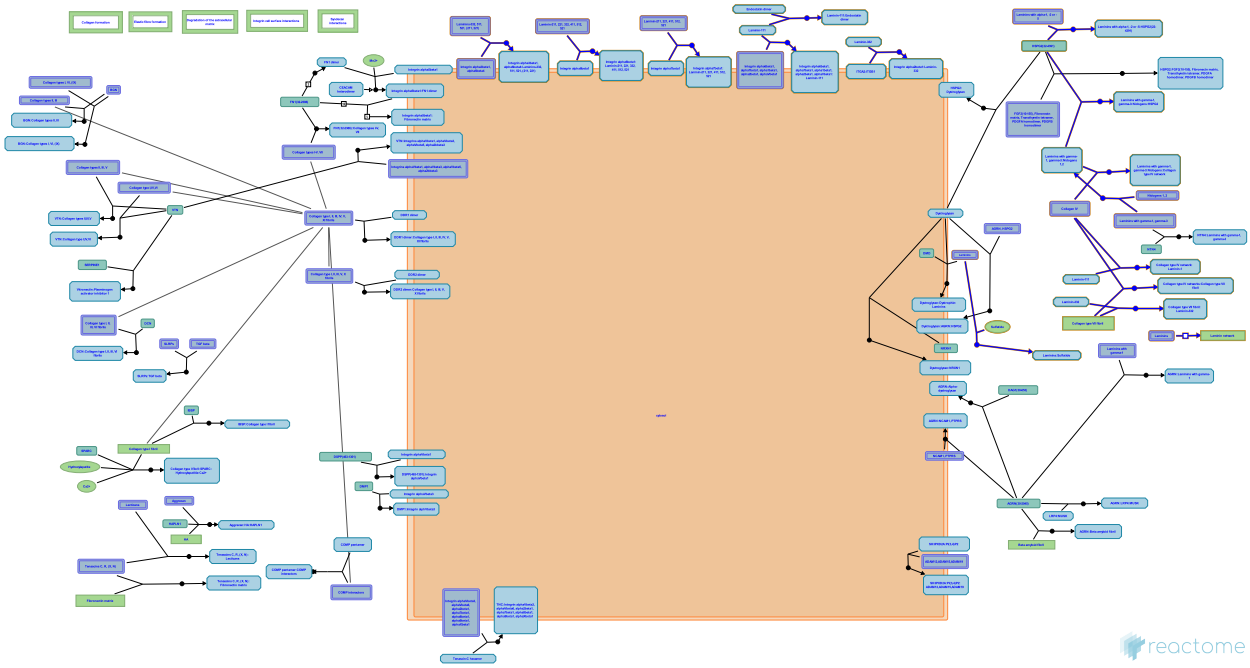
Laminin interactions



Garapati, P V., Geiger, B., Horwitz, AR., Humphries, MJ., Hynes, R., Jupe, S., Ricard-Blum, S., Yamada, KM.

European Bioinformatics Institute, New York University Langone Medical Center, Ontario Institute for Cancer Research, Oregon Health and Science University.

26/04/2024

Introduction

Reactome is open-source, open access, manually curated and peer-reviewed pathway database. Pathway annotations are authored by expert biologists, in collaboration with Reactome editorial staff and cross-referenced to many bioinformatics databases. A system of evidence tracking ensures that all assertions are backed up by the primary literature. Reactome is used by clinicians, geneticists, genomics researchers, and molecular biologists to interpret the results of high-throughput experimental studies, by bioinformaticians seeking to develop novel algorithms for mining knowledge from genomic studies, and by systems biologists building predictive models of normal and disease variant pathways.

The development of Reactome is supported by grants from the US National Institutes of Health (P41 HG003751), University of Toronto (CFREF Medicine by Design), European Union (EU STRP, EMI-CD), and the European Molecular Biology Laboratory (EBI Industry program).

Literature references

Fabregat, A., Sidiropoulos, K., Viteri, G., Forner, O., Marin-Garcia, P., Arnau, V. et al. (2017). Reactome pathway analysis: a high-performance in-memory approach. *BMC bioinformatics, 18*, 142. ↗

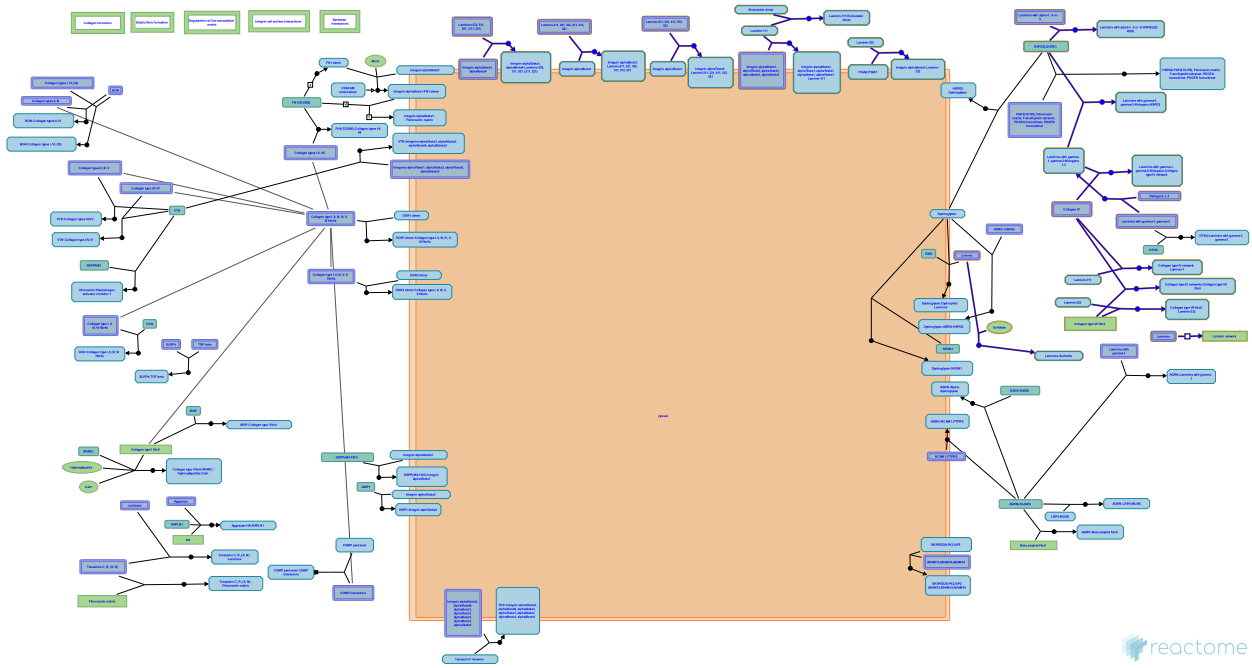
Sidiropoulos, K., Viteri, G., Sevilla, C., Jupe, S., Webber, M., Orlic-Milacic, M. et al. (2017). Reactome enhanced pathway visualization. *Bioinformatics, 33*, 3461-3467. ↗

