Supporting Table S3. List of 71 extracellular and intracellular direct/indirect syndecan-4 interaction partners previously reported in different species, tissues and cells [a]. 29 out of 71 literature partners were also identified to interact with syndecan-4 in LV lysate (this study) (second rightmost column: IP-SDC4 versus IP-IgG in LV, $p<0.01$, n=1-3). We also identified 9 literature partners to have an altered interaction with syndecan-4 during development of heart failure (rightmost column: IP-SDC4 in ABHF versus SHAM, $p<0.05$, n=3, t-test p values are given in Table S1).

Gene	Protein (Uniprot)	Binding	Evidence for interaction	Biological function	Reference	IP-SDC4[b] (LV) (p<0.01)	IP-SDC4[c] (SHAM vs. ABHF) (p<0.05)
*ACTN2**	α-actinin	V-region Direct	Co-localization, Co-IP, Pull down, peptide competition assay	Link to actin cytoskeleton	(1)	n=1	n=3
ADAM17	Disintegrin and metalloproteinase domain-containing protein 17 (TACE)	Ectodomain Direct	Cleavage analysis	Shedding	(2)	n=0	n=0
ADAMTS1	A disintegrin and metalloproteinase with thrombospondin motifs 1	Ectodomain Direct	Cleavage assay	Shedding Cell adhesion	(3)	n=0	ns
ADAMTS6	A disintegrin and metalloproteinase with thrombospondin motifs 6	Ectodomain + HS chains Direct	Biacore KDs of 125 ± 47 nM	Regulation of cell adhesion	(4)	n=0	n=0
ADAMTS10	A disintegrin and metalloproteinase with thrombospondin motifs 10	Ectodomain + HS chains Direct	Biacore KDs of 14. ± 1.1 nM	Cleavage	(4)	n=0	n=0
AKT1	RAC-alpha serine/threonine-protein kinase	Indirect	Functional interaction: Akt phosphorylation decreased in SDC4KO	SDC4 recruits Akt1 to cell surface through PKCα and PAK	(5)	n=0	ns

*ARF6**	ADP-ribosylation factor 6	Indirect	Functional interaction: -Arf6 regulates SDC4 mediated integrin recycling to the surface. -SDC4 engagement trigger Arf6 activation -Arf6 binds to syntenin and β1-integrin	Intracellular trafficking	(6)	ns (n=1, $p<0.05$)	n=3
ARHGAP35	Rho GTPase-activating protein 35	Indirect	Functional interaction: - SDC4 focal adhesion formation depends on ARHGAP35 expression - SDC4 recruits ARHGAP35 to the cell surface - Co-localization	Adhesion	(7)	n=0	n=0
ARHGDIA	Rho GDP-dissociation inhibitor 1 (RhoGDI1)/RhoGDI-α	Indirect	Pull down in cell lysates	Regulation of cell migration	(8)	ns	ns
APP	$A\beta_{42}$ fribrils/ Amyloid-beta A4 protein	Ectodomain Direct	Surface plasmon resonance imaging (Biacore Flexchip)	ND	(9)	n=1	ns
CALM1	Calmodulin 1	Cytoplasmic tail Indirect	Co-IP	Co-activator of calcineurin A	(10)	n=1	ns
CAMK2A	Calcium/calmodulin-dependent protein kinase type II subunit alpha	Indirect	Co-IP	Non-canonical wnt signaling	(11)	n=3	ns
CASK	CASK	C2 (motif: EFYA) Direct	Peptide binding assays, Y2H and co-localization	Membrane scaffold	(12,13)	n=0	n=0
CDH11	Cadherin-11	Indirect	Co-IP	Focal adhesion formation	(14)	n=0	n=0
CLTC	Clathrin	Indirect	Functional interaction: Rspo3 binds SDC4 and is then endocytosed in a	Endocytosis	(15)	n=1	ns

