Citation	Authors	Year	Scaffold material	Cell type	Study design	Transplantation site	Findings
[198]*	Candiello, J. et al.	2018	Amikagel, PEGDM	ESC	In vitro		Seeding of hESC-derived pancreatic progenitor cells into PEGDM-Amikagel composition beta-like cell spheroids and heterogenous organoids.
[58]*	Liu, H. T. et al.	2018	Alginate	Rat islet cell	In vitro		Viability and function was maintained after alginate microencapsulation of islets using a W/W microfluidic system.
[69]* **	Noverraz, F. et al.	2018	PEG, Alginate	Insulin-producing cell line	In vitro	In vivo Peritoneal cavity, Renal subcapsula	PEGylated conjugates of Ketoprofen were grafted to Na-Alg scaffold and reduced perifibrotic overgrowth after intra peritoneal implantation.
[123]*	Galli, A. et al.	2018	Gelatin, Zirconia film	Human islet cell	In vitro		Long-term culture of human islets was supported by glass coverslips with gelatine/ZrOx nano-structured films. A reduction of hypoxia and inflammation of the islets was shown.
[103]*	Mansour, R. N. et al.	2018	PES-collagen fibres	Human iPSC	In vitro		Improved differentiation of hiPSCs on electrospun coated scaffolds if compared to 2D-culture.
[138]*	Huang, Y. B. et al.	2018	Decellularized pancreas	Insulin-producing cell line, in co-culture with EC	In vitro		Adhesion and proliferation of MIN-6 cells and HUVECs within a decellularized murine pancreas.
[139]*	Damodaran, R.G., Vermette, P.	2018	Decellularized pancreas	Mouse islet cell, Insulin-producing cell line	in vitro		28 mouse pancreata were decellularized while preserving the inner vascular structure. 48 hours after perfusion with mouse islets insulin secretion was determined after glucose stimulation and was superior to 2D-culture. GFP-tagged INS-1 cells were cultured within the scaffold for 120 days and remained viable.
[223]* **	An, D. et al.	2018	Alginate, Silk	Human islet cell, Rat islet cell	In vitro	In vivo Peritoneal cavity, Renal subcapsula	Scalable, mechanically robust device was created using a calcium-releasing polymer and a cell-encapsulating alginate hydrogel. Retrievability was shown using minimally invasive surgery.
[221]	Kokorev, O. V. et al.	2018	Titanium, Nickel	Rat islet cell		In vivo Peritoneal cavity	Porous, permeable, disc-shaped TiNi scaffolds kept islets in the internal structure after transplantation into the peritoneal cavity.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[72]*	Mooranian, A. et al.	2018	Alginate, Ursodeoxycholic acid	Insulin-producing cell line	In vitro			Alginate-Poly-L-ornithine-Polystyrene hydrogel and additional bile acid showed no difference in morphology but increased viability and function.
[97]*	Ojaghi, M. et al.	2018	PLA, PVA	MSC	In vitro			Differentiation of adipose derived stem cells into insulin-secreting cells. Intervention group (cells seeded onto electrospun PLA-PVA scaffold) were superior to control (2D-culture).
[190]* **	Soltanian, A. et al.	2018	Matrigel, Agarose, PLA	ESC, in co-culture with MSC and EC	In vitro	In vivo	Peritoneal cavity	Differentiation of human embryonic stem cells into insulin-secreting cells. Organoids of hESCs together with MSCs and ECs were placed into 3D-printed PLA basket together with collagen I.
[99]*	Enderami, S. E. et al.	2018	PVA	MSC	In vitro			PVA scaffolds including platelet-rich plasma were superior to 2D-culture for human adipose derived MSCs in cell viability and insulin secretion.
[96]*	Enderami, S. E. et al.	2018	PLA, PVA	Human iPSC	In vitro			Intervention group with cells seeded on electrospun scaffold showed an increased number of spherical shaped aggregates and enhanced pancreas-specific markers if compared to 2D-control.
[19]*	Buchwald, P. et al.	2018	Alginate	Human islet cell, Mouse islet cell	In vitro			Encapsulation studies with multi-channel perifusion system showing that small capsules (d=700μm) delay and large capsules (d=1,800μm) completely blunt the glucose response. Human islets were shown to secrete approx. 2-3-fold less insulin than murine islets.
[222]	Pereira, L. X. et al.	2018	Polyether-Polyurethane	Mouse islet cell		In vivo	Peritoneal cavity	Disc-shaped scaffold were transplanted into normoglycemic mice.
[196]* **	Kasputis, T. et al.	2018	PLG	Human iPSC	In vitro	In vivo	Epididymal fat	Differentiation of human embryonic stem cells into insulin-secreting cells. Exenedin-4 releasing, collagen IV-coated scaffold significantly improved C-peptide production and blood glucose regulation if compared to control microscaffold. Positive control group (cell pellet with thrombin and fibrinogen was transplantaed under renal capsula and was shown to be superior to epididymal fat as transplantation site.
[53]*	Abazari, M. F. et al.	2018	PVA, PCL	Human iPSC	In vitro			Electrospun and plasma surface-treated PVA/PCL scaffolds enhanced homogenous cell differentiation if compared to 2D-culture.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[37]*	Montalbano, G. et al.	2018	Alginate, Collagen, Fibrin	Insulin-producing cell line, MSC, in co-culture with fibroblasts	In vitro			Viability and function of MIN-6 cells in Collagen-Alginate-Fibrin hydrogel and proliferation of human MSCs showed best results with collagen concentration of 0.5%. Higher collagen concentrations resulted in enhanced osteogenic potential.
[180]* **	Pham, T. T. et al.	2018	PLGA, PEG	Rat islet cell, in co-culture with splenocytes	In vitro	In vivo	Renal subcapsula	Islets were coated with PLGA-PEG-DOPA nanoparticles to camouflage antigen surfaces. Additional loading with tacrolimus inhibited IL-2 production.
[34]*	Espona-Noguera, A. et al.	2018	Alginate	Insulin-producing cell line	In vitro			Alginate hydrogel was modified by addition of disodium phosphate to slow down gelation time and increasing the porosity without reduction of the functionality of the INS-1 cells.
[128]* **	Fukuda, Y. et al.	2018	Gelatin, Fibronectin	Insulin-producing cell line	In vitro	In vivo	Renal subcapsula	Layer-by-layer coating with fibronectin and gelatin can be applied to MIN6 cells and promote spheroid formation. The coated spheroids showed greater insulin secretion ability with increased expression of the insulin and glucose transporter 2 genes and upregulated connexin 36 expression. Transplantation into STZ-induced diabetic mice showed an increased glucose sensitivity compared to non-coated controls.
[104]	Mansour, R. N. et al.	2018	Polyethersulfone	Human iPSC	In vitro			The study showed that pancreatic tissue-specific genes and proteins in cells were significantly higher when cultured on Polyethersulfone nanofibrous scaffolds compared to 2D-culture plates.
[130]* **	Sackett, S. D. et al.	2018	Decellularized pancreas	Insulin-producing cell line	In vitro	In vivo	Subcutaneous	A hydrogel from human decellularized pancreatic tissue was manufactured to provide structural support for cells and enhance differentiation. Cytocompatibility was shown with INS-1 cells, hypoimmunogenicity was shown in mice.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[135]	Vishwakarma S. K. et al.	2018	Decellularized spleen	Human hepatic progenitor cell	In vitro			Human hepatic progenitor cells were trans-differentiated to insulin-producing cells within an acellular spleen scaffold. Functional transition and insulin-secretion was superior to 2D-control due to 3D-architecture and microenvironment closer to nature.
[42]	Aloy-Reverte,C. et al.	2018	Self-assembling peptide	Human islet cell	In vitro			Self assembling peptides showed an enhanced re-aggregation and islet-like structure formation of monolayer cells derived from human islet cells. The effect was further enhanced by addition of the RGD-motif to the scaffold.
[51]* **	Farina, M. et al.	2017	PLA	Human islet cell		In vivo	Subcutaneous	3D-printed discoid, PLA-sphere with 300x300μm caverns and tissue connection through microchannels were subcutaneously implanted. Cell-loading was performed transcutaneously.
