ALLISON HUBEL, PH.D.
Professor
Department of Mechanical Engineering, University of Minnesota
1100 Mech Eng, Del Code 0691, 111 Church Street SE
Minneapolis, MN 55455
612.626.4451
hubel001@umn.edu
http://www.me.umn.edu/people/hubel.shtml
www.biocor.umn.edu

Education

1989 Ph.D., Mechanical Engineering, Massachusetts Institute of Technology
1985 M.S., Mechanical Engineering, Massachusetts Institute of Technology
1983 B.S., Mechanical Engineering, Iowa State University

Academic Faculty Positions

University of Minnesota

1996-2002	Assistant Professor, Department of Laboratory Medicine and Pathology
2002-2008	Associate Professor, Department of Mechanical Engineering
2008-2010	Director of Graduate Studies, Department of Mechanical Engineering
2009-present	Professor, Department of Mechanical Engineering
2010-present	Director, Biopreservation Core Resource (BioCoR)

Massachusetts Institute of Technology

1990-1993	Instructor, Department of Mechanical Engineering

Post Doctoral Researcher

1989-1990	Research Fellow, Department of Surgery, Massachusetts General Hospital
1993-1996	Research Associate, Department of Laboratory Medicine and Pathology, University of Minnesota

Selected Honors and Awards

2017	Outstanding Achievement in Biobanking, ISBER
2013	Scholar, National Blood Foundation
2012	Fellow, American Institute of Medical and Biological Engineers
2008	Fellow, American Society of Mechanical Engineers
2001	Presidential Distinguished Faculty Mentor
1985	Heinrich Hertz Fellowship
1983	ASHRAE Scholarship
1991-1983	General Motors Scholarship

Book

[1] Hubel A, *Preservation of cells: a practical manual*. John Wiley, New York, 2018.

Book Chapters

[1] Hubel A. (2006). “Cellular Preservation - Gene Therapy, Cellular Metabolic Engineering ” In: J.G. Baust (ed). Advances in Biopreservation (143-156). Boca Raton, FL: CRC Press.

[2] Hubel A, and Mathew A,(2016) “Cryopreservation of cells used therapeutically,” In: K. Loper and E. Areman (eds). Cellular Therapy: Principles, Methods and Regulations (444-452) Bethesda, MD: AABB Press.

[3] Hubel A, and Skubitz A.P.N, (2017), “Principals of cryopreservation,” In: P. Hainaut, J. Vaught, M. Pasterk, and K. Zatloukal (eds). Biobanking of human biospecimens: principals and practices (1-21). New York: Springer.

[4] Yu G, Li R, and Hubel A, “Raman cryomicroscopic imaging and sample holder for spectroscopic subzero measures, Method Mol Bio, *in press*.

Editorials

[1] Hubel A, “Cryopreservation of HPCs for clinical use,” Transfusion, 41: 579-580, 2001.

[2] Sputtek A, Hubel A. “In the Days of Beginning Global Warming: Cool is Beautiful,” Transfusion Medicine and Hemotherapy, 34: 223-224, 2007.

Archival Journal Articles

[1] Korber C, Englich S, Schwindke P, Schiewe M, Rau G, Hubel A, and Cravalho EG. “Low temperature light microscopy and its application to study freezing in aqueous solutions and biological cell suspensions,” J Microscopy, 141: 263-276, 1986.

[2] Hubel A, Korber C, and Cravalho EG. “Transient electrical potentials measured during the unidirectional freezing of NaCl/H_2O solutions,” J Crystal Growth, 87: 69-78, 1988.

[3] Beckmann J, Korber C, Rau G, Hubel A, and Cravalho EG. “Redefining cooling rate in terms of ice front velocity and thermal gradient: First evidence of relevance to freezing injury to lymphocytes,” Cryobiology, 27(3): 279-287, 1990.

[4] Koebe H, Dunn J, Toner M, Sterling L, Hubel A, Cravalho EG, Yarmush M, and Tompkins R. “A new approach to the cryopreservation of hepatocytes in a sandwich culture configuration,” Cryobiology, 27: 576-584, 1990.

[5] Harris CL, Toner M, Hubel A, Cravalho EG, Yarmush ML, and Tompkins RG. “Cryopreservation of isolated hepatocytes: Intracellular ice formation under various chemical and physical conditions,” Cryobiology, 28: 436-444, 1991.

[6] Hubel A, Cravalho EG, Nunner B, and Korber C. “Survival of directionally solidified B-lymphoblasts under various crystal growth conditions,” Cryobiology, 29: 183-198, 1992.

[7] Hubel A, Toner M, Cravalho EG, Yarmush ML, and Tompkins RG. “Intracellular ice formation during the freezing of hepatocytes cultured in a double collagen gel,” Biotechnol Prog, 7: 554-559, 1991.

[8] Yarmush M, Toner M, Dunn JCY, Rotem A, Hubel A, and Tompkins RG. “Hepatic tissue engineering: Development of critical technologies,” Ann NY Acad Sci, 665: 238-252, 1992.

[9] McCarty JP and Hubel A. “Endothelial cell detachment from synthetic substrate materials at 4 °C,” Cryo-let, 17: 257-264, 1996.

[10] Darr TB and Hubel A. “Freezing characteristics of isolated pig and human hepatocytes,” Cell Transplant, 6(2): 173-183, 1997.

[11] Hubel A. “Parameters of cell freezing: Implications for the cryopreservation of stem cells,” Transfus Med Rev, 11(3): 224-233, 1997.

[12] Hubel A, Stroncek D, Whitley CB, Pan D, and McCullough J. “Mobilization and transduction of peripheral blood progenitor cells in patients with mucopolysaccharidoses I,” J Hematotherapy, 7(6): 505-514, 1998.

[13] Stroncek DF, Hubel A, Shankar RA, Burger SR, Pan D, McCullough J, and Whitley CB. “Retroviral transduction and expansion of peripheral blood lymphocytes for the treatment of mucopolysaccharidosis type II, Hunter's syndrome,” Transfusion, 39(4): 343-350, 1999.

[14] Korniski B, Darr TB, and Hubel A. “Subzero osmotic characteristics of intact and disaggregated hepatocyte spheroids,” Cryobiology, 38(4): 339-352, 1999.

[15] Hubel A, Norman JA, and Darr TB. “Cryobiophysical characteristics of genetically modified hematopoietic progenitor cells,” Cryobiology, 38: 140-153, 1999.

[16] Burger S, Hubel A, and McCullough J. “Development of an infusible-grade solution for non-cryopreserved hematopoietic cell storage,” Cytotherapy, 1: 123-133, 1999.

[17] Hubel A, Darr TB, and Norman J. “Freezing characteristics of genetically modified lymphocytes for the treatment of MPS II,” Cell Transplant, 8: 521-530, 1999.

[18] Bidault NP, Hammer BE, and Hubel A. “Rapid MR imaging of cryoprotectant permeation in an engineered dermal replacement,” Cryobiology, 40(1): 13-26, 2000.

[19] Orwin EJ and Hubel A. “In vitro culture characteristics of corneal epithelial, endothelial and keratocytes in a native collagen matrix,” Tissue Eng, 6(4): 307-319, 2000.

[20] Koscheyev VS, Leon GR, Hubel A, Nelson ED, and Tranchida D. “Thermoregulation and heat exchange in a nonuniform thermal environment during simulated extended EVA,” Aviat Space Environ Med, 71(6): 579-585, 2000.

[21] Darr TB and Hubel A. “Post thaw viability of precultured hepatocytes,” Cryobiology, 42(1): 11-20, 2001.

[22] Conroy M, Darr TB, and Hubel A. “Influence of preculture on the prefreeze and post thaw characteristics of hepatocytes,” Biotechnol Bioeng, 71(3): 173-183, 2001.