Fabregat, A., Jupe, S., Matthews, L., Sidiropoulos, K., Gillespie, M., Garapati, P. et al. (2018). The Reactome Pathway Knowledgebase. *Nucleic Acids Res, 46*, D649-D655. ↗

Fabregat, A., Korninger, F., Viteri, G., Sidiropoulos, K., Marin-Garcia, P., Ping, P. et al. (2018). Reactome graph database: Efficient access to complex pathway data. *PLoS computational biology, 14*, e1005968. ↗

Laminin interactions ↗

Stable identifier: R-HSA-3000157



Laminins are a large family of conserved, multidomain trimeric basement membrane proteins. There are many theoretical trimer combinations but only 18 have been described (Domogatskaya et al. 2012, Miner 2008, Macdonald et al. 2010) and the existence of isoforms laminin-212 and/or laminin-222 (Durbeej et al. 2010) awaits further confirmation. The chains assemble through coiled-coil domains at their C-terminal end. Alpha chains additionally have a large C-terminal globular domain containing five LG subdomains (LG1-5). The N termini are often referred to as the short arms. These have varying numbers of laminin-type epidermal growth factor-like (LE) repeats. Trimer assembly is controlled by highly specific coiled-coil interactions (Domogatskaya et al. 2012). Some laminin isoforms are modified extracellularly by proteolytic processing at the N- or C-terminal ends prior to their binding to cellular receptors or other matrix molecules (Tzu & Marinkovitch 2008).

The cell adhesion properties of laminins are mediated primarily through the alpha chain G domain to integrins, dystroglycan, Lutheran glycoprotein, or sulfated glycolipids. The N-terminal globular domains of the alpha-1 (Colognato-Pyke et al. 1995) and alpha-2 chains (Colognato et al. 1997) and globular domains VI (Nielsen & Yamada 2001) and IVa (Sasaki & Timpl 2001) of the alpha-5 chain can bind to several integrin isoforms (alpha1beta1, alpha2beta1, alpha3beta1, and alphaVbeta3), which enables cell binding at both ends of laminins with these alpha chains.

Literature references

Domogatskaya, A., Rodin, S., Tryggvason, K. (2012). Functional diversity of laminins. *Annu. Rev. Cell Dev. Biol., 28*, 523-53. ↗

Editions

2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.
2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

Formation of laminin networks ↗

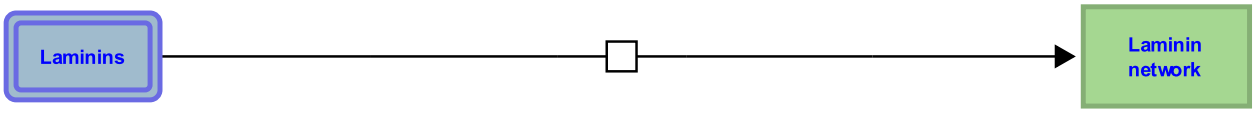
Location: Laminin interactions

Stable identifier: R-HSA-2426676

Type: transition

Compartments: extracellular region

Inferred from: Formation of laminin networks (Mus musculus)



The principal structural elements of basement membrane are laminin (LM) and collagen IV. These form distinct networks that become noncovalently interconnected by nidogen and perlecan, both of which are able to form irregular polymers (Breitkreutz et al. 2013). LM polymeric networks can self-assemble even in the absence of other basement membrane components (Yurchenco et al. 1992) suggesting a key developmental role. Polymerization in vivo occurs at the cell surface, to which LMs are anchored through direct or indirect interactions with cellular receptors, dystroglycan or integrins, and possibly other receptors (Hohenester & Yurchenco 2013). Receptor-engaged LM exceeds the critical concentration for self-assembly (Colognato & Yurchenco 2000).

The three short arms of the cross-shaped LM molecule form the nodes in the polymeric network, with a strict requirement for one each of alpha, beta and gamma arms (Hohenester & Yurchenco 2013). A surface loop, strictly conserved in the LN domains of all alpha chains, is required for stable ternary association with the beta and gamma short arms (Hussain et al. 2011).

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

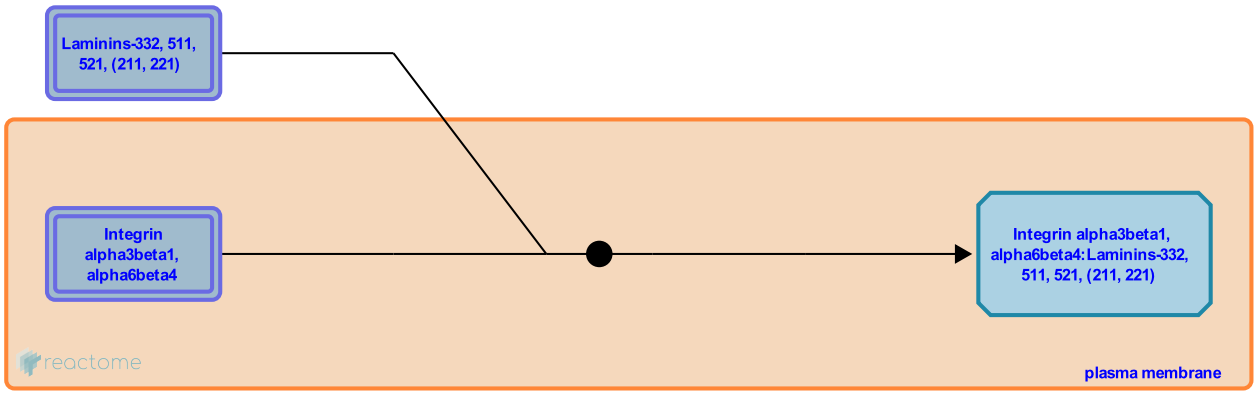
Integrins alpha3beta1, alpha6beta4 bind laminin-332, 511, 521, (211, 221)

Location: Laminin interactions

Stable identifier: R-HSA-216048

Type: binding

Compartments: plasma membrane, extracellular region



The initial process of laminin (LM) deposition onto the cell surface depends upon interactions with the LG domain located at the alpha chain C-terminus. This domain contains binding sites for alpha-dystroglycan, sulfated glycolipids, heparan sulfate chains and integrins. The LM binding site for the major LM-binding integrins alpha6beta1, alpha6beta4, alpha3beta1 and alpha7beta1 (Belkin & Stepp 2000) is located in LG motifs 1-3 of LM alpha (LMA) chains (Hirosaki et al. 2000 - LMA3, unidentified integrin, Shang et al. 2001 - rat LMA3, human alpha3beta1, Smirnov et al. 2002 - LMA2 with mouse alpha6beta1, Talts et al. 2000 - mouse LMA4 with integrin alpha6beta1, Yu & Talts 2003 - mouse LMA5 with integrin alpha3beta1, Nishiuchi et al. 2006 - LMA1and LMA2 with alpha7beta1).