[106]*	Mironov, A. V. et al.	2017	PLGA	Rabbit islet cell in co-culture with MSC and fibroblasts	In vitro			3D-printing of porous scaffold (0.5-500μm pore size, interconnected) based on computer model with extrusion of PLGA. In vitro trial showed good adhesive properties of islets and no cytotoxicity within a period of 10 days.
[126]* **	Wang, X. et al.	2017	Collagen, Porcine pericardium	Mouse islet cell		In vivo	Epididymal fat	Decellularized porcine pericardium and collagen from tendon were used as a scaffold for islets with enhanced viability and function.
[209]	Wang, D. et al.	2017	Small intestinal submucosa	Rat islet cell, in co-culture with MSC	In vitro	In vivo	Subcutaneous	Rat islets were co-cultured with rat MSCs and combined with porcine small intestinal submucosa. Intervention showed improved viability and function if compared to control within a study perios of 30 days. By day 50 there was an entire graft loss in all groups.
[63]* **	Tiernan, A. R., Sambanis, A.	2017	Alginate	Insulin-producing cell line	In vitro	In vivo	Peritoneal cavity	Lentiviral transduction with luciferase to enable bioluminescnece tracking of microencapsulated insulin-secreting cells. Due to high cost and effort not recommended for primary cells.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[162]*	Long, R. et al.	2017	Alginate, Chitosan	Mouse islet cell, in co-culture with MSC	In vitro	In vivo		Electrospun alginate-chitosan-alginate capsules showed beneficial effect of co-culture with MSCs
[207]* **	Liu, L. et al.	2017	PLGA	Rat iPSC, in co-culture with fibroblasts		In vivo	Subcutaneous	Vessel ingrowth was seen after subcutaneous implantation of cell-loaded PLGA membranes into STZ-mice.
[140]*	Wan, J. et al.	2017	Decellularized pancreas	Murine iPSC	In vitro			A higher insulin expression was achieved after seeding of islets in decellularized pancreas through vascular perifusion and multi-positional parenchymal injection.
[199]*	Wang, W., Jin, S., Ye, K.	2017	Collagen	ESC	In vitro			H9 human embryonic stem cells were embedded in collagen I/Matrigel composite scaffold and successful differentiation into insulin-secreting cells was achieved.
[101]*	Nadri, S. et al.	2017	PCL	MSC	In vitro			Human conjunctiva-derived MSCs were differentiated into insulin-secreting cells. PCL-scaffold 3D-culture was superior to 2D-culture measured by GSIS and gene expression.
[36]*	Li, N. et al.	2017	Alginate	Mouse islet cell	In vitro			Alginate hydrogel encapsulation promoted islet formation in 3D-culture.
[203]*	Seyedi, F., Farsinejad, A., Nematollahi-Mahani, S. N.	2017	Fibrin	MSC	In vitro			Human umbilical cord matrix-derived stem cells showed better response to glucose challenge in fibrin scaffold if compared to 2D-culture.
[125]*	Ribeiro, D. et al.	2017	Collagen	Rat iPSC	In vitro			3D-culture of iPSCs together with human-islet-extracellular-vesicles showed increased mRNA level for insulin and lower apoptosis rates than 2D-control.
[48]*	Shih, H., Liu, H. Y., Lin, C. C.	2017	PEG, PEGNB	Insulin-producing cell line	In vitro			Gelation of hydrogel was improved after addition of tyrosine to pre-polymer solution. Good cytocompatibility of material during whole study period.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[208]* **	Mahou, R. et al.	2017	PEG, PMAA	Rat islet cell		In vivo	Subcutaneous	PEG-PMAA semiinterpentrating network with embedded islets showed 2-3-fold increased vessel formation compared to control with PEG alone.
[112]* **	Chaimov, D. et al.	2017	Alginate, Decellularized pancreas	MSC in co-culture with hepatocytes	In vitro	In vivo	Subcutaneous	Differentiation of human MSCs into insulin-secreting cells with pancreatic transcription factors. Proof of function in mouse model.
[29]*	Marchioli, G. et al.	2017	PEGDA, GAGs	Human islet cell, Insulin-producing cell line	In vitro			Two-layer manufacturing method of PEGDA and thiolated hydrogels was used to promote vessel ingrowth with additional ECM derivatives and growth factors.
[178]* **	Jiang, K. et al.	2017	PDMS	Mouse islet cell		In vivo	Epididymal fat	Local release of glucocorticoids from scaffold supported graft vascularization. Best efficiacy was achieved with low-dose glucocorticoids.
[30]*	Bal, T. et al.	2017	PEG	Rat islet cell in co-culture with MSC	In vitro			Covalent incorporation of GLP-1 and cell adhesion peptides (ECM-motifs) in PEG hydrogel and co-culture of MSCs improved viability and function.
[89]	Buitinga, M. et al.	2017	PEOT, PBT thin film	MSC, Mouse islet cell	In vitro	In vivo	Epididymal fat	Scaffolds with 30-40μm pore diameters showed the best neo-vascularization if compared too smaller or larger diameters. Laser-drilling was the most suitable fabrication method to meet this demand.
[169]* **	Coronel, M. M., Geusz, R., Stabler, C. L.	2017	Fibrin	Rat islet cell, Non-human primate islet cell	In vitro	In vivo	Omental pouch	Application of oxygen producing biomaterial for in situ oxygenation based on mathematical modeling.
[154]* **	Vlahos, A. E., Cober, N., Sefton, M. V.	2017	Collagen	Rat islet cell, in co-culture with MSC and EC		In vivo	Subcutaneous	Islets embedded in endothelialized collagen cylinders were transplanted subcutaneously. Insulin response was best without addition of adipose-derived mesenchymal cells.
[197]*	Kuo, Y. C., Liu, Y. C., Rajesh, R.	2017	PLGA, Gelatin	Murine iPSC	In vitro			Grafting of iPSCs with gelatine-PLGA (6.7%) nanoparticles showed better cell adhesion. Scaffolds were manufactured by freeze-drying.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[54]* **	Li, Y. et al.	2017	PGA	Rat islet cell, in co-culture with EC	In vitro	In vivo	Renal subcapsula	Islets were coated with ECs alone or ECs together with a PGA scaffold. Scaffold group showed improved long-term function but still no long-term normoglycemia.
[93]*	Forget, A. et al.	2017	PDMS	Insulin-producing cell line	In vitro			PDMS-wells were coated with BSA, collagen IV and IGF-2. Cell aggregation strongly depends ond geometry of well and surface coating.
[92]* **	Smink, A. M. et al.	2017	PDLLCL	Rat islet cell, in co-culture with EC	In vitro	In vivo	Subcutaneous	Cell-loaded scaffold with casted microchannnels was implanted subcutaneously with additional aFGF. Restorationof normoglycemia was achieved for 37 days but not long-term. An increased vessel ingrowth could be seen after histology after 75 days.
[90]* **	Smink, A. M. et al.	2017	PCL	Rat islet cell		In vivo	Subcutaneous	Subcutaneous implantation of scaffolds four weeks prior to cells for pre-vascularization. Transplantation site inferior to control transplanted under kidney capsula.
[179]*	Kumar, M. et al.	2017	Silk, Alginate, Agarose	Insulin-producing cell line	In vitro			Cells were metabolically active and proliferated up to 2.5-fold over 35 days in culture when encapsulated. Enhanced glucose stimulation index and immunoprotective function by sustained release of preloaded Dex and IL-4 were shown compared to non-encapsulated islets.
[75]*	Nikravesh, N. et al.	2017	Alginate	Insulin-producing cell line	In vitro			Alginate microcapsules with an average diameter of 200μm containing MIN-6 cells were shown to be impermeable to FITC-mouse antibodies. The microcapsules were cultured in a fluidized bed-bioreactor with increased insulin secretion compared to static culture after 7 days.
[168]	Pereira, L. X. et al.	2017	Polyether-Polyurethane	MSC		In vivo	Peritoneal cavity	Scaffold discs were implanted in proximity to the pancreas in mice. 4 days after implantation the intervention group received human adipose derived stem cells. Inoculation of stem cells improved survival, glucose metabolism and weight gain and increased the number of insulin-producing cells (non-human origin) in the scaffold.