			clathrin dependent way				
*COL1A1**	Collagen 1	Ectodomain, Direct	Cross-linking assay	Collagen crosslinking	(16)	n=3	n=3
CTNNB	Catenin β1	Indirect	Co-IP	Cell adhesion	(14)	n=3	ns
CTTN	Cortactin	C1 (Motif: RMKKKDE GSY) Indirect	Affinity chromatography	Engagement of SDC4 might activate cortactin (neurite outgrowth)	(17)	ns (n=1, $p<0.05$)	ns
CYLD	Ubiquitin carboxyl-terminal hydrolase CYLD	Cytoplasmic domain Indirect	Co-IP, co-localization.	Antiviral signalling	(18)	n=0	n=0
CXCR4	C-X-C chemokine receptor type 4	Indirect	Co-IP	Growth factor signaling	(19)	n=0	n=0
DDX58	Retinoic acid-inducible gene I / Probable ATP-dependent RNA helicase DDX58	Cytoplasmic tail Direct	Y2H, co-IP, mutagenesis	Anti-viral signaling	(18)	n=0	n=0
DVL2	Dishevelled	Cytoplasmic domain Indirect	Co-IP	Wnt signalling	(20)	n=0	ns
DNM2	Dynamin-2	C1 Indirect	Co-IP, Y2H, pull down	Focal adhesion and stress-fiber formation	(21)	n=2	ns
EGFR	Epidermal growth factor receptor	Ectodomain (Amino acids 87-131) Direct	Co-IP	EGFR-dependent chemotaxis	(22,23)	n=0	n=0
EZR	Ezrin	C1 (motif: DEGSYD) Direct	Pull-down	Link to actin cytoskeleton	(24)	ns	ns

F2	Thrombin	Ectodomain Direct	Cleavage analysis	Cleavage of SDC4	(25)	ns	ns
FAK	Focal adhesion kinase	Cytoplasmic tail, Indirect	Functional interaction: Lower phosphorylation in absence of SDC4	Adhesion	(26)	n=0	n=0
FYN	Fyn	Cytoplasmic tail, Indirect	Co-IP	In a signal complex in brain	(17)	ns (n=2, $p<0.05$)	n=0
FZD7	Frizzled-7	Indirect	Co-IP, Proximity ligation assay	Wnt signalling	(20,27)	n=0	n=0
GIPC1	Synectin / PDZ domain-containing protein GIPC	C2 (motif: EFYA) Indirect	Y2H, Co-IP	Migration	(28)	n=0	n=0
GPNMB	Transmembrane glycoprotein NMB / DC-HIL	Ectodomain + HS Indirect	Co-IP, Blocking antibodies	Inhibitory function of T cell activation	(29)	n=0	n=0
IGFIR	Insulin-like growth factor 1 receptor	Indirect	Co-IP	Trafficking	(30)	n=0	n=0
ITGA2 [d)]	Integrin α2β1	Indirect	Cooperative interaction: Both integrin α2β1and SDC4 bind laminin	Cooperation of SDC4 and integrin α2β1 to laminin adhesion	(31)	n=1	n=0
ITGA3 [d)]	Integrin α3β1	Indirect	Pull down	In complex with SDC4-EGFR. Motility	(23)	n=0	n=0
ITGA5 [d)]	Integrin α5β1	Indirect	Cooperative interaction: Both integrin α5β1and SDC4 bind FN	Cooperation of SDC4 and RGD binding integrin α5β1 to FN adhesion	(32-34)	ns (n=2, $p<0.05$)	n=0
ITGB1	Integrin β1	Ectodomain (N*X*IP motif) Indirect	Co-IP, Cell adhesion assay	Adhesion	(34-36)	n=2	ns

ITGB3	Integrin β_3	Indirect	Co-IP, co-localization	The shed SDC4 fragment may regulate integrin β_3 signaling	(37)	n=0	n=0
ITGB4	Integrin-β4	C2 + V Direct	Y2H, co-IP, pull down	Cell spreading	(22,38)	n=0	n=0
LAMA3	Laminin subunit alpha-3	Ectodomain + HS chains Direct	Surface plasmon resonance, ELISA	Cell Attachment	(39)	n=0	n=0
LOXL2	Lysyl oxidase homolog 2	Ectodomain Direct	Cross-linking assay	Crosslinking of collagen	(16)	n=0	n=0
MMP2	Matrix metalloproteinase-2	Ectodomain Direct	Cleavage analysis	Cleavage	(40)	n=3	ns
MMP3	Matrix metalloproteinase-3	Ectodomain Direct	Cleavage analysis	Cleavage	(40)	n=0	n=0
MMP7	Matrix metalloproteinase-7	Ectodomain Direct	Cleavage analysis	Cleavage	(40)	n=0	n=0
MMP9	Matrix metalloproteinase-9	Ectodomain + HS chains Direct	Cleavage analysis	Cleavage	(40,41)	ns (n=1, $p<0.05$)	ns
MMP14	Matrix metalloproteinase-14	Ectodomain Direct	Cleavage analysis	Cleavage	(40)	n=0	n=0
MTOR	Serine/threonine-protein kinase mTOR	Indirect	Functional interaction: mTORC2 activity is increased in $SDC4^{-/-}$ endothelial cells and tissues	Signaling via SDC4-PKCα-richter recruits mTORC2 components to lipid rafts	(42)	n=1	ns
*NF1**	Neurofibromin	Cytoplasmic domain Indirect	Y2H, pull down, co-localization	Recruitment to membrane	(43)	ns (n=2, $p<0.05$)	n=3
NOX1	NADPH oxidase 1	Cytoplasmic domain Direct	Pull down, co-IP, co-localization	Hypoxia signaling Bridging partner to Rac1	(44)	n=0	n=0