Recombinant integrins vary in their laminin specificities: integrins alpha3beta1 and alpha6beta4 have a clear specificity for LM-332 and -511/512, integrin alpha6beta1 has a broad specificity, binding all LM isoforms with a preference for LM-111, -332 and -511/521. Alpha7beta1 splice variants do not bind LM-332. Alpha7 isoform X1beta1 binds all LM except LM-332, with a preference for LM-211/221 and LM-511/521, while alpha7X2beta1 variant binds preferentially to LM-111 and LM-211/221. LM-511/521 has the highest affinity ligand for all LM-binding integrins except ofr alpha7 isoform X2beta1, while LM-411 has modest affinities for alpha6beta1 and alpha7 isoform X1beta1 (Nishiuchi et al. 2006 - all human reagents except mouse LM-111).

The N-terminal globular domains of LMA1 (Colognato-Pyke et al. 1995 - mouse LM, rat alpha1 and beta1 integrins) and alpha-2 chains (Colognato et al. 1997 - mouse LMA1, human LMA2, human integrins) can bind integrins alpha1beta1 and alpha2beta1. The N-terminal globular VI domains of LMA5 and LMA1 can bind integrin subunits alpha3, alpha2, alpha4, alpha6 (not LMA1) and beta1 (Nielsen & Yamada 2001 - using mouse LMA1 and LMA5 against human integrins). The IVa domain (L4a) domain of the LMA5 chain can bind integrin alphaVbeta3 (mouse LMA5, human integrin, Sasaki & Timpl 2001). The short arm of the LM gamma-2 chain has been reported to bind alpha2beta1 integrin (Decline & Rousselle 2001). The N-terminal globular domains of some alpha chains can also bind sulfatides, which may also link the LM molecules to the cell surface.

The relative importance of these interactions is unclear (Yurchenko & Patton 2009).

Integrins and dystroglycan indirectly connect the LM network to the actin cytoskeleton.

Literature references

Sekiguchi, K., Hayashi, M., Sanzen, N., Nishiuchi, R., Takagi, J., Ido, H. et al. (2006). Ligand-binding specificities of laminin-binding integrins: a comprehensive survey of laminin-integrin interactions using recombinant alpha3beta1, alpha6beta1, alpha7beta1 and alpha6beta4 integrins. *Matrix Biol., 25*, 189-97.

Kawada, Y., Irimura, T., Han, SA., Mizushima, H., Tsuji, T., Miyazaki, K. et al. (2002). Regulation of melanoma cell migration and invasion by laminin-5 and alpha3beta1 integrin (VLA-3). *Clin Exp Metastasis, 19*, 127-34.

Litjens, SH., Sonnenberg, A., Wilhelmsen, K. (2006). Multiple functions of the integrin alpha6beta4 in epidermal homeostasis and tumorigenesis. *Mol Cell Biol, 26*, 2877-86.

Editions

2008-03-11	Edited	Garapati, P V.
2008-05-07	Authored	Geiger, B., Horwitz, AR.
2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.
2013-08-13	Revised	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

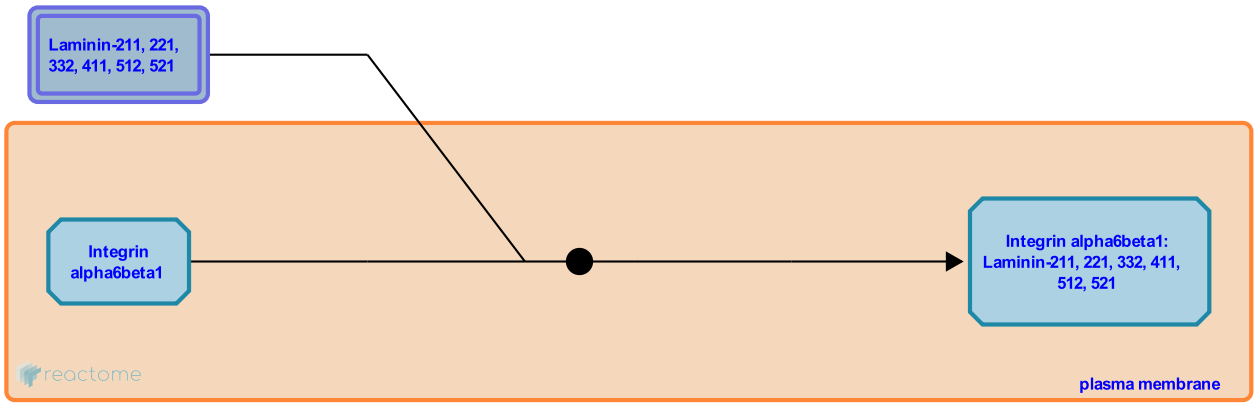
Integrin alpha6beta1 binds laminin-322, 512, 521, 211, 221, 411 ↗

Location: Laminin interactions

Stable identifier: R-HSA-3907292

Type: binding

Compartments: plasma membrane, extracellular region



The initial process of laminin (LM) deposition onto the cell surface depends upon interactions with the LG domain located at the alpha chain C-terminus. This domain contains binding sites for alpha-dystroglycan, sulfated glycolipids, heparan sulfate chains and integrins. The LM binding site for the major LM-binding integrins alpha6beta1, alpha6beta4, alpha3beta1 and alpha7beta1 (Belkin & Stepp 2000) is located in LG motifs 1-3 of LM alpha (LMA) chains (Hirosaki et al. 2000 - LMA3, unidentified integrin, Shang et al. 2001 - rat LMA3, human alpha3beta1, Smirnov et al. 2002 - LMA2 with mouse alpha6beta1, Talts et al. 2000 - mouse LMA4 with integrin alpha6beta1, Yu & Talts 2003 - mouse LMA5 with integrin alpha3beta1, Nishiuchi et al. 2006 - LMA1and LMA2 with alpha7beta1).

