarro, M, Tabarani, G, Rojo, J, Fieschi, F, Clerici, M, & Bernardi, A. (2010) Inhibition of dc-sign-mediated hiv infection by a linear trimannoside mimic in a tetravalent presentation. ACS Chem Biol 5, 301–12.

Sherer, N. M, Jin, J, & Mothes, W. (2010) Directional spread of surface-associated retroviruses regulated by differential virus-cell interactions. Journal of Virology 84, 3248–58.

Soilleux, E. J, Morris, L. S, Leslie, G, Chehimi, J, Luo, Q, Levroney, E, Trowsdale, J, Montaner, L. J, Doms, R. W, Weissman, D, Coleman, N, & Lee, B. (2002) Constitutive and induced expression of dc-sign on dendritic cell and macrophage subpopulations in situ and in vitro. J Leukoc Biol 71, 445–57.

Soilleux, E. J, Barten, R, & Trowsdale, J. (2000) Dc-sign ; a related gene, dc-signr ; and cd23 form a cluster on 19p13. J Immunol 165, 2937–42.

Sol-Foulon, N, Moris, A, Nobile, C, Boccaccio, C, Engering, A, Abastado, J.-P, Heard, J.-M, van Kooyk, Y, & Schwartz, O. (2002) Hiv-1 nef-induced upregulation of dc-sign in dendritic cells promotes lymphocyte clustering and viral spread. Immunity 16, 145–55.

Stambach, N. S & Taylor, M. E. (2003) Characterization of carbohydrate recognition by langerin, a c-type lectin of langerhans cells. Glycobiology 13, 401–10.

Stoitzner, P & Romani, N. (2011) Langerin, the “catcher in the rye” : an important receptor for pathogens on langerhans cells. Eur. J. Immunol. 41, 2526–9.

Svajger, U, Anderluh, M, Jeras, M, & Obermajer, N. (2010) C-type lectin dc-sign : an adhesion, signalling and antigen-uptake molecule that guides dendritic cells in immunity. Cellular Signalling 22, 1397–405.

Tabarani, G, Thépaut, M, Stroebel, D, Ebel, C, Vivès, C, Vachette, P, Durand, D, & Fieschi, F. (2009) Dc-sign neck domain is a ph-sensor controlling oligomerization : Saxs and hydrodynamic studies of extracellular domain. J Biol Chem 284, 21229–40.

Tacken, P. J, Ginter, W, Berod, L, Cruz, L. J, Joosten, B, Sparwasser, T, Figdor, C. G, & Cambi, A. (2011) Targeting dc-sign via its neck region leads to prolonged antigen residence in early endosomes, delayed lysosomal degradation and cross-presentation. Blood.

Tateno, H, Ohnishi, K, Yabe, R, Hayatsu, N, Sato, T, Takeya, M, Narimatsu, H, & Hirabayashi, J. (2010) Dual specificity of langerin to sulfated and mannosylated glycans via a single c-type carbohydrate recognition domain. J Biol Chem 285, 6390–400.

Thépaut, M, Valladeau, J, Nurisso, A, Kahn, R, Arnou, B, Vivès, C, Saeland, S, Ebel, C, Monnier, C, Dezutter-Dambuyant, C, Imberty, A, & Fieschi, F. (2009) Structural studies of langerin and birbeck granule : a macromolecular organization model. Biochemistry 48, 2684–98.

Turville, S. G, Cameron, P. U, Handley, A, Lin, G, Pöhlmann, S, Doms, R. W, & Cunningham, A. L. (2002) Diversity of receptors binding hiv on dendritic cell subsets. Nat Immunol 3, 975–83.

Valladeau, J, Ravel, O, Dezutter-Dambuyant, C, Moore, K, Kleijmeer, M, Liu, Y, Duvert-Frances, V, Vincent, C, Schmitt, D, Davoust, J, Caux, C, Lebecque, S, & Saeland, S. (2000) Langerin, a novel c-type lectin specific to langerhans cells, is an endocytic receptor that induces the formation of birbeck granules. Immunity 12, 71–81.

van den Berg, L. M, Gringhuis, S. I, & Geijtenbeek, T. B. H. (2012) An evolutionary perspective on c-

type lectins in infection and immunity. Annals of the New York Academy of Sciences.

van Gisbergen, K. P. J. M, Sanchez-Hernandez, M, Geijtenbeek, T. B. H, & van Kooyk, Y. (2005) Neutrophils mediate immune modulation of dendritic cells through glycosylation dependent interactions between mac-1 and dc-sign. J Exp Med 201, 1281–92.

van Gisbergen, K. P. J. M, Ludwig, I. S, Geijtenbeek, T. B. H, & van Kooyk, Y. (2005) Interactions of dc-sign with mac-1 and ceacam1 regulate contact between dendritic cells and neutrophils. FEBS Lett 579, 6159–68.

van Gisbergen, K. P. J. M, Aarnoudse, C. A, Meijer, G. A, Geijtenbeek, T. B. H, & van Kooyk, Y. (2005) Dendritic cells recognize tumor-specific glycosylation of carcinoembryonic antigen on colorectal cancer cells through dendritic cell-specific intercellular adhesion molecule-3-grabbing non integrin. Cancer Res 65, 5935–44.

van Kooyk, Y & Geijtenbeek, T. B. H. (2003) Dc-sign : escape mechanism for pathogens. Nature Reviews Immunology 3, 697–709.

Ward, E. M, Stambach, N. S, Drickamer, K, & Taylor, M. E. (2006) Polymorphisms in human langerin affect stability and sugar binding activity. J Biol Chem 281, 15450–6.

Wilen, C. B, Tilton, J. C, & Doms, R. W. (2012) Hiv : Cell binding and entry. Cold Spring Harb Perspect Med 2.