PDCD6IP	ALIX (programmed cell death 6-interacting protein)	Indirect	Biacore	Forms complex with syntenin Involved in exosomes	(45)	n=1	ns
PLG	Plasminogen	Direct	Cleavage analysis	Cleavage	(25)	n=3	ns
PPP3CA	Calcineurin A	V-region Direct	Pull down, co-IP	Dephosphorylates NFATc4 in response to pressure overload	(10)	ns (n=2, $p<0.05$)	ns
	PI(4,5)P2 (A lipid)	V-region, Direct	Crystal structure	Form complex, activation of PKCα, dimerization of SDC4	(46)	-	-
*PRKCA***	PKCα	V-region, Direct	Phosphorylation assay	Phosphorylation, adhesion, trafficking, and signalling	(46,47)	n=0	n=3
*PRKCD***	PKCδ	Direct	Phosphorylation assay	Phosphorylation	(48)	n=0	n=3
PTPRJ	Receptor-type tyrosine-protein phosphatase eta	Indirect, through syntenin	Co-IP	Regulation of T cell activation	(49)	n=0	n=0
PTP4A1	Protein tyrosine phosphatase type IVA 1	Indirect	2YH	ND	(50)	n=0	n=0
PTP4A3	Protein tyrosine phosphatase type IVA 3	Indirect	2YH	ND	(50)	n=0	n=0
PDGFRB	Platelet-derived growth factor receptor beta	Indirect	Co-IP	Form complex with SDC4 and integrin β1 upon stimulation with tenascin	(36)	n=0	n=0
PXN	Paxillin	Indirect	Co-IP	In complex with SDC4 and	(1)	n=1	ns

				syndesmos			
RAC1	Ras-related C3 botulinum toxin substrate 1	Indirect	Co-IP, pull down	Growth factor response through SDC4 Migration	(44,51)	n=1	ns
*RHOA**	Transforming protein RhoA	Indirect	Functional Interaction: - SDC4 cyt tail is able to activate RhoA	Stress fiber formation (and muscle differentiation (52))	(52,53)	n=1	n=3
*RHOG**	Rho-related GTP-binding protein RhoG	Indirect	Functional interaction: - SDC4 can regulate activity of RhoG through synectin - SDC4 controls spatial distribution of RhoG.		(6) (8)	n=2	n=3
SDC2	Syndecan-2	Transmembrane domain Direct	NMR, co-IP, pull down	Heterodimerization Regulation of syndecan signaling mechanisms	(54,55)	n=0	n=0
SDC4	Syndecan-4	GXXXG Direct	Mutagenesis	Dimerization	(47,56)	n=0	n=0
*SDCBP**	Syntenin-1	C2 (EFYA) Direct	Y2H, surface plasmon resonance (Biacore), pull down	Membrane adaptor and trafficking	(57,58)	n=3	n=3
SDOS	Syndesmos/ NUDT16L1	C1 + V Direct	Y2H, co-IP, pull down, crystal structure	Membrane scaffold	(59,60)	n=0	n=0

SRC	Proto-oncogene tyrosine-protein kinase Src	Direct	Phosphorylation assay	Phosphorylation of Tyr-180 (Y180). Regulate integrin trafficking	(61,62)	ns (n=2, $p<0.05$)	n=0
TIAM1	Tiam1	C2 (EFYA) Direct	Co-IP, fluorescence- and NMR-based binding assays	Cell migration	(63,64)	n=0	n=0
TRAPPC4	Trafficking protein particle complex subunit 4 / Synbindin	C2 (EFYA) Direct	Co-IP, pull-down, ligand overlay, Y2H and co-localization	Vesicle trafficking (Spine maturation)	(65)	ns	ns
TRPC4	Short transient receptor potential channel 4	Indirect	Co-IP	Calcium homeostasis in epithelial cells	(66)	n=0	n=0
TRPC6	Short transient receptor potential channel 6	Indirect	Co-IP		(67)	n=0	n=0
TRPC7	Short transient receptor potential channel 7	Indirect	Co-localization, co-IP,	Calcium homeostasis and adhesion	(66)	n=0	n=0