Recombinant integrins vary in their laminin specificities: alpha3beta1 and alpha6beta4 have a clear specificity for LM-332 and -511/512, integrin alpha6beta1 has a broad specificity, binding all LM isoforms with a preference for LM-111, -332 and -511/521. Alpha7beta1 variants do not bind LM-332. Alpha7 isoform X1beta1 binds all LM except LM-332, with a preference for LM-211/221 and LM-511/521, while alpha7 isoform X2beta1 binds preferentially to LM-111 and LM-211/221. LM-511/521 has the highest affinity for all LM-binding integrins except alpha7 isoform X2beta1, while LM-411 has low affinity only for alpha6beta1 and alpha7 isoform X1beta1 (Nishiuchi et al. 2006 - all human reagents except mouse LM-111).

The N-terminal globular domains of LMA1 (Colognato-Pyke et al. 1995 - mouse LM, rat alpha1 and beta1 integrins) and alpha-2 chains (Colognato et al. 1997 - mouse LMA1, human LMA2, human integrins) can bind integrins alpha1beta1 and alpha2beta1. The N-terminal globular VI domains of LMA5 and LMA1 can bind integrin subunits alpha3, alpha2, alpha4, alpha6 (not LMA1) and beta1 (Nielsen & Yamada 2001 - using mouse LMA1 and LMA5 against Cercopithecus aethiops integrins). The IVa domain (L4a) domain of the LMA5 chain can bind integrin alphaVbeta3 (mouse LMA5, human integrin, Sasaki & Timpl 2001). The LM gamma-2 chain has been reported to bind alpha2beta1 integrin (Decline & Rousselle 2001). The N-terminal globular domains of some alpha chains can also bind sulfatides, which may also link the LM molecules to the cell surface.
The relative importance of these interactions is unclear (Yurchenko & Patton 2009).

Integrins and dystroglycan indirectly connect the LM network to the actin cytoskeleton.

Literature references

Sekiguchi, K., Hayashi, M., Sanzen, N., Nishiuchi, R., Takagi, J., Ido, H. et al. (2006). Ligand-binding specificities of laminin-binding integrins: a comprehensive survey of laminin-integrin interactions using recombinant alpha3beta1, alpha6beta1, alpha7beta1 and alpha6beta4 integrins. *Matrix Biol., 25*, 189-97. ↗

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

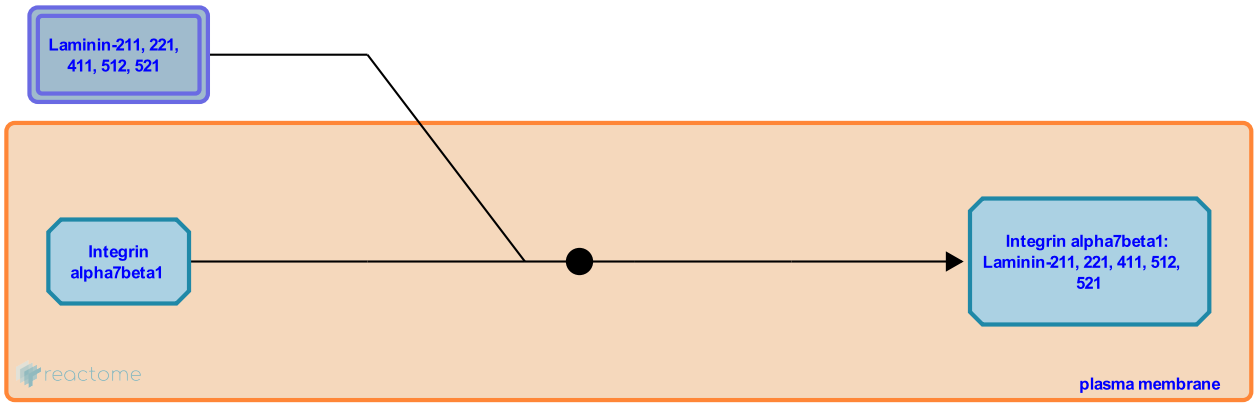
Integrin alpha7beta1 binds Laminin-211, 221, 411, 512, 521 ↗

Location: Laminin interactions

Stable identifier: R-HSA-216058

Type: binding

Compartments: plasma membrane, extracellular region



The initial process of laminin (LM) deposition onto the cell surface depends upon interactions with the LG domain located at the alpha chain C-terminus. This domain contains binding sites for alpha-dystroglycan, sulfated glycolipids, heparan sulfate chains and integrins. The LM binding site for the major LM-binding integrins alpha6beta1, alpha6beta4, alpha3beta1 and alpha7beta1 (Belkin & Stepp 2000) is located in LG motifs 1-3 of LM alpha (LMA) chains (Hirosaki et al. 2000 - LMA3, unidentified integrin, Shang et al. 2001 - rat LMA3, human alpha3beta1, Smirnov et al. 2002 - LMA2 with mouse alpha6beta1, Talts et al. 2000 - mouse LMA4 with integrin alpha6beta1, Yu & Talts 2003 - mouse LMA5 with integrin alpha3beta1, Nishiuchi et al. 2006 - LMA1and LMA2 with alpha7beta1).

Recombinant integrins vary in their laminin specificites: alpha3beta1 and alpha6beta4 have a clear specificity for LM-332 and -511/512, integrin alpha6beta1 has a broad specificity, binding all LM isoforms with a preference for LM-111, -332 and -511/521. Alpha7beta1 variants do not bind LM-332. Alpha7 isoform X1beta1 binds all LM except LM-332, with a preference for LM-211/221 and LM-511/521, while alpha7 isoform X2beta1 binds preferentially to LM-111 and LM-211/221. LM-511/521 has the highest affinity for all LM-binding integrins except alpha7 isoform X2beta1, while LM-411 has low affinity only for alpha6beta1 and alpha7 isoform X1beta1 (Nishiuchi et al. 2006 - all human reagents except mouse LM-111).

The N-terminal globular domains of LMA1 (Colognato-Pyke et al. 1995 - mouse LM, rat alpha1 and beta1 integrins) and alpha-2 chains (Colognato et al. 1997 - mouse LMA1, human LMA2, human integrins) can bind integrins alpha1beta1 and alpha2beta1. The N-terminal globular VI domains of LMA5 and LMA1 can bind integrin subunits alpha3, alpha2, alpha4, alpha6 (not LMA1) and beta1 (Nielsen & Yamada 2001 - using mouse LMA1 and LMA5 against Cercopithecus aethiops integrins). The IVa domain (L4a) domain of the LMA5 chain can bind integrin alphaVbeta3 (mouse LMA5, human integrin, Sasaki & Timpl 2001). The LM gamma-2 chain has been reported to bind alpha2beta1 integrin (Decline & Rousselle 2001). The N-terminal globular domains of some alpha chains can also bind sulfatides, which may also link the LM molecules to the cell surface.