[23] Bidault N, Hammer B, and Hubel A. “Water content in an engineered dermal replacement during permeation of Me_2SO solutions using MR imaging,” Biotechnol Prog, 17(3): 530-536, 2001.

[24] Schmid J, McCullough J, Burger S, and Hubel A. “Non-cryopreserved bone marrow storage in STM-Sav, an infusible-grade cell storage solution,” Cell Preserv Tech, 1(1): 45-51, 2002.

[25] Hubel A, Carlquist D, Clay ME, and McCullough J. “Short term liquid storage of umbilical cord blood,” Transfusion, 43: 626-632, 2003.

[26] Hubel A, Carlquist D, Clay M, and McCullough J. “Cryopreservation of cord blood after liquid storage,” Cytotherapy, 5(5): 370-376, 2003.

[27] Orwin E, Borene M, and Hubel A. “Biomechanical and optical characteristics of a corneal stromal equivalent,” J Biomech Eng, 125: 439-444, 2003.

[28] Borene M, Barocas V, and Hubel A. “Mechanical and Cellular Changes during compaction of a collagen-sponge-based corneal stromal equivalent,” Ann Biomed Engr, 32(2): 274-283, 2004.

[29] Hubel A, Carlquist D, Clay ME, and McCullough J. “Liquid storage, shipment and cryopreservation of cord blood,” Transfusion, 44: 518-525, 2004.

[30] Hubel A, and Darr TB. “Post thaw function and caspase activity of cryopreserved hepatocyte aggregates,” Cell Preserv Tech, 2(3): 164-171, 2004.

[31] Balasubramanian SK, Bischof JC, and Hubel A. “Water transport and IIF parameters for a connective tissue equivalent,” Cryobiology, 52: 62-73, 2006.

[32] Crabb RAB, Chau EP, Evans MC, Barocas VH, and Hubel A. “Biomechanical and microstructural characteristics of a collagen film-based corneal stromal equivalent,” Tissue Engr, 12: 1565-1575, 2006.

[33] Fleming KK and Hubel A. “Cryopreservation of hematopoietic and non-hematopoietic stem cells,” Trans Apheresis Sci, 34: 309-315, 2006.

[34] Crabb RAB, Chau EP, Decoteau D and Hubel A. “Microstructural characteristics of extracellular matrix produced by stromal fibroblasts,” Ann Biomed Engr, 34(10): 1615-1627, 2006.

[35] Fleming KK, Longmire EA and Hubel A. “Numerical characterization of diffusion-based extraction in cell-laden flow through a microfludic channel”, J Biomech Engr, 129: 703-711, 2007.

[36] Chang A, Dantzig J, Darr TB and Hubel A. “Modeling the interaction of biological cells with a solidifying interface,” J Computational Phys, 226: 1808-1829, 2007.

[37] Hubel A, Darr TB, Chang A and Dantzig J. “Cell partitioning during the directional solidification of trehalose solutions,” Cryobiology, 55: 182-188, 2007.

[38] Fleming KK and Hubel A. “Cryopreservation of hematopoietic stem cells: emerging science, technology and issues,” Trans Med Hemotherapy, 34: 268-275, 2007.

[39] Crabb RAB and Hubel A. “Influence of matrix processing on the optical and biomechanical properties of a corneal stromal equivalent,” Tissue Engr, 14(1): 173-182, 2008.

[40] Bischof J, Hubel A and Aksan A. “The role of water at multiple length scales,” J. Japanese Soc Mech Engr, 111(1076): 598-600, 2008.

[41] Mata C, Longmire EK, McKenna DH, Glass KK and Hubel A. “Experimental study of diffusion based extraction from a cell suspension,” Microfluid Nanofluid, 4: 529-540, 2008.

[42] Glass KK, Longmire EK and Hubel, A. “Optimization of a microfluidic device for diffusion based extraction of DMSO from a cell suspension,” Int J Heat Mass Transfer, 51: 5749-5757, 2009.

[43] Hanna J and Hubel A, “Preservation of stem cells”, Organogenesis, 5:134-137, 2009.

[44] Zhang H, Sachdev D, Wang C, Hubel A, Gaillard-Kelly M and Yee D. “Detection and downregulation of type I IGF receptor expression by antibody-conjugated quantum dots in breast cancer cells,” Breast Cancer Research and Treatment, 114: 277-285, 2009.

[45] Dong JP, Hubel A, Bischof JC and Aksan A. “Freeze-Induced phase separation and spatial microheterogeneity in protein solutions,” J Phys Chem B, 113(30): 10081-10087, 2009.

[46] Ragoonanan V, Hubel A and Aksan A. “Response of the cell membrane-cytoskeleton complex to osmotic and freeze/thaw stresses**,**” Cryobiology, 61(3): 335-344, 2010.

[47] Dong JP, Malsam J, Bischof JC, Hubel A and Aksan A. “Spatial distribution of the state of water in frozen mammalian cells,” Biophys J, 99: 2453-2459, 2010.

[48] McCullough J, Haley R, Clay M, Hubel A, Lindgren B and Moroff G. “Long-term storage of peripheral blood stem cells frozen and stored with a conventional liquid nitrogen technique compared with cells frozen and stored in a mechanical freezer,” Transfusion, 50: 808-819, 2010.

[49] Mata C, Longmire EA, McKenna DH and Hubel A. “Cell motion and recovery in a two-stream microfluidic device,” Microfluid & Nanofluid, 8: 457-465, 2010.

[50] Janson C, Romanova L, Hansen E, Hubel A and Lam CH. “Immortalization and functional characterization of rat arachnoid cell lines,” Neuroscience, 177: 23-34, 2011.

[51] Lam CH, Hansen EA and Hubel A. “Arachnoid cells on culture plates and collagen scaffolds: phenotype and transport properties,” Tissue Engineering, 17:1759-1766, 2011.

[52] Hubel A, Aksan A, Skubitz APN, Wendt C and Zhong X. “State of the art in preservation of fluid biospecimens,” Biopreservation & Biobanking, 9: 237-244, 2011.

[53] Hubel A. “Advancing the preservation of cellular therapy products,” Transfusion, 51(S1, Supplement 4): 82S-86S, 2011.

[54] Lam CH, Hansen EA, Jansson C, Bryan A, Hubel A. “The characterization of arachnoid cell transport II: paracellular transport and blood-cerebrospinal fluid barrier formation,” Neuroscience, 222: 228-238, 2012.

[55] Hanna J, Hubel A, Lemke E. “Diffusion-based extraction of DMSO from a cell suspension in a three stream, vertical microchannel,” Biotech & Bioengr, 109: 2316-2324, 2012.

[56] Bala Chandaran R, Reinhart J, Lemke E, Hubel A. “Influence of buoyancy-driven flow on mass transfer in a two-stream microfluidic channel: Introduction of cryoprotective agents into cell suspensions,” Biomicrofluidics, 6: 044110, 2012.

[57] DiVito MD, Rudisill SG, Stein A, Patel SV, McLaren JW, Hubel A. “Silica hybrid for corneal replacement: optical, biomechanical and ex vivo biocompatibility studies,” IOVS, 53: 13, 8192-8199, 2012.

[58] Unhale SA, Solomon R, Skubitz APN, Hubel A. “Stabilization of tissue biospecimens for pathological examination and biomedical research,” Biopres & Biobanking, 10 (6): 493-500, 2012.

[59] Sharma A, Zhu Y, Thor SS, Hubel A, Stadler B. “Magnetic barcode nanowires for osteosarcoma cell control,” IEEE Trans Magnetics, 49: 453-456, 2013.