a) Indirect interaction partners which have not been shown to be in complex with SDC4 or binds through heparan sulfate (HS) glycosaminoglycans (GAGs) chains are excluded

b) IP- SDC4 versus IP-IgG in left ventricle (LV) lysate (each n is performed in triplicates) ($p<0.01$)

c) IP- SDC4 in ABHF (heart failure) vs SHAM (control) lysate ($p<0.05$)

d) Interaction probably through integrin β1

SDC4=syndecan-4; Ectodomain = extracellular part of protein; ns=not significant

1. Greene, D. K., Tumova, S., Couchman, J. R., and Woods, A. (2003) Syndecan-4 associates with alpha-actinin. *The Journal of biological chemistry* **278**, 7617-7623

2. Pruessmeyer, J., Martin, C., Hess, F. M., Schwarz, N., Schmidt, S., Kogel, T., Hoettecke, N., Schmidt, B., Sechi, A., Uhlig, S., and Ludwig, A. (2010) A disintegrin and metalloproteinase 17 (ADAM17) mediates inflammation-induced shedding of syndecan-1 and -4 by lung epithelial cells. *The Journal of biological chemistry* **285**, 555-564
3. Rodriguez-Manzaneque, J. C., Carpizo, D., Plaza-Calonge Mdel, C., Torres-Collado, A. X., Thai, S. N., Simons, M., Horowitz, A., and Iruela-Arispe, M. L. (2009) Cleavage of syndecan-4 by ADAMTS1 provokes defects in adhesion. *Int J Biochem Cell Biol* **41**, 800-810
4. Cain, S. A., Mularczyk, E. J., Singh, M., Massam-Wu, T., and Kielty, C. M. (2016) ADAMTS-10 and -6 differentially regulate cell-cell junctions and focal adhesions. *Scientific reports* **6**, 35956
5. Ju, R., and Simons, M. (2013) Syndecan 4 regulation of PDK1-dependent Akt activation. *Cellular signalling* **25**, 101-105
6. Brooks, R., Williamson, R., and Bass, M. (2012) Syndecan-4 independently regulates multiple small GTPases to promote fibroblast migration during wound healing. *Small GTPases* **3**, 73-79
7. Bass, M. D., Morgan, M. R., Roach, K. A., Settleman, J., Goryachev, A. B., and Humphries, M. J. (2008) p190RhoGAP is the convergence point of adhesion signals from alpha 5 beta 1 integrin and syndecan-4. *The Journal of cell biology* **181**, 1013-1026
8. Elfenbein, A., Rhodes, J. M., Meller, J., Schwartz, M. A., Matsuda, M., and Simons, M. (2009) Suppression of RhoG activity is mediated by a syndecan 4-synectin-RhoGDI1 complex and is reversed by PKCalpha in a Rac1 activation pathway. *The Journal of cell biology* **186**, 75-83
9. Salza, R., Lethias, C., and Ricard-Blum, S. (2017) The Multimerization State of the Amyloid-beta42 Amyloid Peptide Governs its Interaction Network with the Extracellular Matrix. *Journal of Alzheimer's disease : JAD* **56**, 991-1005
10. Finsen, A. V., Lunde, I. G., Sjaastad, I., Ostli, E. K., Lyngra, M., Jarstadmarken, H. O., Hasic, A., Nygard, S., Wilcox-Adelman, S. A., Goetinck, P. F., Lyberg, T., Skrbic, B., Florholmen, G., Tonnessen, T., Louch, W. E., Djurovic, S., Carlson, C. R., and Christensen, G. (2011) Syndecan-4 is essential for development of concentric myocardial hypertrophy via stretch-induced activation of the calcineurin-NFAT pathway. *PloS one* **6**, e28302
11. Xie, Z., Khair, M., Shaukat, I., Netter, P., Mainard, D., Barre, L., and Ouzzine, M. (2018) Non-canonical Wnt induces chondrocyte de-differentiation through Frizzled 6 and DVL-2/B-raf/CaMKIIalpha/syndecan 4 axis. *Cell death and differentiation*
12. Hsueh, Y. P., Yang, F. C., Kharazia, V., Naisbitt, S., Cohen, A. R., Weinberg, R. J., and Sheng, M. (1998) Direct interaction of CASK/LIN-2 and syndecan heparan sulfate proteoglycan and their overlapping distribution in neuronal synapses. *The Journal of cell biology* **142**, 139-151
13. Cohen, A. R., Woods, D. F., Marfatia, S. M., Walther, Z., Chishti, A. H., and Anderson, J. M. (1998) Human CASK/LIN-2 binds syndecan-2 and protein 4.1 and localizes to the basolateral membrane of epithelial cells. *The Journal of cell biology* **142**, 129-138
14. Langhe, R. P., Gudzenko, T., Bachmann, M., Becker, S. F., Gonnermann, C., Winter, C., Abbruzzese, G., Alfandari, D., Kratzer, M. C., Franz, C. M., and Kashef, J. (2016) Cadherin-11 localizes to focal adhesions and promotes cell-substrate adhesion. *Nature communications* **7**, 10909
15. Ohkawara, B., Glinka, A., and Niehrs, C. (2011) Rspo3 binds syndecan 4 and induces Wnt/PCP signaling via clathrin-mediated endocytosis to promote morphogenesis. *Developmental cell* **20**, 303-314
16. Herum, K. M., Lunde, I. G., Skrbic, B., Louch, W. E., Hasic, A., Boye, S., Unger, A., Brorson, S. H., Sjaastad, I., Tonnessen, T., Linke, W. A., Gomez, M. F., and Christensen, G. (2015) Syndecan-4 is a key determinant of collagen cross-linking and passive myocardial stiffness in the pressure-overloaded heart. *Cardiovasc Res* **106**, 217-226