The relative importance of these interactions is unclear (Yurchenko & Patton 2009).

Integrins and dystroglycan indirectly connect the LM network to the actin cytoskeleton.

Literature references

Sekiguchi, K., Hayashi, M., Sanzen, N., Nishiuchi, R., Takagi, J., Ido, H. et al. (2006). Ligand-binding specificities of laminin-binding integrins: a comprehensive survey of laminin-integrin interactions using recombinant alpha3beta1, alpha6beta1, alpha7beta1 and alpha6beta4 integrins. *Matrix Biol., 25*, 189-97. ↗

Stepp, MA., Belkin, AM. (2000). Integrins as receptors for laminins. *Microsc Res Tech, 51*, 280-301. ↗

Editions

2008-03-11	Edited	Garapati, P V.
2008-05-07	Authored	Geiger, B., Horwitz, AR.
2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.
2013-08-13	Revised	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

Integrin alpha6beta1, alpha7beta1, alpha1beta1, alpha2beta1 bind laminin-111 ↗

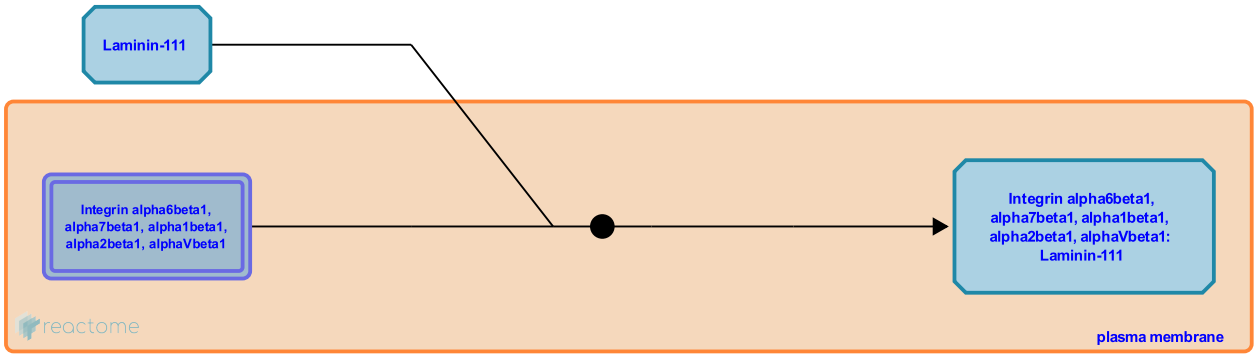
Location: Laminin interactions

Stable identifier: R-HSA-216051

Type: binding

Compartments: plasma membrane, extracellular region

Inferred from: Integrin alpha6beta1, alpha7beta1, alpha1beta1, alpha2beta1, alphaVbeta1 bind laminin-111 (Homo sapiens)



The initial process of laminin (LM) deposition onto the cell surface depends upon interactions with the LG domain located at the alpha chain C-terminus. This domain contains binding sites for alpha-dystroglycan, sulfated glycolipids, heparan sulfate chains and integrins. The LM binding site for the major LM-binding integrins alpha6beta1, alpha6beta4, alpha3beta1 and alpha7beta1 (Belkin & Stepp 2000) is located in LG motifs 1–3 of LM alpha (LMA) chains (Hirosaki et al. 2000 - LMA3, unidentified integrin, Shang et al. 2001 - rat LMA3, human alpha3beta1, Smirnov et al. 2002 - LMA2 with mouse alpha6beta1, Talts et al. 2000 - mouse LMA4 with integrin alpha6beta1, Yu & Talts 2003 - mouse LMA5 with integrin alpha3beta1, Nishiuchi et al. 2006 - LMA1and LMA2 with alpha7beta1).

Recombinant integrins vary in their laminin specificities: alpha3beta1 and alpha6beta4 have a clear specificity for LM-332 and -511/512, integrin alpha6beta1 has a broad specificity, binding all LM isoforms with a preference for LM-111, -332 and -511/521. Alpha7beta1 variants do not bind LM-332. Alpha7 isoform X1beta1 binds all LM except LM-332, with a preference for LM-211/221 and LM-511/521, while alpha7 isoform X2beta1 binds preferentially to LM-111 and LM-211/221. LM-511/521 has the highest affinity for all LM-binding integrins except alpha7 isoform X2beta1, while LM-411 has low affinity only for alpha6beta1 and alpha7 isoform X1beta1 (Nishiuchi et al. 2006 - all human reagents except mouse LM-111).

The N-terminal globular domains of LMA1 (Colognato-Pyke et al. 1995 - mouse LM, rat alpha1 and beta1 integrins) and alpha-2 chains (Colognato et al. 1997 - mouse LMA1, human LMA2, human integrins) can bind integrins alpha1beta1 and alpha2beta1. The N-terminal globular VI domains of LMA5 and LMA1 can bind integrin subunits alpha3, alpha2, alpha4, alpha6 (not LMA1) and beta1 (Nielsen & Yamada 2001 - using mouse LMA1 and LMA5 against Cercopithecus aethiops integrins). The IVa domain (L4a) domain of the LMA5 chain can bind integrin alphaVbeta3 (mouse LMA5, human integrin, Sasaki & Timpl 2001). The LM gamma-2 chain has been reported to bind alpha2beta1 integrin (Decline & Rousselle 2001). The N-terminal globular domains of some alpha chains can also bind sulfatides, which may also link the LM molecules to the cell surface. The relative importance of these interactions is unclear (Yurchenko & Patton 2009). Integrins and dystroglycan indirectly connect the LM network to the actin cytoskeleton.

The alpha6beta1 integrin is one of the major platelet receptors for laminin-1 and plays an important role in supporting platelet adhesion under arterial rates of flow (Inoue et al. 2006).