[60] Pollock K, Albares A, Wendt C, Hubel A. “Isolation of fibroblasts and epithelial cells in Bronchoalveolar Lavage (BAL),” Exp Lung Res, 39: 146-154, 2013.

[61] Lam CH, Hansen EA, Hall W, Hubel A. “Application of transport phenomena analysis technique to cerebrospinal fluid,” J Neurosurg Sci, 57: 317-326, 2013.

[62] Pollock K, Sumstad D, Kadidlo D, McKenna DH, “Clinical mesenchymal stromal cell products undergo functional changes in response to freezing,” Cytotherapy, 17(1): 38-45, 2014.

[63] Sharma RR, Pollock K, Hubel A, McKenna D, “Mesenchymal stem or stromal cells: a review of clinical applications and manufacturing practices,” Transfusion, 54(5): 1418-1437, 2014. *ISI highly cited paper*

[64] Hubel A, Spindler R, Skubitz A, “Storage of human biospecimens: selection of the optimal storage temperature,” Biopres & Biobanking, 12(3): 165-175, 2014.

[65] Hubel A, Spindler R, Curtsinger J, Lindgren B, Wiederoder S, McKenna DH, “Postthaw characterization of umbilical cord blood: markers of storage lesion,” Transfusion, 55: 1033-1039, 2015.

[66] Rudisill S, Divito MD, Stein A, Hubel A, “*In vitro* Collagen Fibril Alignment via Incorporation of Nanocrystalline Cellulose,” Acta Biomaterialia, 12: 122-128, 2015.

[67] Sharma A, Orlowski GM, Zhu Y, Shore D, Kim SY, DiVito MD, Hubel A, Stadler BH, “Inducing cells to disperse nickel nanowires via integrated-mediated response,” Nanotechnology, 26: Article Number: 135102, 2015.

[68] Pollock K, Yu G, Moller-Trane R, Koran M, Dosa PI, McKenna DH, Hubel, A, “Combinations of osmolytes, including monosaccharides, disaccharides and sugar alcohols act in concert during cryopreservation to improve mesenchymal stromal cell survival,” Tissue Engineering: Part C, 22: 999-1006, 2016.

[69] Pollock K, Budenske JW, McKenna DH, Dosa PI, Hubel A, “Algorithm-driven optimization of cryopreservation protocols,” J Tissue Engr Regen Med, 10: 2806-2815, 2017.

[70] Lam CH, Romanova L, Hubel A, Janson C, Hanson C E, “The influence of fibroblasts on the arachnoid leptomeningeal cells in vitro,” Brain Research, 1657: 109-229, 2017.

[71] Pollock K, Samsonraj RM, Dudakovic A, Thaler R, Stumbras A, McKenna DH, Dosa PI, van Wijnen AJ, Hubel A, “Improved post-thaw function and epigenetic changes in mesenchymal stromal cells cryopreserved using multicomponent osmolyte solutions,” Stem Cells and Development, 26: 828-842, 2017.

[72] Rasooly R, Gossett D, Henderson M, Hubel A, Thibodeau S, “A Precision Medicine Initiative Cohort Program Workshop,” Biopreservation and Biobanking, 15: 4341-343, 2017.

[73] Yu G, Pollock K, Yap YR, Hubel A, “Characterizing intracellular ice formation of lymphoblasts cryopreserved in different cryoprotectant compositions using low temperature Raman microspectroscopy,” Biophysical J, 112 (12): 2653-2663, 2017.

[74] Li R, Yu G, Azarin SM, Hubel A, “Freezing responses in DMSO-based cryopreservation of human iPS cells: aggregates versus single cells,” Tissue Engineering: Part C, 24 (5): 289-299, 2018.

[75] Sharma A, DiVito, M D, Shore DE, Block AD, Pollock K,Solheid P,Feinberg JM, Modiano J,Lam CH, Hubel A, Stadler BJH, “Alignment of collagen matrices using magnetic nanowires and magnetic barcode readout using first order reversal curves (FORC)”, J Magnetism and Magnetic Materials, 459: p. 176-181, 2018.

[76] Pi CH, Yu G, Petersen A, Hubel A, “Characterizing the ‘Sweet spot” for the preservation of a T-cell line using osmolytes”, Scientific Reports, 8(1): p. 16223, 2018.

[77] Yu G, Li R, Hubel A, “Interfacial interactions of sucrose during cryopreservation detected by Raman spectroscopy”, Langmuir, 35(23): p. 7388-7395, 2019.

[78] Pi CH, Yu G, Dosa PI, Hubel A, “Characterizing modes of action and interaction for multicomponent osmolyte solutions on Jurkat cells”, Biotech & Bioengr, 116(3): p. 631-643, 2019.

[79] Hornberger K, Yu G, McKenna DH, Hubel A, “Cryopreservation of hematopoietic stem cells: emerging cryoprotectants, and technology to improve outcome”, Transfusion Med Hemotherapy, 4(3): p. 188-196, 2019.

[80] Yu G, and Hubel A, “The role of preservation in the variability of regenerative medicine products”, Regen Engr and Trans Med, doi.org/10.1007/s40883-019-00110-9

[81] Li R, Johnson R, Yu G, McKenna DH, Hubel A, “Preservation of cell-based immunotherapies for clinical trials”, Cytotherapy, 21(9): 943-957, 2019.

[82] Pi CH, Dosa PI, Hubel A, “Differential evolution for the optimization of the DMSO-free cryoprotectants: influences of control parameters, J Biomech Engr, 142 (7): 071006.

[83] Li R, Hornberger K, Dutton JR, Hubel A, “Cryopreservation of human iPS cell aggregates in a DMSO-free solution-an optimization and comparative study”, Frontiers in Biotechnology, **DOI:** 10.3389/fbioe.2020.00001.

[84] Pi CH*, Hornberger K*, Dosa PI, Hubel A, “Understanding the freezing responses of T-cells and other subsets of human peripheral blood mononuclear cells using DSMO-free cryoprotectants, Cytotherapy, in press.

Refereed Conference Proceedings

[1] Hubel A, Toner M, and Cravalho EG. “Isothermal nucleation stage and its application in the freezing of biological cells,” Trans Am Soc Mech Eng Heat Transfer Division, 87-WA/HTD-90/BED-5: 67-71, 1987.

[2] Darr TB and Hubel A. “Investigation of subzero water transport properties for isolated hepatocytes and hepatocytes cultured in spheroids,” Trans Am Soc Mech Eng, Bioeng Div, 29: 269-270, 1995.

[3] Nelson ED and Hubel A. “Post-freeze thaw characteristics of collagen sponge,” Trans Am Soc Mech Eng, Bioeng Div, 29: 99-100, 1995.

[4] Hubel A and Darr TB. “Cryobiophysical parameters for freshly isolated human hepatocytes and HEP G2/C3A cells,” Adv Heat and Mass Transfer Biotech, HTD-Vol 322: 73-74, 1995.

[5] Hubel A, Burger S, Whitley CB, and McCullough J. “Expansion and transduction of blood cells for gene therapy,” Trans Am Soc Mech Eng, Bioeng Div, 35: 419-420, 1997.

[6] Hubel A and McCullough J. “Cryopreservation of cultured blood cells for use in gene therapy and immunotherapy,” Adv Heat and Mass Transfer Biotech, HTD-Vol 355: 97-98, 1997.

[7] Korniski B and Hubel A. “A model of low-temperature water transport for hepatocyte spheroids,” Ann NY Acad Sci, 858: 183-190, 1998.

[8] Hubel A, Williams A, and McCullough J. “Role of surface modification on the culture and transduction of hematopoietic cells for gene therapy,” Trans Am Soc Mech Eng, Bioeng Div, 42: 7-8, 1999.