17. Kinnunen, T., Kaksonen, M., Saarinen, J., Kalkkinen, N., Peng, H. B., and Rauvala, H. (1998) Cortactin-Src kinase signaling pathway is involved in N-syndecan-dependent neurite outgrowth. *The Journal of biological chemistry* **273**, 10702-10708
18. Lin, W., Zhang, J., Lin, H., Li, Z., Sun, X., Xin, D., Yang, M., Sun, L., Li, L., Wang, H., Chen, D., and Sun, Q. (2016) Syndecan-4 negatively regulates antiviral signalling by mediating RIG-I deubiquitination via CYLD. *Nature communications* **7**, 11848
19. Charnaux, N., Brule, S., Hamon, M., Chaigneau, T., Saffar, L., Prost, C., Lievre, N., and Gattegno, L. (2005) Syndecan-4 is a signaling molecule for stromal cell-derived factor-1 (SDF-1)/ CXCL12. *The FEBS journal* **272**, 1937-1951
20. Munoz, R., Moreno, M., Oliva, C., Orbenes, C., and Larrain, J. (2006) Syndecan-4 regulates non-canonical Wnt signalling and is essential for convergent and extension movements in Xenopus embryos. *Nature cell biology* **8**, 492-500
21. Yoo, J., Jeong, M. J., Cho, H. J., Oh, E. S., and Han, M. Y. (2005) Dynamin II interacts with syndecan-4, a regulator of focal adhesion and stress-fiber formation. *Biochem Biophys Res Commun* **328**, 424-431
22. Wang, H., Jin, H., Beauvais, D. M., and Rapraeger, A. C. (2014) Cytoplasmic domain interactions of syndecan-1 and syndecan-4 with alpha6beta4 integrin mediate human epidermal growth factor receptor (HER1 and HER2)-dependent motility and survival. *The Journal of biological chemistry* **289**, 30318-30332
23. Wang, H., Jin, H., and Rapraeger, A. C. (2015) Syndecan-1 and Syndecan-4 Capture Epidermal Growth Factor Receptor Family Members and the alpha3beta1 Integrin Via Binding Sites in Their Ectodomains: NOVEL SYNSTATINS PREVENT KINASE CAPTURE AND INHIBIT alpha6beta4-INTEGRIN-DEPENDENT EPITHELIAL CELL MOTILITY. *The Journal of biological chemistry* **290**, 26103-26113
24. Granés, F., Berndt, C., Roy, C., Mangeat, P., Reina, M., and Vilaró, S. (2003) Identification of a novel Ezrin-binding site in syndecan-2 cytoplasmic domain. *FEBS Letters* **547**, 212-216
25. Schmidt, A., Echtermeyer, F., Alozie, A., Brands, K., and Buddecke, E. (2005) Plasmin- and thrombin-accelerated shedding of syndecan-4 ectodomain generates cleavage sites at Lys(114)-Arg(115) and Lys(129)-Val(130) bonds. *The Journal of biological chemistry* **280**, 34441-34446
26. Wilcox-Adelman, S. A., Denhez, F., and Goetinck, P. F. (2002) Syndecan-4 modulates focal adhesion kinase phosphorylation. *The Journal of biological chemistry* **277**, 32970-32977
27. Bentzinger, C. F., Wang, Y. X., von Maltzahn, J., Soleimani, V. D., Yin, H., and Rudnicki, M. A. (2013) Fibronectin regulates Wnt7a signaling and satellite cell expansion. *Cell stem cell* **12**, 75-87
28. Gao, Y., Li, M., Chen, W., and Simons, M. (2000) Synectin, syndecan-4 cytoplasmic domain binding PDZ protein, inhibits cell migration. *Journal of cellular physiology* **184**, 373-379
29. Chung, J. S., Dougherty, I., Cruz, P. D., Jr., and Ariizumi, K. (2007) Syndecan-4 mediates the coinhibitory function of DC-HIL on T cell activation. *Journal of immunology (Baltimore, Md. : 1950)* **179**, 5778-5784
30. Afratis, N. A., Bouris, P., Skandalis, S. S., Multhaupt, H. A., Couchman, J. R., Theocharis, A. D., and Karamanos, N. K. (2017) IGF-IR cooperates with ERalpha to inhibit breast cancer cell aggressiveness by regulating the expression and localisation of ECM molecules. *Scientific reports* **7**, 40138
31. Morgan, M. R., Humphries, M. J., and Bass, M. D. (2007) Synergistic control of cell adhesion by integrins and syndecans. *Nature reviews. Molecular cell biology* **8**, 957-969