Editions

2008-03-11	Edited	Garapati, P V.
2008-05-07	Authored	Geiger, B., Horwitz, AR.
2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.
2013-08-13	Revised	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

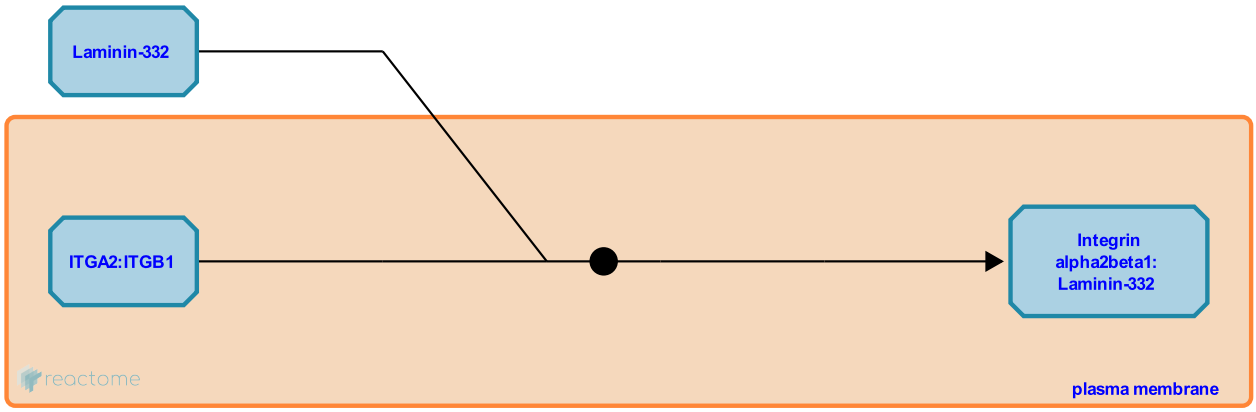
Integrin alpha2beta1 binds laminin-332 ↗

Location: Laminin interactions

Stable identifier: R-HSA-349626

Type: binding

Compartments: plasma membrane, extracellular region



Colonic epithelial cells use integrin alpha2beta1 to adhere to Laminin-5.

Literature references

Meneguzzi, G., Gavrilovic, J., Orian-Rousseau, V., Messent, A., Kedinger, M., Aberdam, D. et al. (1998). Human colonic cancer cells synthesize and adhere to laminin-5. Their adhesion to laminin-5 involves multiple receptors among which is integrin alpha2beta1. *J Cell Sci, 111*, 1993-2004. ↗

Editions

2008-03-11	Edited	Garapati, P V.
2008-05-07	Authored	Geiger, B., Horwitz, AR.
2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.

Laminins bind Nidogens 1, 2 ↗

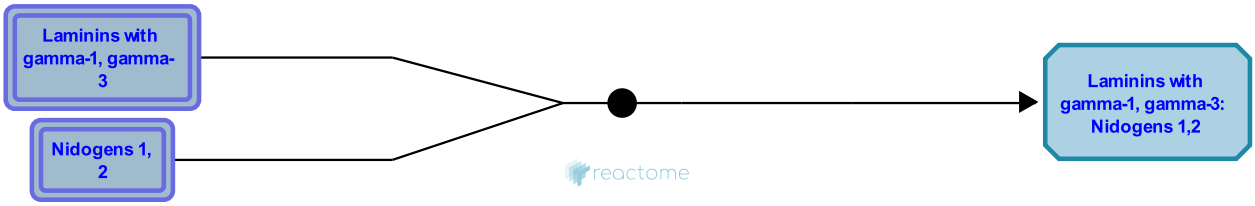
Location: Laminin interactions

Stable identifier: R-HSA-2327803

Type: binding

Compartments: extracellular region

Inferred from: Laminins bind Nidogens 1, 2 (Mus musculus)



Nidogen-1 and nidogen-2, also known as the entactins, are basement membrane glycoproteins with three globular domains (G1, G2, G3) separated by rod-like regions. They form stable complexes with laminins and collagen IV (Fox et al. 1991, Talts et al. 1999, Salmivirta et al. 2002), thereby acting as a major linking agent between these two networks in basement membrane ECM (Nischt et al. 2007). Interactions mediated by HSPG2 (perlecan) (Behrens et al. 2012) or HSPG2 and agrin (Hohenester & Yurchenko 2013) have been proposed as an alternative basis for the association of the laminin and collagen type IV networks in basement membrane. Nidogen-1 binds to the laminin-1 gamma subunit (Mayer et al. 1998). The gamma-2 chain of laminin-332 contains a homologous binding module. Nidogen-1 was reportedly unable to bind this laminin (Mayer et al. 1995), though an N-terminal fragment was able to bind (Sasaki et al. 2001). Laminin gamma-3 has been shown to bind to nidogen-1 and -2 with a lower affinity than that of gamma-1 (Gersdorff et al. 2005). The ab initio reconstruction of complexes between nidogen-1 and the laminin gamma-1 short arm confirms that this interaction is mediated solely by the C-terminal domains (Patel et al. 2013).

Followed by: Laminins:Nidogens binds HSPG2

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

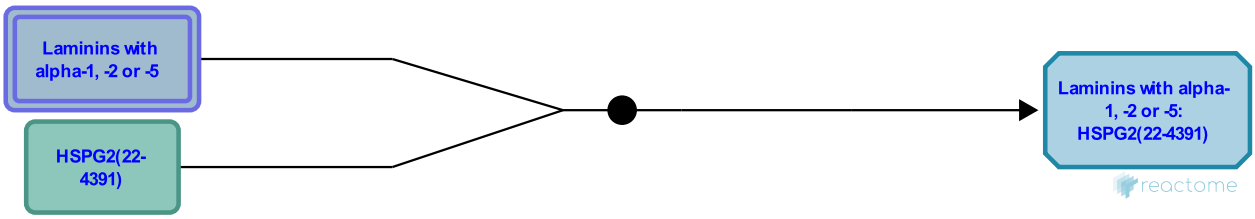
Laminins bind HSPG2 ↗

Location: Laminin interactions

Stable identifier: R-HSA-4084505

Type: binding

Compartments: extracellular region



Laminins bind to HSPG2 (perlecan) through interactions with its heparan sulfate sidechains (Battaglia et al. 1992, Behrens et al. 2012). The E3 fragment of laminin (containing the C-terminal LG4-LG5 domain pair) harbours binding sites for heparin, sulfatides and the cell surface receptor dystroglycan (Andac et al. 1999, Tisi et al. 2000) This interaction, rather than nidogen-mediated association, has been proposed to be the structural basis for association of the laminin and collagen type IV networks in basement membrane (Behrens et al. 2012). Alternatively the heparan sulfate chains of both perlecan and agrin might extend from a nidogen-containing laminin network to bind type IV collagen (Hohenester & Yurchenko 2013).