[9] Hubel A and Orwin EJ. “Migration of corneal epithelium on a collagen sponge in vitro and in vivo,” Trans Am Soc Mech Eng, BED-vol 50, 351-352, 2001.

[10] Hubel A, Bidault N, and Hammer B. “Transport characteristics of glycerol and propylene glycol in an engineered dermal replacement,” IMECE2002-32557, 2002.

Conference Abstracts

[1] Hubel A, Korber C and Cravalho EG. “Transient electrical potentials measured during the unidirectional freezing of $NaCl/H_2O$ solutions,” Society for Cryobiology Annual Meeting (Augusta, Georgia; July 1985) [abstract].

[2] Hubel A, Cravalho EG, Beckmann J and Korber C. “Influence of growth velocity and temperature gradient in the encapsulation of B-lymphoblasts,” Society for Cryobiology Annual Meeting (Aachen, Germany; July 1988) [abstract].

[3] Beckmann J, Korber C, Hubel A and Cravalho EG. “The freezing behavior of human lymphocytes in a process of directional solidification characterized by a thermal gradient and ice front velocity,” Society for Cryobiology Annual Meeting (Aachen, Germany; July 1988) [abstract].

[4] Koebe H, Dunn J, Toner M, Hubel A, Sterling L, Cravalho EG, Yarmush M and Tompkins RG. “Cryopreservation of hepatocytes: initial experience with an improved technique to maintain long-term hepatocyte function,” Society for Cryobiology Annual Meeting (Charleston, South Carolina; June 1989) [abstract].

[5] Nunner B, Korber C, Rau G, Hubel A and Cravalho EG. “Characterization of phase front morphologies in aqueous solutions subjected to directional solidification,” Society for Cryobiology Annual Meeting (Charleston, South Carolina; June 1989) [abstract].

[6] Hubel A, Nunner B, Korber C and Cravalho EG. “Directional solidification for the freezing of cell suspensions,” Society for Cryobiology Annual Meeting (Charleston, South Carolina; June 1989) [abstract].

[7] Toner M, Harris CL, Hubel A, Sterling LM, Dunn JCY, Yarmush ML, Cravalho EG and Tompkins RG. “Water permeability parameters of isolated hepatocytes between 0 and 12 C,” Society for Cryobiology Annual Meeting (Binghamton, New York; June 1990) [abstract].

[8] Toner M, Harris CL, Hubel A, Sterling LM, Dunn JCY, Yarmush ML, Cravalho EG and Tompkins RG. “Intracellular ice formation in isolated rat hepatocytes: I-Theory,” Society for Cryobiology Annual Meeting (Binghamton, New York; June 1990) [abstract].

[9] Harris CL, Toner M, Hubel A, Sterling LM, Dunn JCY, Yarmush ML, Cravalho EG and Tompkins RG. “Intracellular ice formation in isolated rat hepatocytes: II-Experiments,” Society for Cryobiology Annual Meeting (Binghamton, New York; June 1990) [abstract].

[10] Hubel A, Toner M, Harris CL, Sterling LM, Dunn JCY, Yarmush ML, Cravalho EG and Tompkins RG. “Intracellular ice formation in hepatocytes cultured in a double-layer collagen matrix,” Society for Cryobiology Annual Meeting (Binghamton, New York; June 1990) [abstract].

[11] Toner M, Hubel A, Cravalho EG, Ryan C, Borel-Rinkes IB, Yarmush M and Tompkins RG. “Thermodynamics and cryomicroscopy of hepatocyte freezing,” Society for Cryobiology Annual Meeting (Leuven, Belgium; July 1991) [abstract].

[12] Toner M, Hubel A, Cravalho EG, Ryan C, Tompkins RG and Yarmush ML. "Cryopreservation of hepatocytes: biophysical properties and cellular response," Biomedical Engineering Society Annual Meeting (Charlottesville, NC; October 1991) [abstract].

[13] Hubel A. "Solidification microstructures: relevance to freezing injury," Society for Cryobiology Annual Meeting (Ithaca, New York; July1992) [abstract].

[14] Hubel A and Darr TB. "Internal ice formation characteristics of isolated pig hepatocytes," Society for Cryobiology Annual Meeting (Kyoto, Japan; August 1994) [abstract].

[15] Hubel A and McCarty JP. "Endothelial cell detachment at 4°C under static conditions," Society for Cryobiology Annual Meeting (Madison, Wisconsin; July 1995) [abstract].

[16] Huebsch JC and Hubel A. "Basic cryobiophysical parameters of IIF and dehydration for G-CSF stimulated mononuclear cells," Society for Cryobiology Annual Meeting (Madison, Wisconsin; July 1995) [abstract].

[17] Hubel A. "Cryopreservation of hematopoietic progenitor cells: fundamental issues and merging technologies," International Society of Blood Transfusion (Makuhari, Japan; April 1996) [abstract].

[18] Hubel A, McCullough J, Whitley CB and Stroncek D. "Transduction of stem cells for the treatment of mucopolysaccharidoses type I," Keystone Symposium on Gene Therapy (Snowbird, Utah; April 1997) [abstract].

[19] Hubel A, Whitley CB, Burger S and McCullough J. "Expansion and transduction of blood cells for gene therapy," Summer Bioengineering Meeting (Sun River, Oregon; 1997) [abstract].

[20] Burger S, Kadidlo D, Hubel A, Whitley CB, Stroncek D and McCullough J. "Serum-free expansion of transduced lymphocytes for gene therapy," American Society of Hematology Annual Meeting (San Diego, California; December 1997) [abstract].

[21] Burger SR, Herr F, Hubel A and McCullough J. "Development of an infusible-grade hematopoietic cell storage solution," American Association of Blood Banks Annual Meeting (San Diego, California; December 1997) [abstract].

[22] Cornelius E and Hubel A. "Development of a tissue engineered corneal replacement," Biomedical Engineering Society Annual Meeting (San Diego, California; October 1997) [abstract].

[23] Korniski B and Hubel A. "Transport modeling during the freezing of hepatocyte spheroids," Biomedical Engineering Society Annual Meeting (San Diego, California; October 1997) [abstract].

[24] Bidault NP, Hammer BE and Hubel A. "Use of a combined C4S-Keyhole imaging technique to study the dynamics of cryoprotective agents in an engineered tissue," International Society for Magnetic Resonance in Medicine Annual Meeting (Sydney, Australia; April 1998) [abstract].

[25] Cornelius E and Hubel A. "Behavior of corneal epithelium, endothelium, and stromal cells cultured in a three-dimensional matrix," Association for Researchers in Vision and Ophthalmology Annual Meeting (St. Petersburg, Florida; April 1998) [abstract].

[26] Orwin EC and Hubel A. "Corneal wound healing: role of matrix composition in transparency," Association for Researchers in Vision and Ophthalmology Annual Meeting (St. Petersburg, Florida; April 1999) [abstract].

[27] Hubel A, Williams A and McCullough J. “The role of surface modification on the culture and transduction of hematopoietic cells for gene therapy,” Summer Bioengineering Conference (Big Sky, Montana; July 1999) [abstract].

[28] Hubel A and Norman J. “Role of culture on the post thaw survival of lymphocytes,” Society for Cryobiology Annual Meeting (Boston, Massachusetts; July 2000) [abstract].

[29] Hubel A and Orwin E. “Migration of corneal epithelium on a collagen sponge in vitro and in vivo,” Summer Bioengineering Meeting (Snowbird, Utah; June 2001) [abstract].

[30] Hubel A and Darr TB. “Passive loading of trehalose into cells,” Society for Cryobiology Annual Meeting (Breckenridge, Colorado; July 2002) [abstract].