32. Bloom, L., Ingham, K. C., and Hynes, R. O. (1999) Fibronectin regulates assembly of actin filaments and focal contacts in cultured cells via the heparin-binding site in repeat III13. *Molecular biology of the cell* **10**, 1521-1536
33. Woods, A., Couchman, J. R., Johansson, S., and Hook, M. (1986) Adhesion and cytoskeletal organisation of fibroblasts in response to fibronectin fragments. *The EMBO journal* **5**, 665-670
34. Saoncella, S., Echtermeyer, F., Denhez, F., Nowlen, J. K., Mosher, D. F., Robinson, S. D., Hynes, R. O., and Goetinck, P. F. (1999) Syndecan-4 signals cooperatively with integrins in a Rho-dependent manner in the assembly of focal adhesions and actin stress fibers. *Proceedings of the National Academy of Sciences of the United States of America* **96**, 2805-2810
35. Whiteford, J. R., and Couchman, J. R. (2006) A conserved NXIP motif is required for cell adhesion properties of the syndecan-4 ectodomain. *The Journal of biological chemistry* **281**, 32156-32163
36. Tanaka, R., Seki, Y., Saito, Y., Kamiya, S., Fujita, M., Okutsu, H., Iyoda, T., Takai, T., Owaki, T., Yajima, H., Taira, J., Hayashi, R., Kodama, H., Matsunaga, T., and Fukai, F. (2014) Tenascin-C-derived peptide TNIIIA2 highly enhances cell survival and platelet-derived growth factor (PDGF)-dependent cell proliferation through potentiated and sustained activation of integrin alpha5beta1. *The Journal of biological chemistry* **289**, 17699-17708
37. Kim, E. Y., Roshanravan, H., and Dryer, S. E. (2015) Syndecan-4 ectodomain evokes mobilization of podocyte TRPC6 channels and their associated pathways: An essential role for integrin signaling. *Biochimica et biophysica acta* **1853**, 2610-2620
38. Wang, H., Leavitt, L., Ramaswamy, R., and Rapraeger, A. C. (2010) Interaction of Syndecan and α6β4 Integrin Cytoplasmic Domains: REGULATION OF ErbB2-MEDIATED INTEGRIN ACTIVATION. *The Journal of biological chemistry* **285**, 13569-13579
39. Carulli, S., Beck, K., Dayan, G., Boulesteix, S., Lortat-Jacob, H., and Rousselle, P. (2012) Cell surface proteoglycans syndecan-1 and -4 bind overlapping but distinct sites in laminin alpha3 LG45 protein domain. *The Journal of biological chemistry* **287**, 12204-12216
40. Manon-Jensen, T., Multhaupt, H. A., and Couchman, J. R. (2013) Mapping of matrix metalloproteinase cleavage sites on syndecan-1 and syndecan-4 ectodomains. *The FEBS journal* **280**, 2320-2331
41. Brule, S., Charnaux, N., Sutton, A., Ledoux, D., Chaigneau, T., Saffar, L., and Gattegno, L. (2006) The shedding of syndecan-4 and syndecan-1 from HeLa cells and human primary macrophages is accelerated by SDF-1/CXCL12 and mediated by the matrix metalloproteinase-9. *Glycobiology* **16**, 488-501
42. Partovian, C., Ju, R., Zhuang, Z. W., Martin, K. A., and Simons, M. (2008) Syndecan-4 regulates subcellular localization of mTOR Complex2 and Akt activation in a PKCalpha-dependent manner in endothelial cells. *Molecular cell* **32**, 140-149
43. Hsueh, Y. P., Roberts, A. M., Volta, M., Sheng, M., and Roberts, R. G. (2001) Bipartite interaction between neurofibromatosis type I protein (neurofibromin) and syndecan transmembrane heparan sulfate proteoglycans. *The Journal of neuroscience : the official journal of the Society for Neuroscience* **21**, 3764-3770
44. Kim, J., Lee, J. H., Park, H. S., Hwang, J., Han, I. O., Bae, Y. S., and Oh, E. S. (2008) Syndecan-4 regulates platelet-derived growth factor-mediated MAP kinase activation by altering intracellular reactive oxygen species. *FEBS Lett* **582**, 2725-2730
45. Baietti, M. F., Zhang, Z., Mortier, E., Melchior, A., Degeest, G., Geeraerts, A., Ivarsson, Y., Depoortere, F., Coomans, C., Vermeiren, E., Zimmermann, P., and David, G. (2012) Syndecan-syntenin-ALIX regulates the biogenesis of exosomes. *Nature cell biology* **14**, 677-685