Literature references

Bruckner-Tuderman, L., Sorokin, L., Bruckner, P., Villone, D., Brunner, G., Hansen, U. et al. (2012). The epidermal basement membrane is a composite of separate laminin- or collagen IV-containing networks connected by aggregated perlecan, but not by nidogens. *J. Biol. Chem., 287*, 18700-9. ↗

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

Laminins:Nidogens binds HSPG2 ↗

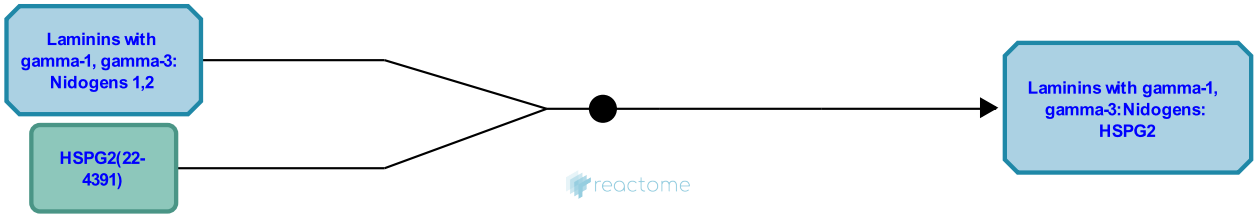
Location: Laminin interactions

Stable identifier: R-HSA-2426530

Type: binding

Compartments: extracellular region

Inferred from: Laminins:Nidogens binds HSPG2 (Mus musculus)



The IG3 repeat in domain IV of perlecan is the principal site of interaction with nidogens, binding to the G2 domain (Mayer et al. 1998, Hopf et al. 2001). Domain V of perlecan also binds to nidogen (Brown et al. 1997). Nidogen-1 in turn binds to the laminin gamma1-subunit (Mayer et al. 1998), providing a bridge between the two proteins (Hopf et al. 1999, 2001, Kvansakul et al. 2001).

Preceded by: Laminins bind Nidogens 1, 2

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

Laminins bind galactosyl sulfatide and related sulfated glycolipids ↗

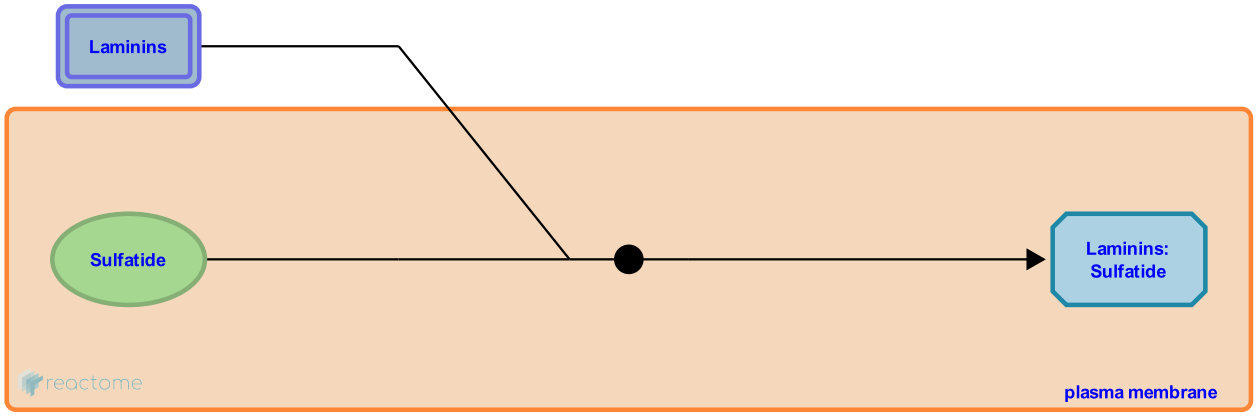
Location: Laminin interactions

Stable identifier: R-HSA-2396083

Type: binding

Compartments: plasma membrane, extracellular region

Inferred from: Laminin binds galactosyl sulfatide and related sulfated glycolipids (Mus musculus)



Sulfated glycolipids (SGs) such as the sulfatides bind strongly to the LG domains of laminin (Roberts et al. 1985, 1986, Ishizuka 1997). The most common SG, HSO3-3galactosylBeta-1ceramide (galactosyl-3-sulfate ceramide or sulfatide) is highly expressed in developing and adult peripheral nerves (Mirsky et al. 1990), Schwann cells, kidney and other tissues. SGs are thought to mediate or enhance the cell surface anchorage of laminins, possibly by allowing the short arms to bind the cell surface in addition to the LG domains (Li et al. 2005, Yurchenko & Patton 2009).

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

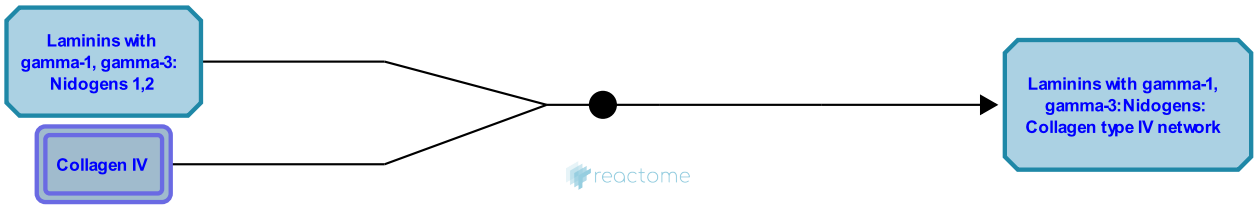
Laminins:Nidogens binds collagen type IV networks ↗

Location: Laminin interactions

Stable identifier: R-HSA-2426450

Type: binding

Compartments: extracellular region



Laminin-bound nidogens can bind to type IV collagen (Aumailey et al. 1989, 1993, Fox et al. 1991, Reinhardt et al. 1993, Ries et al. 2001, Bechtel et al. 2012).

Basement membrane formation involves self-assembly of laminin and of collagen IV into two independent networks (Yurchenco & Schittny 1990, Timpl & Brown 1996) that are connected by nidogen (Fox et al. 1991, Aumailley & Smyth 1998, Aumailey et al. 2000) and the heparan sulfate chains of both perlecan and agrin (Hohenester & Yurchenko 2013).

Literature references

Yurchenco, PD., Tsilibary, EC., Furthmayr, H., Charonis, AS. (1985). Binding of laminin to type IV collagen: a morphological study. *J Cell Biol, 100*, 1848-53. ↗

Editions

2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.
2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

Laminin-111 binds collagen type IV ↗

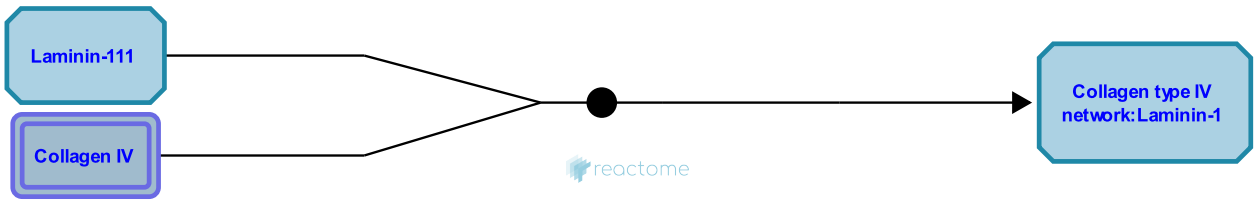
Location: Laminin interactions

Stable identifier: R-HSA-2328145

Type: binding

Compartments: extracellular region

Inferred from: Collagen type IV binds laminin-111 (Mus musculus)