[31] Hubel A, Carlquist D, Clay M and McCullough J. “Influence of liquid storage on post-thaw viability,” International Society for Cell Therapy Annual Meeting (Phoenix, Arizona; May 2003) [abstract].

[32] Hubel A and Darr TB. “Post thaw function of cryopreserved hepatocyte aggregates,” Society for Cryobiology Annual Meeting (Coimbra, Portugal; September 2003) [abstract].

[33] Crabb RAB and Hubel A. “Influence of microstructure on the biomechanical and optical properties of corneal stroma equivalents,” Association for Researchers in Vision and Ophthalmology Annual Meeting (Fort Lauderdale, Florida; May 2005) [abstract].

[34] Balasubramian S, Bischof JC and Hubel A. “Water transport and IIF parameters for a connective tissue equivalent,” Summer Bioengineering Conference (Vail, Colorado; June 2005) [abstract].

[35] Fleming KK, Hubel A, Barocas VH and Longmire EA. “Diffusion-based extraction of DMSO from post thaw cell suspension,” Society for Cryobiology Annual Meeting (Minneapolis, Minnesota; July 2005) [abstract].

Note: received best student poster award.

[36] Arefe G, Hubel A, Kortshagen U, Sedgewick G, and Unger, G. “Silicon Quantum Dots For Breast Cancer Imaging,” Biomedical Engineering Society Annual Meeting (Chicago, IL; Oct 2006) [abstract].

[37] Arefe G, Hubel A, Kortshagen U, Sedgewick G, and Unger, G. “Silicon Quantum Dots For Breast Cancer Imaging,” Minnesota Biomedical Nanotechnology Workshop (Minneapolis, MN; Nov 2006 [abstract]).

[38] Mata C, Longmire E, Fleming K and Hubel, A. “Experimental Study of Diffusion-Based Extraction from a Cell Suspension,” BMES Annual Fall Meeting (Chicago, IL; Oct 2006) [abstract].

[39] Fleming K, Mata C, Longmire EK and Hubel A. “Diffusion-based extraction of dimethyl sulfoxide from a cell suspension,” Society for Cryobiology Annual Meeting (Lake Louise, Canada; July 2007) [abstract].

[40] Crabb RAB and Hubel A. “Macroscopic and microstructural properties of a multilayer corneal replacement,” Association for Research in Vision and Ophthalmology Meeting (Fort Lauderdale, FL; May 2008) [abstract].

[41] McKane AV, Sumstad D, Sumstad T, Kadidlo D, Hubel A and McKenna DH. “Haematopoietic progenitor cell viability quality control ability of umbilical cord blood integral segments,” AABB Annual Meeting (Montreal, Quebec, Canada; Oct 2008) [abstract].

[42] Jacob E, Sumstad D, Hubel A, Kadidlo D and McKenna DH. “Temperature spikes during transport of umbilical cord blood units: an evaluation of impact on product quality,” AABB Annual Meeting (Montreal, Quebec, Canada; Oct 2008) [abstract].

[43] Hubel, A. “Preservation of cell therapies: stem cells and beyond,” Society for Thermal Medicine Annual Meeting (Phoenix, AZ; April 2009) [abstract].

[44] Hubel, A. “Why do we need research in preservation science?” Biorepository Research Network Annual Meeting (Washington DC; Mar 2010) [abstract].

[45] Hubel A, Zhong X and Aksan A, “Novel biocomposite corneal replacement,” International Society for Eye Research (Montreal, Quebec, Canada; May 2010) [abstract].

[46] Hubel A and Aksan A. “Preservation of biofluid biospecimens,” Science of Biobanking meeting (Providence, RI; Dec 2010) [abstract].

[47] Hubel A, Skubitz APN and Aksan A. “The Biopreservation Core Resource (BioCoR): A resource based on the science of biospecimen preservation,” International Society for Biological and Environmental Repositories Annual Meeting (Crystal City, VA; May 2011)[abstract].

[48] Hubel A, Malsam J, Bischof JC and Aksan A. “Determination of the intracellular thermodynamic state of cells during freezing using single-cell microspectroscopy,” Society for Cryobiology Annual Meeting (Corvallis, OR; July 2011) [abstract].

[49] Hubel A, Albares L, Osten M, Wendt C. “Stabilizing and isolating cellular biomarkers in lung biospecimens,” Biorepository Research Network (Washington DC; Jan 2012)[abstract]

[50] Pollock K, Sumstad D, McKenna D, Hubel A. “Senescence and cell function: prefreeze and post-thaw analysis of clinical MSC products,” Society for Cryobiology Annual Meeting (Washington DC; July 2013) [abstract].

[51] Hubel A, “Selecting the proper storage temperature for your biospecimens”, Biobanken-Forschung in Deutchland: vom konzept sur Realisierung,” Tagungsband (Berlin, Germany; December 2014) [abstract].

[52] Pollock K, Budenske J, Moy E, McKenna DH, Dosa PI and Hubel A, “Algorithm Optimization Of Non-DMSO Cryopreservation Protocols Results In Improved Mesenchymal Stem Cell Functionality,” BMES 2016 (Minneapolis, MN; October 2016) [abstract].

[53] Pollock K, Budenske JW, McKenna DH, Dosa PI and Hubel A, “Algorithm optimization of cryopreservation protocols to improve Mesenchymal stem cell functionality,” Cryobiology 2016 (Ottawa, Canada; July 2016) [abstract].

[54] Pollock K, Budenske JW, McKenna DH, Dosa PI and Hubel A, “Optimization of Mesenchymal Stem Cell Freezing,” Engineering/Stem Cell Institute Symposium (Minneapolis, MN; June 2016) [abstract].

[55] Hubel A, Pollock K, Samsonraj R, McKenna DH and van Wijnen AJ, “Improved post thaw function of mesenchymal stromal cells using solutions containing osmolytes,” ISCT (London, UK; May 2017) [abstract].

[56] Pi CH, Hubel A, "Improving the preservation of T-cells", ISBioTech Spring Meeting (Norfolk, VA; March 2018)[abstract].

[57] Yu G, Li R, Hubel A. "Characterizing Freezing Responses of Human iPS Cells Using Low-Temperature Raman Spectroscopy ", ISBER (Dallas, TX; May 2018) [abstract].

[58] Hubel A, Hornberger K, Li R, Pi CH " Mechanisms Of Cryoprotection For Multicomponent Osmolyte Solutions", Society for Cryobiology Annual meeting (San Diego; CA, July 2019) [abstract].

[59] Elliott J, Bhullar J, Tona A, Hubel A, Pi CH, Li R, Cell-Based Reference Materials For Cryopreservation?", Society for Cryobiology Annual meeting (San Diego, CA; July 2019) [abstract].

[60] Hubel A, Li R*, Pi CH*, "Cryopreservation Of Cellular Therapies Using Multicomponent Osmolyte Solutions", Society for Cryobiology Annual meeting (San Diego, CA; July 2019) [abstract].

[61] Hornberger K*, Hubel A, "Improving Natural Killer Cell Cryopreservation Using Natural Deep Eutectic Systems", Society for Cryobiology Annual meeting (San Diego, CA; July 2019) [abstract].

[62] Hubel, A, "Optimizing freezing profiles", Society for Low Temperature Biology Annual meeting (Seville, Spain; Sept 2019) [abstract].

[63] Li R, Hubel A, "Optimizing Freezing Profile And DMSO-free Solution To Ensure Successful Cryopreservation Of IPS Cell Aggregates", TERMIS annual meeting (Orlando, FL; Dec 2019) [abstract].

Patents

"Infusible grade short-term cell storage medium for mononuclear cells," U.S. Patent 5,955,257, Issued September 21, 1999.

"Infusible grade short-term cell storage medium," U.S. Patent 6,277,557, Issued August 21, 2001.