[166]	Perez-Basterrechea, M. et al.	2017	Thrombin	Rat islet cell, in co-culture with fibroblasts		In vivo	Subcutaneous	Subcutaneous transplantation of plasma-based scaffolds containing islets and fibroblasts into mice was investigated. The presence of fibroblasts correlated with a faster graft re-vascularization, a higher insulin-positive area and a lower cell death.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[228]	Berman, D. M. et al.	2016	Thrombin	Rat islet cell, Non-human primate islet cell		In vivo	Omental pouch	Isolated islets were implanted together with plasma and covered with thrombin sheet to create a resorbable scaffold for implantation.
[234]	Jin, L. et al.	2016	Matrigel, Laminin	Murine iPSC	In vitro	In vivo	Renal subcapsula	CD133highCD71low are enriched for tripotent colony-forming progenitor cells and in the presence of defined ECM containing laminin- or Matrigel hydrogels they showed bihormal glocagon and insulin expression. No proof of function in vivo.
[127]*	McEwan, K. et al.	2016	Collagen, Chitosan, Laminin	Porcine islet cell in co-culture human circulating angiogenic cell	In vitro			20:1 collagen-chitosan resulted in best viability and function.
[167]*	Rhett, J. M. et al.	2016	Agarose, SPECs	Mouse islet cell, in co-culture with EC and fibroblasts	In vitro			Intervention inferior to control with free islets. SPEC (Self-organizing, prevascularized endothelial-fibroblast constructs) molded in agarose hosted mouse islets in intervention.
[210]* **	Song, J., Millman, J. R.	2016	PLA, Fibrin	ESC	In vitro	In vivo	Subcutaneous	3D-printed PLA device was loaded with Fibrin and human pancreatic progenitor cells and implanted into SCID-mice. The retrievable, structural stable device was functional within a study period of 12 weeks.
[141]*	Katsuki, Y. et al.	2016	Decellularized pancreas	Porcine islet cell	In vitro			Viability and function were improved if compared to 2D-control without decellularized scaffold. Function decreased after 5 days.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[79]* **	Ibarra, V. et al.	2016	Alginate	Rat islet cell	In vitro	In vivo	Omental pouch	X-ray-phase contrast μCT was performed for 3D imaging and reconstruction of alginate microbeads within omental pouch.
[165]	Matsushima, H. et al.	2016	Fibroblast cell sheet	Human islet cell, in co-culture with fibroblasts	In vitro			Beneficial effect of dermal fibroblast cell sheet for islet cells.
[52]*	Marchioli, G. et al.	2016	PCL, Alginate	Human islet cell	In vitro	In vivo		Ring-shaped PCL scaffold with heparin and VEGF surface functionalization and a core of alginate hydrogel with embedded islets was manufactured using 3D-printing. Low VEGF doses but also heparin alone promoted vessel ingrowth in ovo.
[61]* **	Appel, A. A. et al.	2016	Alginate	Rat islet cell		In vivo	Omental pouch	X-ray phase contrast imaging for monitoring islet-containing alginate capsules after implantation showed good results.
[159]* **	Montazeri, L. et al.	2016	Collagen, Fibrin	Rat islet cell, Insulin-producing cell line		In vivo	Omental pouch	Fibrin-conjugated heparin/VEGF collagen scaffolds supported insulin-secreting cells. Oxygen-producing microparticles of hydrogen peroxide and PLGA significantly improved graft function.
[224]	Kokorev, O. V. et al.	2016	Titanium, Nickel	Rat islet cell, and additional groups with MSC and hepatocytes		In vivo	Peritoneal cavity	Cells showed adhesive growth and secretion of ECM on porous TiNi-based shape memory alloy scaffolds.
[66]* **	Vegas, A. J. et al.	2016	Alginate	ESC, Rat islet cell	In vivo	In vivo	Peritoneal cavity	Encapsulation of cells in modified alginate with a pore size of 1-3μm resulted in less perifibrotic overgrowth. Study period of 174 days.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[211]* **	Borg, D. J. et al.	2016	PEG	Mouse islet cell, in co-culture with MSC	In vitro	In vivo	Subcutaneous	Glass-beads in islet-size were used to show eligibility of the scaffolds pores for islets in pre-trial. In vitro function was shown but in vivo no insulin production function was shown in short study period (7days). ECM secretion of MSCs.
[71]* **	Arifin, D. R. et al.	2016	Alginate, Protamine sulfate	Human islet cell		In vivo	Renal subcapsula, Subcutaneous, Portal Vein, Skeletal Muscle, Liver Capsula	Magneto-labelled alginate microspheres for MRI imaging were used to compare different transplantation sites. Hepatic and renal capsula were found to be the least immune-responsive.
[83]* **	Rios, P. D. et al.	2016	PEG, PDMS	Mouse islet cell	In vitro	In vivo	Epididymal fat	PDMS molds were used to lithographically fabricate islet-containing PEG hydrogels including microchannels. Normoglycemia was induced 12 days post-implantation and lasted until end of study. Tissue and vascular ingrowth into channels was demonstrated in histological analysis after explantation.
[55]*	Smink, A. M. et al.	2016	PDLLCL, PEOT/PBT, Polysulfone	Human islet cell	In vitro			3 different materials were compared. PDLLCL was shown to be superior as it contained the most hormon granules (nanotomy) and showed less dsDNA release (danger associated molecular patterns) and cellular outgrowth. Islets remained functional for 7d. Higher hydrophylicity leads to less EMT (Epithelial-Mesenchymal Transformation).
[149]	Shalaly, N. D. et al.	2016	Silk	Mouse islet cell, Human islet cell, Insulin-producing cell line	In vitro	In vivo	Eye	Foamed silk matrices improved islet viability and triggered spontaneous formation of cell clusters in static culture. Modification of matrix with RGD-motifs.
[136]*	Zhou, P. et al.	2016	Decellularized liver	MSC	In vitro			Islet-like cell clusters were injected through the portal vein into the liver scaffold. A ciculating perifusion culture system was established.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[143]*	Peloso, A. et al.	2016	Decellularized pancreas	Human islet cell, in co-culture with EC	In vitro			Acellular human pancreas was seeded with autologous cells. The scaffold was shown to modulate the immune system by inducing apoptosis of CD4+ T-cells or conversion into Treg-cells.
[132]* **	Abualhassan, N. et al.	2016	Decellularized lung	Mouse islet cell, Human islet cell		In vivo	Renal subcapsula, Peritoneal cavity, Subcutaneous	A 3D lung-derived microscaffold seeded with islet cells is used to provide ECM-components of the islet microenvironment. 66,7% of the mice with intraperitoneal grafts restored normoglycemia compared to 12,5% of mice with free islets. All mice with islets under the kidney restored glycaemic control. The scaffold improved insulin response to glucose challenge and supported islet architecture.
[98]* **	Fazili, A. et al.	2016	PLLA	MSC	In vitro	In vivo	Peritoneal cavity between pancreas and spleen	The pancreatic region is suited for differentiating adipose derived MSCs into insulin-secreting cells. Chamomile oil as an antioxidant agent and scaffold coating increases cell adhesion to the scaffold and cell differentiation. animal adipose MSC
[161]*	McReynolds, J. et al.	2016	Collagen	Insulin-producing cell line	In vitro			Encapsulated oxygen-generator (ebedding hydrogen peroxide into nontoxic polydimethylsiloxane) in 3D cell culture and mathematical modelling indicates that an oxygenation-aided 3D culture augment the oxygen supply required for beta-cells and increases insulin production. Mouse beta-cells (MIN6)
[184]* **	Liu, J.M.H. et al.	2016	PLG	Mouse islet cell	In vitro	In vivo	Epididymal fat	Mouse islet cells were seeded in PLG scaffold with additional recombinant murine TGF-β1 to suppress the local inflammatory response and were transplanted into diabetic mice. After a maximum period of 6 days all mice reverted to hyperglycemia.