Type IV collagen (Yurchenco & Furthmayr 1984) and laminin (Yurchenco et al. 1985,1992, Cheng et al. 1997) can self-assemble in vitro, forming lattice-like polymeric networks which resemble laminin-collagen matrices observed in vivo (Timpl & Brown 1996). Purified laminins are the only basement membrane component able to assemble on cell surfaces in the absence of other components (McKee et al. 2007). Laminin knockouts prevent basement membrane assembly, arresting development at a much earlier stage than knockouts of other ECM components such as collagen IV, nidogens (entactin), perlecan or agrin (Yurchenko et al. 2004). This suggests a regulatory function for the laminin network. Laminin molecules bind to each other in a three-way interaction involving the LN domains located at the end of the three short arms. Each interaction involves one each of alpha, beta and gamma laminin subunits (Yurchenko & Cheng 1993, McKee et al. 2007) forming a polygonal structure (Yurchenko et al. 1992).

In the basement membrane collagen type IV and laminin are found in an approximately 1:1 molar ratio (Kleinman et al. 1986). Binding between laminin and collagen type IV is primarily facilitated by nidogen (Aumailley et al. 1989, Fox et al. 1991), but direct binding has been observed (Charonis et al. 1985, Rao et al. 1985). Laminin-111 (laminin-1) binds to type IV collagen through its short arms (Laurie et al. 1986).

Editions

2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.
2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

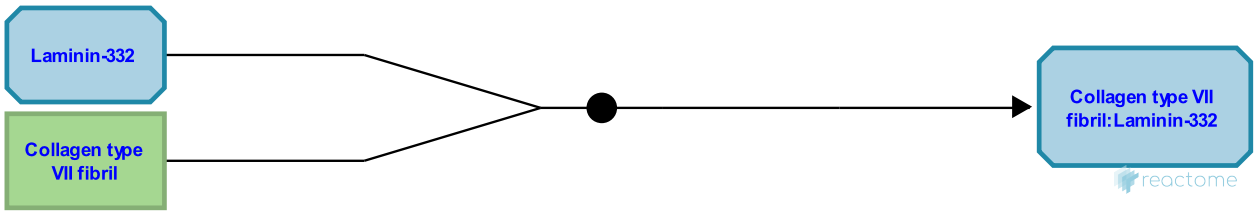
Laminin-332 binds collagen type VII ↗

Location: Laminin interactions

Stable identifier: R-HSA-3787997

Type: binding

Compartments: extracellular region



Laminin-332 (laminin-5) consists of laminin alpha-3, beta-3 and gamma-2 chains. It is epithelial-basement membrane specific. It directly interacts with the NC1 domain of Collagen type VII through the N-terminus of the beta-3 laminin subunit and, to a lesser extent, the gamma-2 laminin subunit (Rousselle et al. 1997, Chen et al. 1999, Brittingham et al. 2006).

Literature references

Rest, M., Rousselle, P., Burgeson, RE., Champliaud, MF., Keene, DR., Ruggiero, F. (1997). Laminin 5 binds the NC-1 domain of type VII collagen. *J. Cell Biol., 138*, 719-28. ↗

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

Collagen type VII binds collagen type IV ↗

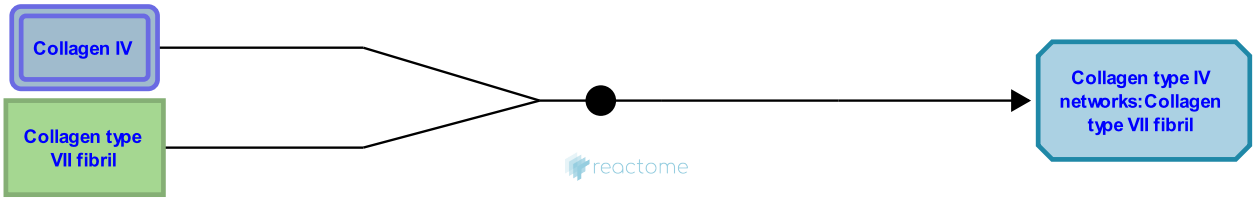
Location: Laminin interactions

Stable identifier: R-HSA-4084501

Type: binding

Compartments: extracellular region

Inferred from: Collagen VII binds collagen IV (Homo sapiens)



The NC1 domain of collagen VII is able to bind collagen type IV and laminin-322 (laminin-5) (Brittingham et al. 2006). This facilitates stabilization of the basement membrane structure.

Editions

2008-05-07	Reviewed	Humphries, MJ., Yamada, KM., Hynes, R.
2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

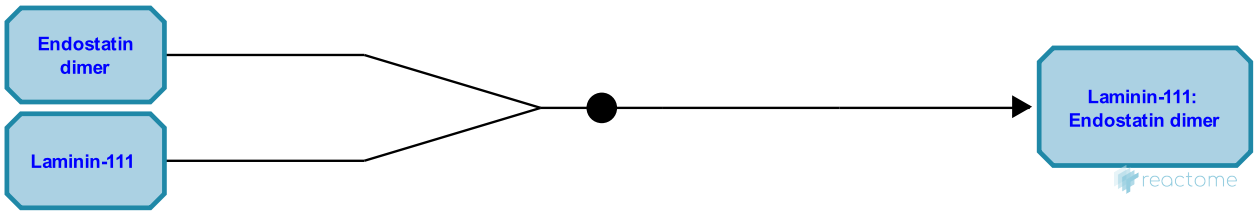
Laminin-111 binds endostatin dimer ↗

Location: Laminin interactions

Stable identifier: R-HSA-4084507

Type: binding

Compartments: extracellular region



Endostatin is an anti-angiogenic and motility-inducing factor produced by proteolytic cleavage within the NC1 domain of collagen type XVIII. It is bound by all three short arms of laminin-111 (Javaherian et al. 2002). Laminin-111 complexes strongly with the NC1 trimeric domain or endostatin dimer, but only weakly with endostatin monomer.

Literature references

LaMontagne, KR., Javaherian, K., Lo, KM., Park, SY., Gillies, S., Pickl, WF. et al. (2002). Laminin modulates morphogenic properties of the collagen XVIII endostatin domain. *J. Biol. Chem., 277*, 45211-8. ↗

Editions

2012-08-08	Authored	Jupe, S.
2013-08-13	Edited	Jupe, S.
2013-08-13	Reviewed	Ricard-Blum, S.

Table of Contents