"Compositions and methods for cryopreservation of peripheral blood lymphocytes," U.S. Patent 7,112,576, Issued September 26, 2006.

"Silica-based composite ocular device and methods," US Patent 9,492,271, 2016.

"Inlet and outlet geometries for a vertical three-stream microfluidic device," EP 2838984A1, US 9556412, US 2015011241, WO2013158737A1, 2017.

"Cryopreservative compositions and methods," 10314302, issued: 06/11/2019.

Start up companies

mesoFLOW

BLUE CUBE

Invited Presentations

Universities and Research Institutions

"Cryopreservation of Stem Cells for Gene and Immunotherapy," Fred Hutchinson Cancer Research Center (Seattle, Washington; June 1997).

"Gene Therapy for Blood Cells," College of St. Johns (Collegeville, Minnesota; October 1997).

“Gene Therapy Using Blood Cells,” Department of Bioengineering, Rice University (Houston, Texas; Feb 1998).

“Gene Therapy Using Hematopoietic Cells,” Robarts Research Institute, University of Western Ontario (London, Ontario; May 1998).

“Cryopreservation of Cellular Therapies,” National Institutes of Health Warren Magnuson Clinical Research Center (Bethesda, Maryland; Aug 2000).

“Collagen Matrix Applications in Corneal Wound Healing,” Department of Laboratory Medicine and Pathology, University of Alberta (Edmonton, Alberta; June 2000).

“Collagen Matrix Applications for Corneal Wound Healing,” Department of Mechanical Engineering, Louisiana State University (Baton Rouge, Louisiana; Feb 2001).

“Preservation of Engineered Tissues and Cell Based Therapies: Emerging Opportunities and Challenges,” Department of Biomedical Engineering, University of Wisconsin (Madison, Wisconsin; Jan 2002).

“Preservation of Engineered Tissues and Cell Based Therapies: Emerging Opportunities and Challenges,” Department of Biomedical Engineering, Rice University (Houston, Texas; March 2002).

“Preservation of Engineered Tissues and Cell-Based Therapies: Integration of Engineering and Biology,” Department of Mechanical Engineering, University of Illinois, Champagne-Urbana (Urbana, Illinois; March 2002).

“Nanoparticle/Cell Interactions,” Minnesota Particle Society Annual Meeting (Brooklyn Park, Minnesota; March 2005).

“Emerging issues in cryopreservation,” National University Medical Institutes, National University of Singapore, (Singapore; Oct 2006).

“Silicon quantum dots for cancer imaging,” Drexel University (Philadelphia, Pennsylvania; Dec 2007).

“Cryopreservation of stem cells,” University of Hannover, Institute fuer Mehrphasenprozesse, (Hannover, Germany; Oct 2007).

“Corneal tissue engineering,” Department of Mechanical Engineering, Michigan State University, (East Lansing, Michigan; Feb 2009).

“Advances in techniques and strategies for preserving cells,” Food and Drug Administration (Bethesda, MD; Dec 2010).

“Cryopreservation: moving beyond myths and developing an understanding molecular mechanisms of damage,” National Institute of Standards and Technology (Rockville, MD; Dec 2010).

“Advances in Biopreservation,” Department of Mechanical Engineering, Iowa State University (Ames, IA; Feb 2012).

“Cryopreservation of cell therapies: emerging issues and challenges,” Department of Mechanical Engineering, U of Washington (Seattle, WA; Nov 2012).

“Common pitfalls and problems in biobanking,” Karolinska Institute (Stockholm, Sweden; Dec 2014).

“Emerging approaches to preserving cells for therapeutic applications,” Frauenhofer IBMT (Sulzbach, Germany; Feb. 2016)

"Improving preservation of mesenchymal stromal cells", Production Assistance for Cell Therapy Workshop (NHLBI, Washington DC; May 2018)

National/International Conferences

"Solidification Microstructures: Relevance to Freezing Injury," Society for Cryobiology Annual Meeting (Ithaca, NY; June 1992).

"Cryopreservation of Hematopoietic Cells," International Society for Blood Transfusion (Makuhari, Japan; July 1996).

"Cryopreservation of Cultured Blood Cells for Use in Gene Therapy and Immunotherapy," International Mechanical Engineering Congress and Exposition, American Society of Mechanical Engineers (Houston, TX; Nov 1997).

"Regulatory Issues in Cryopreservation of Cellular Therapeutics and Engineered Tissues," Society for Cryobiology Annual Meeting (Pittsburgh, PA; July 1998).

"Modeling of Transport in Hepatocyte Spheroids," Biotransport 1998 (Kusadasi, Turkey; June 1998).

"Biocompatibility of Surgical MEMS," International Mechanical Engineering Congress and Exposition (Nashville, TN; Nov 1999).

"Cryopreservation of Hepatocytes," Society for In Vitro Biology (Minneapolis, MN; June 2006).

"Cell Graft Engineering using Microfludics," American Association of Blood Banks (Miami, FL; Oct 2006).

"Cryopreservation of hematopoietic stem cells: how did we get here and where are we going," Production Assistance for Cell Therapy Spring Meeting (Saint Paul, MN; April 2007).

"Cryopreservation of cells: how did we get here," American Association of Blood Banks, Spring Cell Therapy Meeting (San Diego, CA; Mar 2007).

"Cryopreservation of cells: where we are and where we are going," Production Assistance for Cell Therapy (Minneapolis, MN; April 2007).

"Cryopreservation of stem cells," Society for Cryobiology (Lake Louise, Edmonton, Canada; July 2007).

"Aspekte der Kryochirurgie und Kryokonservierung: Zellschädigung an biologischen Zellen und Gewebe," Deutsch Kalte- und Klimatechnischer Verein (Hannover, Germany; Oct 2007).

"Fundamentals of cryopreservation," Wilbio Cell Banking Meeting (Philadelphia, PA; Nov 2007).

Cryopreservation of hematopoietic stem cells: how did we get here and where are we going," AABB Spring Cell Therapy Meeting (Orlando, FL; April 2008).

"Improving your preservation practice," Production Assistance for Cell Therapy Workshop (Pittsburgh, PA; May 2008).

"Why do we need research in preservation science?" Biorepository Research Network Meeting (Washington DC; March 2010).

"Emerging issues in preservation of cellular therapies," Production Assistance for Cell Therapy Workshop (Minneapolis, MN; Oct 2010).

"Preservation of biofluid biospecimens," Science of Biobanking meeting (Providence, RI; Dec 2010).

"Corneal Tissue Engineering," International Society for Eye Research (Montreal, Canada; July 2010).

"Exploring the need for universal standardization of good storage practices," ISBER Annual Meeting (Crystal City, VA; May 2011).

"Bridging the gap: the need to stabilize biological systems to facilitate biomedical and scientific research," NAOSSM Annual meeting (Minneapolis, MN; July 2011).

"Entrepreneurship," Big Ten Women's Workshop (Milwaukee, WI; April 2013).

"Bookends to the freezing process: prefreeze processing and post thaw assessment," ISCT North American Meeting (Philadelphia, PA; Sept 2013).

"What we know about the influence of storage temperature on biospecimen quality," Leaders in Biobanking Meeting (Indianapolis, IN; Nov 2013).

"Scientific basis for selection of a storage temperature," ISBER Annual Meeting, (Orlando, FL; May 2014).

"Common sense and common pitfalls in biobanking," Leaders in Biobanking Meeting, (Seattle, WA; Sept 2014).

"The bleeding edge: emerging issues in biobanking and cryopreservation," European Society of Biopreservation and Biobanking (Leipzig, Germany; Oct 2014).

"Using thermodynamic principals and practical realities to select a storage temperature for biospecimens,"3rd National Biobank Symposium, TMV (Berlin, Germany; Dec 2014).