[31]*	Sabek, O. M. et al.	2016	PLA	Human islet cell, MSC	In vitro			3D-printed and surface treated PLA-microchambers were used to for encapsulation of human islets or bone marrow derived mesenchymal stem cells, respectively. The stem cells were in vitro differentiated into islet-like insulin-producing cell aggregates.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[81]	Nibbelink, M. G. et al.	2016	Polyethersulfone	Insulin-producing cell line	In vitro			Non-invasive imaging with near-infraread photoacustic tomography was performed to monitor clustering and spatial distribution of insulinoma cells within a polyethersulfone scaffold. The cells were labelled with carbon nanoparticles as optical absorbers.
[142]* **	Wu, D. et al.	2015	Decellularized pancreas	Mouse islet cell	In vitro	In vivo	Subcutaneous	Decellularized pancreata of mice were seeded with MIN-6 cells and were superior to control. Normoglycemia could not be maintained.
[212]	Hirabaru, M. et al.	2015	MSC sheets	Rat islet cell, in co-culture with MSC	In vitro	In vivo	Subcutaneous	No permanent normoglycemia was seen. No differentiation of MSCs into insulin secreting cells was observed.
[133]*	Sionov, R. V. et al.	2015	Decellularized pancreas, Decellularized lung of rat	Human islet cell	In vitro			Islets seeded onto acellular scaffolds from rat organs remained viable and functional.
[150]*	Formo, K. et al.	2015	Alginate	ESC	In vitro			Alginate hydrogel did not promote cell differentiation but instead cells showed higher likelihood to differentiate into other endocrine cell types. Additional ECM motifs did not influence viability.
[80]*	Daoud, J. et al.	2015	PLGA	Human islet cell	In vitro			Dielectric spectroscopy for live, non-invasive monitoring of maturation and functional status of cells. 3D-printing was applied for extrusion of PLGA into stamp-like scaffold.
[113]* **	Phelps, E. A. et al.	2015	PEG, Alginate, Collagen	Rat islet cell	In vitro	In vivo	Small Intestine	Gradual release of VEGF from PEG-MAL hydrogel promoted vascularized artificial islets in rats. Not successful in alginate model.
[109]* **	Marchioli, G. et al.	2015	Alginate, Gelatin, Matrigel, Hyaluronic acid	Human, Mouse and Rat islet cell	In vitro	In vivo	Subcutaneous	3D-bioprinted porous scaffold of alginate and gelatine including islets were superior to other composites but still showed no glucose-responsiveness in vivo.

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Citation	Authors	Year	Scaffold material	Cell type	Study design	Transplantation site	Findings
[60]*	Aijaz, A. et al.	2015	PEGDA	Insulin-producing cell line, Mouse Sarcoma Line, Keratinocytes	In vitro In vivo	Skin, Subcutaneous	Cell-containing hydrogel remained viable and functional for 21 days and secreted insulin served as a chemoattractant and mitogen to promote wound healing.
[187]* **	Hosseini-Tabatabaei, A. et al.	2015	Collagen, GAGs	Mouse islet cell, in co-culture with fibroblasts	In vitro In vivo	Renal subcapsula	Co-culturing islets with IDO-producing fibroblasts suppressed T-cell response and thus prolonged islet allograft survival.
[229]* **	Kollmer, M. et al.	2015	Alginate	Rat islet cell	In vitro In vivo	Omental pouch	Micro-encapsulation of islets into 300-400µm alginate capsules together with aFGF did not result in a significant difference of blood glucose if compared to control without aFGF.
[134]*	Willenberg, B. J. et al.	2015	Decellularized kidney	Insulin-producing cell line, in co-culture with fibroblasts and EC	In vitro		Cell perfusion of acellular scaffold: Antegrade with fibroblasts, retrograde with ß-TC cells (through ureter), through renal artery with endothelial cells.
[137]*	Xu, T. et al.	2015	Decellularized liver	Mouse islet cell	In vitro		Mouse islet cells were infused in liver ECM and were showed to tbe superior to 2D-culture in a study period of 5 days.
[202]*	Khorsandi, L. et al.	2015	Fibrin	MSC	In vitro		3D-culture enhances differentiation of rat bone-marrow derived MSCs into insulin producing cells if compared to 2D-culture.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[131]* **	Yuan, X. et al.	2015	Collagen, Silk	Insulin-producing cell line	In vitro	In vivo	Peritoneal cavity	The study investigated the combination of a silk scaffold with collagen IV as a culture template for MIN-6 cells. The cells showed an increased viability and function in vitro and a longer normoglycemic period post-transplantation compared to 2D-control or scaffold-free transplantation respectively.
[204]*	Niknamasl, A. et al.	2014	Fibrin	MSC	In vitro			MSCs formed islet-like clusters after differentiation into insulin-secreting cells.
[76]*	Richardson, T., Kumta, P. N., Banerjee, I.	2014	Alginate, Gelatine	ESC	In vitro			Inducing cell differentiation after encapsulation yielded higher survival rates compared to encapsulation of matured cells.
[119]	Nyitray, C. E., Chavez, M. G., Desai, T. A.	2014	Polyacrylamide	Mouse islet cell, Insulin-producing cell line	In vitro			Islets sorrounded by scaffold of tissue like stiffness (1kPa) showed higher insulin expression and moderate insulin secretion. Mechanical properties of the ECM were suspected to be mediated through ROCK/MLCK pathways.
[21]*	Kojima, N., Takeuchi, S., Sakai, Y.	2014	Alginate	Insulin-producing cell line	In vitro			1:8 ratio of alpha/beta cell co-culture in islets (8000 cells) yielded the highest insulin secretion rates, being 3-fold higher than ß-cell mono-culture aggregates.
[205]*	Aloysious, N., Nair, P. D.	2014	Gelatine, Acrylate	MSC	In vitro			Rabbit adipose derived mesenchymal stem cells showed islet-like cluster formation and differentiated into multihormon-secreting stages.
[230]* **	Pareta, R. et al.	2014	Alginate	Rat islet cell	In vitro	In vivo	Omental pouch	Addition of aFGF to scaffold materials slightly decreased insulin secretion but might have affected body weight positively. Microcapsules proved to be an effective protection against host immune cells.
[102]*	Blackstone, B. N. et al.	2014	Gelatine	Insulin-producing cell line	In vitro			In 3D-culture cells formed clusters and electrospun fibers and showed significantly higher metabolism than in conventional 2D monolayer culture. Cell viability and metabolism increases with fiber diameter and interfiber distance.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[100]*	Hoveizi, E. et al.	2014	PCL	Human iPSC	In vitro			Human induced pluripotent stem cells were differentiated into insulin-producing cells on electrospun PCL-scaffold (200nm fibers).
[64]*	Tiernan, A. R., Thule, P. M., Sambanis, A.	2014	Alginate	Intestinal L-cell	In vitro	In vivo	Peritoneal cavity	Cells (lentivirus transduced) expressing both luciferase and insulin secreted less insulin than cells expressing insulin alone. After 4 days, mice reverted to hyperglycemia. Initial normoglycemia was partly attributed to reduced post-surgery diet.
[39]*	Kuehn, C. et al.	2014	Fibrin, Alginate	Porcine islet cell in co-culture with human monocytes	In vitro			Monocyte migration towards embedded islets was limited in alginate, but not in fibrin-hydrogel. Pro-inflammatory cytokins were significantly increased in fibrin hydrogel, representing a distinct ECM-immune cell interaction.
[91]* **	Weizman, A. et al.	2014	PLGA, PLLA, Fibrin	ESC, in co-culture with fibroblasts and EC	In vitro	In vivo	Subcutaneous	3D co-culture of hESC, EC and fibroblasts resulted in cluster formation and in vitro differentiation into pancreatic progenitor cells seeded in a fibrin gel within a porous, polymeric scaffold. After implantation into mice the progenitor cells further matured into mono-hormonal insulin-secreting cells.
[213]* **	Ellis, C. E. et al.	2013	Collagen, Chitosan	Porcine islet cell	In vitro	In vivo	Subcutaneous	Collagen-Chitosan-Chondroitin-Laminin became vascularized successfully after 28 days, showed a higher biostability and a lower apoptosis rate than normal gelatin. Omental pouch is suggested as an optimal transplantation site.