46. Koo, B. K., Jung, Y. S., Shin, J., Han, I., Mortier, E., Zimmermann, P., Whiteford, J. R., Couchman, J. R., Oh, E. S., and Lee, W. (2006) Structural basis of syndecan-4 phosphorylation as a molecular switch to regulate signaling. *Journal of molecular biology* **355**, 651-663
47. Oh, E. S., Woods, A., and Couchman, J. R. (1997) Multimerization of the cytoplasmic domain of syndecan-4 is required for its ability to activate protein kinase C. *The Journal of biological chemistry* **272**, 11805-11811
48. Murakami, M., Horowitz, A., Tang, S., Ware, J. A., and Simons, M. (2002) Protein kinase C (PKC) delta regulates PKCalpha activity in a Syndecan-4-dependent manner. *The Journal of biological chemistry* **277**, 20367-20371
49. Chung, J. S., Cruz, P. D., Jr., and Ariizumi, K. (2011) Inhibition of T-cell activation by syndecan-4 is mediated by CD148 through protein tyrosine phosphatase activity. *European journal of immunology* **41**, 1794-1799
50. Lee, J. D., Jung, H., and Min, S. H. (2016) Identification of proteins suppressing the functions of oncogenic phosphatase of regenerating liver 1 and 3. *Experimental and therapeutic medicine* **12**, 2974-2982
51. Bass, M. D., Roach, K. A., Morgan, M. R., Mostafavi-Pour, Z., Schoen, T., Muramatsu, T., Mayer, U., Ballestrem, C., Spatz, J. P., and Humphries, M. J. (2007) Syndecan-4-dependent Rac1 regulation determines directional migration in response to the extracellular matrix. *The Journal of cell biology* **177**, 527-538
52. Shin, J., McFarland, D. C., and Velleman, S. G. (2013) Migration of turkey muscle satellite cells is enhanced by the syndecan-4 cytoplasmic domain through the activation of RhoA. *Molecular and cellular biochemistry* **375**, 115-130
53. Thodeti, C. K., Albrechtsen, R., Grauslund, M., Asmar, M., Larsson, C., Takada, Y., Mercurio, A. M., Couchman, J. R., and Wewer, U. M. (2003) ADAM12/syndecan-4 signaling promotes beta 1 integrin-dependent cell spreading through protein kinase Calpha and RhoA. *The Journal of biological chemistry* **278**, 9576-9584
54. Kwon, M. J., Park, J., Jang, S., Eom, C. Y., and Oh, E. S. (2016) The Conserved Phenylalanine in the Transmembrane Domain Enhances Heteromeric Interactions of Syndecans. *The Journal of biological chemistry* **291**, 872-881
55. Choi, Y., Kwon, M. J., Lim, Y., Yun, J. H., Lee, W., and Oh, E. S. (2015) Trans-regulation of Syndecan Functions by Hetero-oligomerization. *The Journal of biological chemistry* **290**, 16943-16953
56. Choi, S., Lee, E., Kwon, S., Park, H., Yi, J. Y., Kim, S., Han, I. O., Yun, Y., and Oh, E. S. (2005) Transmembrane domain-induced oligomerization is crucial for the functions of syndecan-2 and syndecan-4. *The Journal of biological chemistry* **280**, 42573-42579
57. Grootjans, J. J., Zimmermann, P., Reekmans, G., Smets, A., Degeest, G., Durr, J., and David, G. (1997) Syntenin, a PDZ protein that binds syndecan cytoplasmic domains. *Proceedings of the National Academy of Sciences of the United States of America* **94**, 13683-13688
58. Zimmermann, P., Zhang, Z., Degeest, G., Mortier, E., Leenaerts, I., Coomans, C., Schulz, J., N'Kuli, F., Courtoy, P. J., and David, G. (2005) Syndecan recycling [corrected] is controlled by syntenin-PIP2 interaction and Arf6. *Developmental cell* **9**, 377-388
59. Baciu, P. C., Saoncella, S., Lee, S. H., Denhez, F., Leuthardt, D., and Goetinck, P. F. (2000) Syndesmos, a protein that interacts with the cytoplasmic domain of syndecan-4, mediates cell spreading and actin cytoskeletal organization. *J Cell Sci* **113 Pt 2**, 315-324
60. Kim, H., Yoo, J., Lee, I., Kang, Y. J., Cho, H. S., and Lee, W. (2015) Crystal structure of syndesmos and its interaction with Syndecan-4 proteoglycan. *Biochem Biophys Res Commun* **463**, 762-767