"Tackling the challenges of downstream processing of cell therapies," Cell Culture and Downstream Processing Meeting (Munich, Germany; Feb 2016)

"Single cell spectroscopy for understanding freezing damage," SCIX (Minneapolis, MN; Sept 2016)

"Transforming preservation of cells used therapeutically: improved post thaw function of MSC," ISBiotech Meeting (Washington DC; Mar 2017)

"Improved post thaw function of mesenchymal stromal cells using solutions containing osmolytes," ISCT (London, UK; May, 2017)

"Transforming the preservation of cells used therapeutically: improved post thaw function of MSCs", ISbiotech Meeting (Washington DC, March 2017)

"The biophysics of freezing tissue", Histochemical Society Annual Meeting (San Diego, CA, May 2018)

"The role of preservation in the variability of regenerative medicine products", National Academy of Medicine, Science and Engineering, Regenerative Medicine Forum (Washington DC, Oct 2018).

"Mechanisms of cryoprotection for multicomponent osmolyte solutions", Cryo2019 (San Diego, CA, July 2019).

"Controlled rate freezing of cell therapy product", SCUG/SLTB (Seville Spain, Sept 2019).

Industry/Business

"Cryopreservation of Cells and Development of Artificial Cornea," APCO Associates (Minneapolis, MN; April 1995).

"Cryopreservation of Cells for Immunotherapy," Minnesota Project Innovation (Minneapolis, MN; May 1995).

"Development of a Tissue Engineered Cornea," Minnesota Medical Foundation Board of Trustees (Minneapolis, MN; Feb 1996).

"Development of an Artificial Cornea," Baxter Healthcare Corporation (Minneapolis, MN; July 1996).

"Gene Therapy," Medical Device/Venture Capital Forum (Minneapolis, MN; Dec 1996).

"Preservation Issues for Stem Cells and Stem-Cell Based Therapies," British American Business Council (St. Paul, MN; March 2003).

"The Role of Cell Preservation in the Development of a Manufacturing Paradigm for Cell Therapies," Baxter Health Care (Round Lake, IL; August 2003).

"Cell Preservation," Beckman-Coulter (Chaska, MN; March 2004).

"Advances in Biopreservation: Fundamentals of Cryopreservation," BioLife Solutions, (Boston, MA; April 2004)

"Stem Cell Preservation," MedSuds Stem Cell Conference, (Minneapolis, MN; Nov 2004).

"Cryopreservation of Stem Cells," National Marrow Donor Program, (Minneapolis, MN; Nov 2008).

"Biopreservation Core Resource," Life Science Alley (Minneapolis, MN; Dec 2010).

"Cryopreservation of Adult-derived hematopoietic and mesenchymal stem cells," ISBiotech Meeting (Norfolk, VA; April 2011).

"New Methods and Best Practices for Improving Biopreservation of Research Samples," Biostorage Technologies Sample Management Symposium (Indianapolis, IN; May 2011).

"MicroFluidics and Micro-scale Infrared Imaging - a marriage of important advances for dynamic chemical studies of cells," Regional Nanotechnology Conference (St. Cloud, MN; Feb 2013).

"Using microfluidics to improve cell preservation processing," 3M (Saint Paul, MN; May 2013).

"What we know about the influence of storage temperature on biospecimen quality," Leaders in Biobanking Meeting (Indianapolis, IN; Nov 2013).

"The process is the product," Genetech (San Francisco, CA; Jan 2016)

"Cryopreservation of cellular therapies," Gamida (Tel Aviv, Israel; May 2016)

"Preservation of cells: fundamentals and emerging issues," Bio-Techne (Minneapolis, MN; March 2018).

"Naturally inspired approach to the preservation of multicellular systems", ARMI/BioFab Spring meeting (Manchester, NH, June 2019).

University of Minnesota

"Engineered Tissues: Determination of Cryobiophysical Characteristics," Biomedical Engineering Seminar (Dec 1993).

“Gene and Immunotherapy at the University of Minnesota,” Pres. Mark Yudof (Feb 1996).

“Fundamentals of Cryopreservation,” Cell Therapy Laboratory, Fairview University Medical Center (Oct 1996).

“Engineering Issues for the Development of Cellular Therapies,” Biomedical Engineering Graduate Program (March 1998).

“Cryopreservation of Cellular Therapeutics,” Grand Rounds, Department of Laboratory Medicine and Pathology (Nov 1998).

“NMR Applications in Cryobiology,” Graduate Program in Biophysics Seminar (Dec 2000).

“Cryopreservation of Cellular Therapeutics: Emerging Opportunities and Challenges,” Grand Rounds, Department of Laboratory Medicine and Pathology (Sept 2001).

“Cryopreservation of Cellular Therapy,” MD/PhD Seminar Series (Feb 2002).

“Preservation of Engineered Tissues and Cell-based Therapies: Integration of Engineering and Biology,” Department of Mechanical Engineering Seminar (March 2002).

“Permeability: Applications in Cryobiology and Tissue Engineering,” Department of Chemical Engineering/Membrane Group (March 2004).

“Stealth Nanoparticles: Fooling Biological Defenses,” Nanoparticle Science and Engineering (March 2004).

“Characterizing Cell/Nanoparticle Interactions,” Design of Medical Devices Symposium (April 2004).

“Microfluidics in Cell Processing,” Design of Medical Devices Symposium (April 2004).

“Fundamentals of Cell Preservation,” Design of Medical Devices Symposium (April 2004).

“Functional Corneal Stromal Engineering,” Design of Medical Devices Symposium (April 2005).

“Film-Based Tissue-Engineered Cornea Stromal Equivalents,” Design of Medical Devices Conference (April 2006).

“Silicon nanocrystals for cancer imaging,” Nanobiotechnology Workshop (Oct 2006).

“Stem cell engineering: role of cryopreservation,” Stem Cell Institute (Jan 2008).

“Tissue engineering in urology,” Department of Urology (Oct 2008).

“Issues in stem cell preservation,” Stem Cell Institute (May 2009).

“Liquid and cryopreservation of stem cells,” Medical Device Symposium (Sept 2009).

“Biopreservation and biobanking: engineering contributions,” ME Departmental Seminar (Oct 2010).

“Preservation as a platform technology for improving treatment of neurological disorders,” U of MN Department of Neurology (Oct 2013).

“Advances in our understanding of stem cells can be used to improve their preservation,” Stem Cell Institute (Oct 2014)

“Transcending the cold black box: the future of preservation,” MN Stem Cell Engineering Symposium (Nov 2015)

"Looking to nature to improve preservation of cellular therapies," College of Science and Engineering Curiosity Drives Lecture Series (March 2018)

Webinars

"Cryopreservation: troubleshooting," Production Assistance for Cell Therapy, Feb 2008.

"Emerging issues in cryopreservation of cellular therapies," ISCT webinar series, Jun 2011.

"Practices in cellular therapy: cryopreservation, thaw and infusion," AABB Audioconference Series, Nov 2011.

"Cord blood: markers for storage lesion", AABB Audioconference, Nov 2014.

"State of the art in the preservation of pediatric biomarker research", Sumner J Yaffe Memorial Lecture Series, NICHD; Oct 2016.

"Advancing the preservation of tissue biospecimens", HuMap/NIH workshop, Washington DC, Jun 2017.

Post Doctoral Candidates Supervised

Mark Conroy (2000) "NMR spectroscopy of hepatocytes with and without preculture." Present position: Assistant Professor, Department of Radiology, University of Minnesota.

Clara Mata (2006-2008) "Cell graft engineering using microfluidics" (co-advised with Ellen Longmire).