[84]*	Jamal, M. et al.	2013	PEG	Insulin-producing cell line	In vitro			Photo-lithography for self-folding of curved, cell-laden 3D PEG scaffolds without UV light. Photoencapsulation of beta-TC-6 cells with hydrogel samples less than 100μm in thickness for better oxygen or nutrient diffusion compared to planar hydrogels.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[146]* **	Yap, W. T. et al.	2013	Collagen, PLGA	Mouse islet cell	In vitro	In vivo	Epididymal fat	Comparison between collagen IV-modified PLGA-scaffolds and serum protein-modified control PLGA-scaffolds. Decreased time to euglycemia from 17 to 3 days and enhanced islet cell viability.
[87]*	Park, J. et al.	2013	Alginate	Insulin-producing cell line	In vitro			Lithographically fabricated device allowing for reproducible, exact manufacturing of computer-calculated models containing a certain cell mass and attached to an alginate sheet. Maximum 200µm distance from the surrounding medium was considered.
[65]*	Li, Z. et al.	2013	Alginate	Rat islet cell	In vitro			Perfusion 3D-culture of rat isles in dynamic culture system improved islet functions compared to static 3D-culture system and conventional 2D-culture for 7 days. Enables supply of fresh media i.e. for drug testing.
[118]* **	Hosseini-Tabatabaei, A. et al.	2013	Collagen, GAGs	Mouse islet cell, in co-culture with fibroblasts	In vitro	In vivo	Renal subcapsula	Fibroblasts with expression of indoleamine-2,3-dioxygenase for immunosuppression were cultured on cross-linked collagen-GAG matrix . Insulin and glucagon production, enhanced viability of beta-cells and reduced fibroblast proliferation were shown in cross-linked scaffold.
[38]	Lim, D. J. et al.	2013	Peptide Amphiphiles	Insulin-producing cell line	In vitro			Study compared effect of ECM molecules (RGD, laminin-1, collagen IV, IKLLI, IKVAV, YIGSR) attached to amphiphile nanofibers to enhance viability and function of MIN6 cells. RGDS and YIGSR resulted in superior function and viability.
[27]	Sasikala, M. et al.	2013	Polytetrafluoroethylene	Non-human primate islet cell	In vitro	In vivo	Subcutaneous	Study about viability and function of macroencapsulating devices (TheraCytes) in vivo without immunosuppression (rhesus monkey, 2 autologous, 2 allogenic transplantations). Implantation of the device before and separately from cells resulted in lower curative dose of cells required to restore normoglycemia. Islets remained viable and functional for a period of 12 months and showed signs of proliferation.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[59]* **	Onoe, H. et al.	2013	Alginate, Agarose	Rat islet cell, Insulin-producing cell line	In vitro	In vivo	Renal subcapsula	Hydrogel microfibres encapsulated insulin-secreting cells. A microfluidic device with double-coaxial laminar flow was applied for fabrication of the alginate-agarose interpenetrating network scaffold. Restoration of physiological blood glucose levels for 13 days.
[78]*	Li, W. et al.	2013	PEG, Decellularized pancreas	Rat islet cell	In vitro			Culturing ß-cells in a 20µm microbead environment that has been modified with ECM components. Highest viability and insulin secretion was achieved in a system containing both decellularized pancreatic extracellular matrix components and EphrinA ligands.
[88]	Buitinga, M. et al.	2013	PEOT, PBT	Human islet cell	In vitro			This study investigated the fabrication of microwell scaffolds that (one islet per well). The material was described superior to PGA/PLGA as enzymatic hydrolytic degradation will not produce acidic products. Viability and function were proved over a period of 7 days. The construct cannot be scaled up to human demands. In theory the upscaled scaffold would take up an area of 40cm diameter (if stacked up in height diffusion would be limited). Results can be compared to free-floating islets.
[235]	Jaroch, D. B. et al.	2013	Porous silica	Mouse islet cell, Human islet cell	In vitro	In vivo	Renal subcapsula	Encapsulation of islet cells with a porous silica shell in a liquid medium for protection from the immune system with preservation of oxygen flux an glucose-stimulated insulin release.
[214]* **	Bhang, S. H. et al.	2013	Fibrin	Rat islet cell, MSC		In vivo	Subcutaneous	Co-transplanted islets and human adipose-derived mesenchymal stem cells in fibrin scaffold restored normoglycemia. Result was enhanced when bFGF was added. hADSCs differentiated into insulin-secreting cells.
[145]*	Goh, S. K. et al.	2013	Decellularized pancreas	Insulin-producing cell line, in co-culture with acinar cell Line	In vitro			Mouse pancreata were decellularized and re-cellularized. Scaffold itself resulted in no adverse events when implanted subcutaneously. No proof of function but engraftment could be achieved.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[147]	Beenken-Rothkopf, L. N. et al.	2013	Protein polymer hydrogel	Insulin-producing cell line	In vitro			Encapsulation of insulin-secreting with enzymatically crosslinked protein polymer hydrogels with addition of collagen IV, laminin and/or fibronectin. Scaffolds showed a fast formation and were highly elastic. A high viability was achieved in all formulations but no synergistic effects when investigated in combination.
[40]*	Raza, A., Lin, C. C.	2013	PEG	MSC, Insulin-producing cell line	In vitro			Cells were encapsulated in thiol-ene hydrogel with two different PEG-norbornene macromers (PEG-ester-NB, PEG-amid-NB) with different degradability. Rapidly hydrolytic degradation of PEG-ester-NB enhanceed cell survival, proliferation and cell/matrix interactions.
[94]* **	Yin, H. et al.	2013	PCL, PGC	Mouse islet cell	In vitro	In vivo	Renal subcapsula	Electrospun scaffold promoted growth of islet population after 12 weeks by 89% compared to 18% in the scaffold-free control group. Administration of MCP-1 along with insulin into diabetic mice with moderate kidney failure restored physiological blood glucose levels, creatinine, urea nitrogen and urine albumin levels due to a MCP-1 mediated reno-vascular regeneration.
[120]* **	Phelps, E. A. et al.	2013	PEG	Mouse islet cell, in co-culture with EC		In vivo	Mesentery	PEG-MAL (PEG-maleimide hydrogel) in combination with RGD peptide +/- VEGF-A +/- human umbilical vein endothelial cells was applied for the encapsulation of islet cells. Viability, function and vascularization wer superior to intrahepatic transplantation site and less donor islets were required due to better vascularization.
[45]*	Shih, H., Lin, C. C.	2013	PEG, PEGDA	Insulin-producing cell line in co-culture with MSC	In vitro			Gelation of thiol-norbonene was achieved using a visible light source with eosin-Y as the only photoinitiator without use of cytotoxic components.
[124]*	Kuehn, C. et al.	2013	Fibrin	Porcine islet cell	In vitro			Islets were encapsulated in fibrin hydrogel or cultured on TCPS-plate in the control group. Fibrin had protective effects on porcine islets if exposed to hydrogen peroxide.

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Citation	Authors	Year	Scaffold material	Cell type	Study design	Transplantation site	Findings
[74]	Ahmad, H. F., Sambanis, A.	2013	RGD–Alginate	Recombinant insulin-producing myoblasts	In vitro		This study investigated the response to conventional freezing and vitrification of encapsulated insulin-secreting cells. Due to the simplicity of the procedure and slightly superior results (metabolic activity and insulin secretion rate) relative to fresh controls freezing is reported to be the more appropriate method.
[86]*	Bernard, A. B., Lin, C. C., Anseth, K. S.	2012	PEGDA	Insulin-producing cell line	In vitro		PEG microwell arrays (crosslinking through contact-photolithography) were used to produce MIN-6 aggregates of specific size. The study showed that the aggregated cells maintained viability and function. Significantly better than single cells after being encapsulated.
[43]*	Steele, J. A. et al.	2012	Gelatine, Alginate	Rat islet cell	In vitro		Gelatin microfibers were fabricated to envelope pancreatic islets with the intention to be incorporated within barium-alginate microcapsules. Fibres were still too thick (22.3 +- 0,4μm) to produce a microencapsulated network.