61. Morgan, M. R., Hamidi, H., Bass, M. D., Warwood, S., Ballestrem, C., and Humphries, M. J. (2013) Syndecan-4 phosphorylation is a control point for integrin recycling. *Developmental cell* **24**, 472-485
62. Ott, V. L., and Rapraeger, A. C. (1998) Tyrosine phosphorylation of syndecan-1 and -4 cytoplasmic domains in adherent B82 fibroblasts. *The Journal of biological chemistry* **273**, 35291-35298
63. Shepherd, T. R., Klaus, S. M., Liu, X., Ramaswamy, S., DeMali, K. A., and Fuentes, E. J. (2010) The Tiam1 PDZ domain couples to Syndecan1 and promotes cell-matrix adhesion. *Journal of molecular biology* **398**, 730-746
64. Keller-Pinter, A., Ughy, B., Domoki, M., Pettko-Szandtner, A., Letoha, T., Tovari, J., Timar, J., and Szilak, L. (2017) The phosphomimetic mutation of syndecan-4 binds and inhibits Tiam1 modulating Rac1 activity in PDZ interaction-dependent manner. *PloS one* **12**, e0187094
65. Ethell, I. M., Hagihara, K., Miura, Y., Irie, F., and Yamaguchi, Y. (2000) Synbindin, A novel syndecan-2-binding protein in neuronal dendritic spines. *The Journal of cell biology* **151**, 53-68
66. Gopal, S., Sogaard, P., Multhaupt, H. A., Pataki, C., Okina, E., Xian, X., Pedersen, M. E., Stevens, T., Griesbeck, O., Park, P. W., Pocock, R., and Couchman, J. R. (2015) Transmembrane proteoglycans control stretch-activated channels to set cytosolic calcium levels. *The Journal of cell biology* **210**, 1199-1211
67. Liu, Y., Echtermeyer, F., Thilo, F., Theilmeier, G., Schmidt, A., Schulein, R., Jensen, B. L., Loddenkemper, C., Jankowski, V., Marcussen, N., Gollasch, M., Arendshorst, W. J., and Tepel, M. (2012) The proteoglycan syndecan 4 regulates transient receptor potential canonical 6 channels via RhoA/Rho-associated protein kinase signaling. *Arteriosclerosis, thrombosis, and vascular biology* **32**, 378-385