[215]* **	Kaufman-Francis, K. et al.	2012	PLGA, PLA	Mouse islet cell, in co-culture with fibroblasts and ECs	In vitro In vivo	Subcutaneous	Ex vivo tissue tri-culture (endothelial cells, fibroblasts and islets) was investigated as a 3D multi-cellular model with self-arrangement of branched vessel-like structures.
[148]*	Davis, N. E. et al.	2012	Silk, Collagen	Mouse islet cell in co-culture with mesenchymal stromal cell	In vitro		Co-encapsulation of ECM proteins (laminin, collagen IV), stromal and islet cells in a hydrogel scaffold. Addition of both ECM proteins together did not improve viability and reduced function compared to islets with single ECM protein.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[163]*	Bhaiji, T., Zhi, Z. L., Pickup, J. C.	2012	Alginate, PLL-PC	Insulin-producing cell line, Rat islet cell, in co-culture with MSC	In vitro			Pseudoislet formation was investigated by coculturing beta-cells with MSCs and nanoencapsulation with alternating layers of PLL-PC/heparin, PLL-PC/alginate and PPL-PC/chondroitin-4-sulfate. MSCs suppresses the inflammatory cytokine-mediated apoptosis and enhances insulin production.
[216]	Lee, J. I. et al.	2012	Chondrocyte Sheet	Insulin-producing cell line, in co-culture with HepG2 cell	In vitro	In vivo	Subcutaneous	Chondrocyte sheets were fabricated to develop immunodelusive, immunoisolated bioartificial pancreas (CSI-BAP) by macroencapsulation of artificial islets from commercially available cell lines (RIN-5F). Immunoisolation of allogenic or xenogenic cell lines with immunocompatible chondrocyte sheets.
[160]*	Pedraza, E. et al.	2012	PDMS, Agarose	Insulin-producing cell line, Rat islet cell	In vitro			PDMS together with solid calcium was incorporated within the center of 3D-constructs to prevent the development of detrimental oxygen gradients within large implants. Mathematical modelingwas used to predict what cell loadings and implant geometries will lead to oxygen limitations.
[115]* **	Vernon, R. B. et al.	2012	Collagen, PVA, Alginate	Mouse islet cell	In vitro	In vivo	Omental pouch	Polyvinyl alcohol sponge was infused with collagen I and alginate hydrogel. VEGF release from alginate macrosphere in the center in +VEGF group. No exogenous insulin therapy was necessary.
[23]*	Zhang, Y. et al.	2012	Collagen	Human islet cell, in co-culture with fibroblasts	In vitro			Collagen matrix (CM) or fibroblast-populated collagen matrix (FPCM) were used to investigate the formation of islet-toxic amyloid deposition compared to scaffold-free 2D-control. FPCM-embedded islets had significantly higher insulin response and lower amyloid formation than CM-embedded islets and both significantly improved islet viability and function if compared to 2D-control.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[26]	Forster, N. A. et al.	2011	Vascularized groin chamber	Mouse islet cell		In vivo	Along vessel	This study focused on in vivo engraftment of islets transplanted into prevascularized chamber (silicon tube with matrigel filling) along the superficial epigastric vessels of mice (implanted 3 weeks prior to islets). Engraftment and function was delayed (around 6 weeks) after implantation. Islets in chamber have been significantly inferior to normal healthy pancreata in mice.
[70]* **	Bloch, K. et al.	2011	Alginate	Insulin-producing cell line	In vitro	In vivo	Peritoneal cavity	It was demonstrated that in vivo cell selection by repeated rounds of encapsulation, xenotransplantation and in vitro recovery resulted in the isolation of functional INS-1 cells with improved defense properties against various oxydative agents (hydrogen peroxide, nitric oxide, alloxan) and hypoxia. The selected cells expressed more insulin than the parental ones, but did not show an improved glucose sensitivity.
[232]* **	Gupta, R., Sefton, M. V.	2011	Collagen	Rat islet cell, in co-culture with EC	In vitro	In vivo	Omental pouch	Islet cells were transpanted in endothelial cell (EC)-containing collagen I modules to compare vascularization, cell viability and function to islets in collagen modules (without EC) and free islets. EC-modules resulted in higher peri-islet vascular density, however did not significantly increase islet function.
[17]*	Skiles, M. L. et al.	2011	PEGDM	Insulin-producing cell line	In vitro			The aim of the study was to develope a fluorescent hypoxia detection system by transfering DsRed to cells, which responds to HIF. The study demonstrated that at low oxygen concentrations an early signal occurs prior to insulin production decrease. It is suggested to be a valid predictor which could allow to initiate a remediating response.
[231]* **	Gibly, R. F. et al.	2011	PLGA	Mouse islet cell, Porcine islet cell	In vitro	In vivo	Omental pouch, Epididymal fat	The influence of scaffold-microarchitecture was analyzed: scaffolds fabricated by foaming from 6% polymere solution showed better cell-infiltration and faster diabetes reversal (control group: 2%). Implantation into an omental pouch showed increased survival than epididymal fat pad

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[164]* **	Jalili, R. B. et al.	2011	Collagen	Mouse islet cell, in co-culture with fibroblasts	In vitro	In vivo	Renal subcapsula	A fibroblast populated collagen matrix (FPCM) proved to increase cell survival and function after transplantation, compared to scaffold-free control. Collagen matrices (CM) without fibroblasts also increased viability and function however in a smaller degree. In FPCM enhanced fibronectin, aFGF and HGF production was proven, as well as increased beta cell proliferation rate compared to CM group. No fibroblast overgrowth was observed.
[175]*	Hume, P. S., Bowman, C. N., Anseth, K. S.	2011	PEGDA, PEGDM	Insulin-producing cell line	In vitro			Modified PEG scaffolds were dip-coated using glucose oxidase reactions. The coating induced apoptosis in more than 60% of T-cells seeded atop the coating. While acrylated-PEG coatings had toxic effects on cells (e.g. beta-cells), methacryl-PEG showed cytocompatibility.
[22]*	Vermesh, U. et al.	2011	PDMS, PEG	Human islet cell, Mouse islet cell	In vitro			High-resolution 3D-islet cell constructs (alpha and beta cells) were built using DNA microarrays. The resulting pattern was transferred into PEG hydrogel films.
[225]* **	Chandra, V. et al.	2011	Alginate, PU-PVP-IPN	MSC	In vitro	In vivo	Peritoneal cavity	Human adipose derived mesenchymla stem cells were used as a cell source to be differentiated into insulin-secreting islet like cell aggregates. Pancreatic hormones in vitro were produced in vitro. Encapsulated and transplanted into mice, blood glucose levels were lowered, however normoglycemia was not restored.
[110]*	Daoud, J. T. et al.	2011	PLGA, Collagen	Human islet cell	In vitro			The effects of various bioprinted 3D-microenvironmets on in vitro islet cell cultures were analysed. Three scaffolds with different spacing between strands were compared. A spacing of 400μm was shown to be superior. Cells on a PLGa-scaffold, cultured in collagen I, with additional ECM components (fibronectin, collagen IV) showed the highest islet functionality (insulin release, immunofluorescence, gene expression) compared to other controls groups.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[50]*	Hall, K. K., Gattas-Asfura, K. M., Stabler, C. L.	2011	PEG, Alginate	Human islet cell, Rat islet cell, Insulin-producing cell line	In vitro			Alg-PEG microbeads were fabricated by cross-linking with the Staudinger ligation scheme. Compared to Ba-Alg hydrogels the Alg-PEG hydrogel showed lower osmotic swelling and better survival rates of the cell s.
[57]*	Lin, C. C., Raza, A., Shih, H.	2011	PEGDA, PEG4NB	Insulin-producing cell line	In vitro			Two photo-polymerisation methods were compared. Chain-growth (from PEGDA) and step-growth thiolene reaction (from PEG4NB). Step-growth showed significantly higher cell viability after encapsulation of MIN-6 cells.
[238]* **	Kheradmand, T. et al.	2011	PLGA	Mouse islet cell	In vitro	In vivo	Epididymal fat	Treatment with ethylcarcodiimide-fixed donor splenocytes led to permanent protection (>150d) of 80% of islet grafts and restored normoglycemia after transplantation. Without pre-treatment a rejection occured within 20 days. The pre-treatment was superior in the scaffold-group compared to intra-portal transplantation.
[174]*	Hume, P. S., Anseth, K. S.	2011	PEGDA	Insulin-producing cell line	In vitro			The incorporation of superoxide dismutase mimic into the PEG resulted in a higher viability of cells and preserved metabolic activity after exposure to ROS if compared to blank PEG-control.
[68]* **	Johnson, A. S. et al.	2011	Alginate	Rat islet cell, Insulin-producing cell line, Human islet cell	In vitro	In vivo	Peritoneal cavity	The study analysed different alginate blends by measuring the oxygen consumption rate (OCR), DNA content and the number of nuclei. Perfluorcarbon-alginate showed a higher O2 permeability and thus prevented cell death at low oxygen concentrations (0,5%). however, it was observed cytotoxic to islet cells in contact. In vivo immunreactions could be eliminated by alginate with poly-L-lysin coating but not by aginate alone.
[117]* **	Xu, J. et al.	2011	Collagen	Mouse islet cell	In vitro	In vivo	Renal subcapsula, Subcutaneous	The scaffold investigated in the study significantly increased cell survival and improved the restoration of normoglycemia. The subcutaneous location was inferior to the subrenal location due to less vascularisation.

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Citation	Authors	Year	Scaffold material	Cell type	Study design	Transplantation site	Findings
[226]* **	Muthyala, S. et al.	2011	GPE, PU-PVP-IPN	Mouse islet cell, Pancreatic progenitor cell	In vitro In vivo	Peritoneal cavity	Differentiation to pancreatic progenitor cell-derived islet-like clusters was achieved and showed insulin production. However, less than compared to mouse islet cells. A combined transplantation (scaffold + macroencapsulation) restored normoglycemia in both pancreatic progenitor cell group and islet cell group and was maintained over a period of 90 days.
[44]*	Skiles, M. L., Sahai, S., Blanchette, J. O.	2011	PEGDM	Insulin-producing cell line	In vitro		MIN-6 cells were encapsulated in PEG. Adenoviral transfection of red fluorescencing protein controlled by HIF was shown to be an easy non-invasive way of monitoring the cells.
[217]* **	Deng, C. et al.	2011	Collagen, Chitosan	Human circulating progenitor cell, Mouse islet cell	In vitro In vivo	Subcutaneous	Collagen-chitosan matrices showed better viability than collagen only and increased neo-vascularization was observed in both progenitor cell group and mouse islet group.
[47]*	Lin, C-C., Anseth, K. S.	2011	PEGDA	Insulin-producing cell line	In vitro		The importance of cell-cell interactions on islet viability and function were investigated after encapsulation into PEG hydrogels. A minimum cell packing density of 2 x 10^7 cells/ml was necessary to maintain viability and function without addition of adhesive ligands. Thiolated EphA5–Fc and ephrinA5–Fc positively influence metabolic activity/viability of the cells when added to hydrogels compared to control IgG–Fc.
[82]	Suszynski, T. M. et al.	2011	Porcine plasma, Thrombin	Human islet cell	In vitro		19F-MRS imaging technique allowed non-invasive quality assessment of tissue engineered grafts by determination of pO2 and estimation of the oxygen consumption rate in vitro.

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Citation	Authors	Year	Scaffold material	Cell type	Study design	Transplantation site	Findings
[121]	Mei, Y. et al.	2010	Acrylate	Rat islet cell, ESC	In vitro		A library with 496 different polymers was designed and used to examine the attachment of islet cells. The amine containing monomer was shown to be critical for islet cell attachement. It was less beneficial for ESC attachement. The study discussed the application of polymers to direct cell attachment depending on the cell type.
[41]*	Mason, M. N., Mahoney, M. J.	2010	PEG	Mouse islet cell, in co-culture with fibroblasts and EC	In vitro		Fibroblasts and endothelial cells were encapsulated and cultured within fibrin ribbons that were suspended in a PEG hydrogel. Endothelial cells formed multicellular structures along the fibrin ribbons. Murine islet cells were viable and showed positive staining for insulin.
[182]*	Su, J. et al.	2010	PEG	Insulin-producing cell line	In vitro		MIN-6 cells in PEG hydrogel modified with IL-1 receptor inhibitory peptide showed enhanced viability and insulin secretion in contact with different cytokines and immunoreactive T-lymphocytes than in unmodified hydrogels.
[49]*	Muthyala, S., Bhonde, R. R., Nair, P. D.	2010	Gelatine, PVP	Mouse islet cell	In vitro		Islets in gelatin-PVP crosslinked with ethylcarbodiimide maintained their viable and functional for 30 days without significant difference to control group.
[67]* **	Opara, E. C. et al.	2010	Alginate	Rat islet cell	In vitro In vivo	Omental pouch	Multilayer alginate/poly-l-ornithine/alginate microcapsules were fabricated and showed a release of aFGF and the heparin binding-growth associated molecule from the outer alginate layer.
[176]*	Kizilel, S. et al.	2010	PEG	Mouse islet cell, Rat islet cell	In vitro		The study investigated a nano-thin cell coating of islets of GLP-1 as insulinotropic agent via biotin/streptavidin connection. The intention was to improve islet transplantations into the portal vein.
[201]*	Mason, M. N., Mahoney, M. J.	2010	PEG	Rat iPSC	In vitro		The addition of gamma-secretase inhibitor to the fabricated hydrogel inhibited the Notch signaling pathway and enhanced differentiation and maturation of encapsulated cell clusters. Glucose responsiveness could be maintained.

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Citation	Authors	Year	Scaffold material	Cell type	Study design	Transplantation site	Findings
[177]*	Yang, K. C. et al.	2010	Agarose	Mouse islet cell	In vivo	Intramedullary cavity	Insulin-secreting cells were encapsulated in agarose gel and then enclosed into a calcium phosphate chamber. The construct was transplanted into the intramedullary cavity of diabetic dogs. Cells stayed intact and continued to secrete insulin.
[144]* **	De Carlo, E. et al.	2010	PEG, PVA, Decellularized pancreas	Rat islet cell	In vitro In vivo	Subcutaneous	Decellularized matrices of rat pancreas and liver together with rat islets were entrapped into PVA/PEG tubes. The devices were then implanted subcutaneously into diabteic rats. Implantation led to a reduction of daily insulin needed.
[239]* **	Hussey, A. J. et al.	2010	Gelatine	Mouse islet cell	In vivo	Along vessel	FDA-approved gelatin sponge with nerval groth factor placed in a silicon chamber and transplanted subcutaneously around the femoral neurovascular pedicle of diabetic mice. Islet survival and function in short term. Growth factor was suspected to improv islet viability and secretory function.
[85]*	Mendelsohn, A. D. et al.	2010	PEG	Rat islet cell	In vitro		INS-1 cells were seeded in PEG scaffold functionalized with laminin and 3D-cluster formation to the outlines of the laminin patterns was confirmed after 24h. Insulin production capabilities were maintained. This was the first example of pancreatic beta cell patterning able to perform mono- and multilayerd cell clusters by micro-contact printing.
[18]* **	O'Sullivan, E. S. et al.	2010	Alginate	Rat islet cell	In vitro In vivo	Peritoneal cavity	Single cell solution re-aggregated to clusters again in culture and was superior to intact islets after alginate microencapsulation in viability and function under hypoxic conditions. Higher cell loss in dispersion procedure was outweighed by higher viability in low-oxygen culture.
[227]	Kadam, S. S. et al.	2010	PU-PVP-IPN	MSC	In vitro In vivo	Peritoneal cavity	Differentiation into islet-like clusters was achieved in 10 days. Encapsulated and transplanted, normoglycemia was restored after 15 days and lasted over study period of 3 months.
[24]	Zhao, M. et al.	2010	Peptide nanofibres	Rat islet cell	In vitro		3D-self assembling peptide nanofiber hydrogel was cocultured with rat islets. Islets encapsulated in the scaffold exhibited better secretion function and viability than the control group in 2D culture.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[46]*	Blanchette, J. O. et al.	2010	PEGDM	Mouse islet cell, Insulin-producing cell line	In vitro			The effect of integrin-linked kinase and Bcl-2 overexpression on viability and function was analysed. Both increased viability of dispersed MIN-6 cells and intact islets.
[237]* **	Yang, K. C. et al.	2010	Chitosan	Rat islet cell	In vitro	In vivo	Renal subcapsula	Rat islets were encapsulated in chitosan hydrogel. After implantation viability and function was increased compared to free islets. Encapsulation lead to immunoprotection and thus enabled xenogenic transplantation into mice.
[77]*	Hoesli, C. A., Luu, M., Piret, J. M.	2009	Alginate	Porcine islet cell, in co-culture with hamster ovary cell	In vitro			Alginate filled hollow fiber bioreactor increased insulin content of primary neonatal pancreatic porcine cells compared to suspension culture.
[32]	Silva, A. I., Mateus, M.	2009	Polysulfone	Rat islet cell, Insulin-producing cell line	In vitro			The study observed a cell-clotting on the hydrophobic membranes of the device and thus impaired viability and function.
[14]	Yang, X. D. et al.	2009	Polyhydroxyalkanoates	Insulin-producing cell line	In vitro			Oligo(3-hydroxybutyrate-co-3-hydroxyhexanoate) showed best results with increased viability and function after 48h of culture time in compariason with other investigated polyhydroxyalkanoat substances.
[236]* **	Kodama, S. et al.	2009	PGA, Gelatin	Rat islet cell	In vitro	In vivo	Renal subcapsula	Islets and PGA scaffold were incubated together with growth factors, afterwards suspended in thermoreversible gelatin polymer until degradation of PGA (40days). In cold temperature gelatin polymer was extracted and tissue engineered islets were handpicked and transplanted into SCID mice in subrenal capsula (n=6).

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Citation	Authors	Year	Scaffold material	Cell type	Study design	Transplantation site	Findings
[20]*	Ito, M., Taguchi, T.	2009	PEG	Rat islet cell	In vitro		Polymeric crosslinker working via hydrophobic interactions was used on pacreatic rat cell line. Enhancement of forming spheroids which resulted in higher insulin-secreting capacity. Medium without serum showed best results in forming spheroids.
[200]*	Mason, M. N. et al.	2009	PEG, Collagen	Rat iPSC	In vitro		Rat pancreatic precursor cells were entrapped into PEG and PEG-Collagen hydrogel and effects of cell differentiation were measured. No detectable clusters remaining in PEG hydrogels after 1 week. Differentiation of all cells in clusters into islet-like clusters with glucose responsiveness in PEG-Collagen hydrogel.
[181]*	Lin, C. C., Metters, A. T., Anseth, K. S.	2009	Functionalized PEGDA	Mouse islet cell, in co-culture with MSC	In vitro		Survival and function of mouse islets could be prolonged with TNFalpha-antagonizing PEG hydrogels. Prevention of TNFalpha induced proliferation of hMSCs and maintenence of osteogenic proliferation potential could be noticed.
[188]* **	Jalili, R. B. et al.	2009	Collagen	Mouse islet cell, in co-culture with fibroblasts	In vitro	In vivo	Renal subcapsula	Mouse islets in 3D indoleamine-2,3-dioxygenase-expressing fibroblast populated collagen matrix showed no negative effects on islets in vitro and in vivo.
[219]	Perez-Basterrechea, M. et al.	2009	Thrombin	Rat islet cell, in co-culture with fibroblasts	In vivo	In vivo	Subcutaneous	Islets embedded in clotted blood plasma together with fibroblasts were implanted subcutaneously. Control groups of free islets were tranplanted subcutaneously or under kidney capsule. Normoglycemia was restored over a study period of 60 days in intervention as well as in control under kidney capsula.
[191]*	Mason, M. N., Mahoney, M. J.	2009	PEG	Rat embryonic pancreatic precursor cell	In vitro		Pancreatic precursor cells remained viable for 7 days when cultured in PEG hydrogel. A differntiation into insulin-producing cells was shown but glucose-responsiveness was not achieved.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[153]* **	Mao, G. H. et al.	2009	PLGA	ESC	In vitro	In vivo	Subcutaneous	Generated islet-like cells from ESCs were transplanted with PLGA scaffold under shoulders or without scaffold under kidney capsule of diabetic SCID mice. The cell-scaffold construct could reverse hyperglycemia in the mice.
[73]*	Constantinidis, I. et al.	2009	Alginate	Insulin-producing cell line	In vitro			Supramagnetic nanoparticles were used to perform in vivo cell tracking in MRI of cell-containing alginate microcapsules. Not superior to native contrast. Cell-linked nanoparticles allowed better destinction than scaffold-linked nanoparticles.
[233]	Berman, D.M. et al.	2009	Vircryl, Poly-P-dioxanone	Non-human primate islet cell		In vivo	Omental pouch	Autologous and allogenic islets seeded onto a biodegradable scaffold were used to compare the omental pouch model to the standard intrahepatic transplantation. The grafts remained viable and functional in a long-term, but showed an delayed engraftment. No comparison to transplantation sites without scaffolds.
[129]*	Kawazoe, N. et al.	2009	PLGA, Collagen	Insulin producing cell line	In vitro			PLGA-collagen hybrid meshes were coated with laminin, fibronectin, vitronectin, collagen IV and poly(L-lysine) for 3D culture with most significant effect when coated with laminin regarding cell adhesion and proliferation. More insulin production in 3D culture compared to 2D culture.
[220]* **	Grundfest-Broniatowski, S. F. et al.	2009	Poly(N,N-dimethyl acrylamide), PDMS, Polyurethane, Nitinol	Porcine islet cell		In vivo	Omental pouch, Subcutaneous	Porcine islet cells in a bioartificial scaffold device were implanted in three pancreatectomized dogs. Insulin-secretion could be detected for a maximum of 5 days. Islets remained viable for up to three weeks after implantation without prevascularization or immunosuppression at both transplantation sites. Neovascularization was observed.
[183]*	Lin, C-C. et al.	2009	PEG, PEGDA	Insulin-producing cell line	In vitro			PEG hydrogel functionalized with MCP-1 binding peptides with encapsulated MIN6 cells were transferred in a cytokine cocktail for 6/24h and concentrations of the cell-secreted MCP-1 from gels were determined by ELISA. The release of cell-secreted MCP-1 was significantly reduced.

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Citation	Authors	Year	Scaffold material	Cell type	Study design		Transplantation site	Findings
[25]	Hussey, A. J. et al.	2009	Matrigel in chamber	Mouse islet cell		In vivo	Along vessel	A b-FGF enriched Matrigel chamber was implanted along the epigastric pedicle in mice. After 21 days of prevascularization islets were added in a second surgery and resulted in significant reduction of blood glucose levels.
[192]*	Wang, X., Ye K.	2009	Collagen	ESC	In vitro			A 3D pancreatic differentiation system was investigated that allowed to differentiate the embryonic stem cells stepwise into clustered, insulin-secreting cells.
[114]*	Weber L.M., Hayda K.N., Anseth K.S.	2008	PEG	Insulin-producing cell line	In vitro			MIN-6 cells were cultured in PEG hydrogel. The addition of ECM molecules (collagen IV and laminin) resulted in glucose stimulated insulin secretion.
[218]* **	Yang, K. C. et al.	2008	Chitosan, Gelatin	Insulin-producing cell line	In vitro	In vivo	Subcutaneous	Chitosan/gelatin hydrogel was investiagted as a feasible carrier for cell microspheres. The hydrogel could serve as immunoisolative matrix and protective layer during xenotransplantation. Insulin secretion of macroencapsulated spheres in hydrogel was higher than without macroencapsulation.
[122]	Yuan, Y. et al.	2008	Peptide nanofibres	Rat iPSC	In vitro			Self-assembling peptide nanofibers were suggested as scaffold material for pancreatic islet cells. Increased viability and a higher stimulation index if compared to 2D-control was achieved.
[116]	Kin, T. et al.	2008	Vicryl, Poly-p-dioxanone patch	Dog islet cell		In vivo	Omental pouch	Biodegradable scaffolds enhanced viability and function of islets transplanted into the omental pouch of totally pancreatomized diabetic dogs.