Sen Lin (2010), "Development of a novel hybrid cornea" (co-advised with Alptekin Aksan)

Sanket Unhale (2011-2012), "Spectroscopy of fixed and frozen tissue".

Ralf Spindler (2013-2014), "Analysis of umbilical cord blood stored for extended periods of time"

Junjie Zhu (2013-2015), "Microfluidic device for removal of DMSO from frozen and thawed cell therapy products".

Ph.D. Graduate Student Advisees *(current candidates in italics)*

Nicolas Bidault (1999) "Characterization of Viability and Transport of Cryoprotective Agents in an Engineered Tissue Using Nuclear Magnetic Resonance." Present position: Proctor and Gamble; Rome, Italy.

Elizabeth Orwin (nee Cornelius) (2000) "Culture of Corneal Cells on a Collagen Scaffold: Development of an Engineered Corneal Replacement." Present Position: Professor and Chair, Engineering Department, Harvey Mudd College; Claremont, CA.

Rachael AB Crabb (2007) "Collagen processing for tissue-engineered corneas: influence on optical and biomechanical properties." Present position: Coloplast; Maple Grove, MN.

Katie Glass (nee Fleming) (2008) "Numerical modeling of diffusion based-extraction of DMSO from a cell suspension in a microfluidic channel. " *3M Fellowship recipient. Doctoral Dissertation Fellowship recipient.* Present position: Proctor and Gamble; Cincinnati, OH.

Cornelius Lam (2011) "Engineering of arachnoid granulation tissue." Present position: Physician, Department of Neurosurgery, Veterans Administration Hospital; Minneapolis, MN.

Michael D. DiVito (2015) "Design of Silica-Collagen Nanocomposite for Corneal Replacement." *Doctoral Dissertation Fellowship recipient.* Present position: Postdoctoral associate, Northwestern University Medical School; Chicago, IL.

Katie Pollock (2016) “Algorithm Optimization of non-DMSO cryopreservation protocols to improve MSC post thaw function.” *3M Fellowship recipient. Doctoral Dissertation Fellowship recipient.* Present position: Engineer, Juno Therapeutics; Seattle, WA.

Guanglin Yu, (2018) “Characterizing Freezing and Thawing Response of Multiple Types of Cells Cryopreserved in both DMSO and non-DMSO Cryoprotectants”. Present position: Novartis.

Chia-Hsing Pi,(2019) “Using Computational Tools to Understand Interactions between Osmolytes and Optimize the Preservation of Heterogeneous Cell Populations of Primary Cells”. Present position: postdoctoral associate.

Rui Li, “Preservation of multicellular systems” (expected graduation date 2021)

Kathryn Hornberger, “Sites of damage and mechanisms of protection for immune cell subsets” (expected graduation date 2022).

Rachel Johnson, “Strategies for preservation of bioprinted tissues”, (expected graduation date 2023).

Adam Juelfs, “Preservation of cardiomyocytes in sheets and aggregates”, (expected gradutation date 2024).

M.S. Graduate Student Advisees *(current candidates in italics)*

John McCarty (1995 Plan B) “Endothelial Cell Detachment from Vascular Graft Materials under Hypothermic Conditions.” Present position: Development Manager, Medtronic Corporation; Fridley, MN.

Brian Korniski (1999 Plan A) “Theoretical and Experimental Characterization of Water Transport in Spheroids.” Present position: Assistant Scientist, Department of Laboratory Medicine and Pathology; Minneapolis, MN.

Melinda Borene (nee Madgett) (2002 Plan A) “Corneal Keratocyte Phenotype and Traction Force in a Collagen Matrix.” Present position: Medtronic Corporation; Minneapolis, MN.

Andrew Zachman, (2004 Plan B) “Chemical Modification of Collagen to Enhance Mechanical ad Biological Properties.” Present position: Galil Medical; Minneapolis, MN.

Jeff Walhoff (2004 Plan B) “Modeling Dehydration in Mammalian Cells for Cellular Preservation Applications.” Present position: Physician; Duluth, MN.

Niroop Ammbashankar (2007 Plan B) “Silicon quantum dot as a probe to optical imaging.” Present position: Sirona Corporation; York, PA.

Ghidewon Arefe (2008 Plan B) “Synthesis and modification of luminescent silicon quantum dots for use as a biomedical imaging probe.” Present position: Rosemount Co.

Ivan Lui (2008 Plan B) “Encapsulation of cells in alginate and freezing response.” Present position: BAE; Eden Prairie, MN.

Nik Goran (2009 Plan B), “Influence of viscosity mismatch on the diffusion of cryoprotective agents from a fluid stream in a microfluidic device.” Present position: BAE; Eden Prairie, MN.

Rohini Balachandaran (2010 Plan A) “Introduction of cryoprotective agents in using a microfluidic device.” Present position: Postdoctoral associate, Lawrence Berkeley Laboratory; Berkeley, CA.

Tapan Sharma (2012 Plan B) “Characterizing Properties of Collagen-based Endothelial Cell Carriers as Corneal Stroma Equivalent.” Present position: Data Sciences International; New Brighton, MN.

Damian Harris (2013 Plan B) “Light scattering in corneal material.” Present position: Sila Nanotechnologies; Alameda, CA.

Amit Sawhey (2014 Plan B) “Deposition of silica on collagen fibers using the Stober method.” Present position: Beckman Coulter; Chaska, MN.

Chi Tran (2015 Plan B) “DMSO-free preservation of lymphocytes.” Present position: Boston Scientific, Arden Hills, MN.

Marissa Koran (2015 Plan B) “Optimization of sugar, polyol and amino acid based cryopreservation solutions: the effect of monosaccharides versus disaccharides.” Present position: Smith Medical; Minneapolis, MN.

Marika Crider (2016 Plan B) “Bioprinting as a method to manufacture collagen and collagen-silica composites for the application of corneal replacement applications.” Present position: Medtronic Corporation; Minneapolis, MN.

Arjun Dubhashi (2016 Plan B) “Numerical Optimization of a gravity fed high throughput microfluidic device for the extraction of cryoprotective agents.” Present position: Medtronic Corporation; Minneapolis, MN.

Aron Stumbras (2016, Plan A), “Examination of Post-Thaw Behavioral between DMSO and Non-DMSO cryopreserved Bone Marrow Mesenchymal Stem Cells.” Present position: Miromedix; Minneapolis, MN.

Emily Vance (2017, Plan B), “Influence of red blood cell hematocrit on the viscosity of RBCs in glycerol.” Present position: Beckman Coulter; Chaska, MN.

Fadumo Yusuf (2018, Plan A), “Control of cell motion using microfluidics”

Undergraduate Research Advisees (in chronological order)

Rosemary Little	Shepali Bhaktia	Eric Chao
Elizabeth Cornelius	Amelia Wang	Scott Mahanty
Chad Achenbach	Christine Tse	Murtaza Adam
Amy Williams	Melody Taveras	Ta-Yuan Ho
Kristine Peterson	Kimberly Opraseuth	Stephanie Hequembourg
Jessica Marzec	Gregely Hegedus	Danya Decoteau
Adi McCarthy	Nathan Meyer	Nathan Handel
Lindsay Wisnewski	Nadia Jahaveri	David Welch
Jacob Hanna	Mike Vanacora	Maykong Leepo
Rob Chambers	Jennifer Reinhart	Jeremy Boedeker
Luke Albares	Craig Huang	Katrina Kniez
Thomas Dufresene	Matt Hagen	Samantha Madden
Matt Osten	Luke Albares	Anshul Gupta
Laura Billar	Seneca Thornley	Jane Danstrom
Botian Zhang	Joe Budensky	Taylor Lund
Masaki Amada	Tijen Peterson	Danielle Chase
Elizabeth Moy	Yan Rou Yap	Hafsa Ibraham
Po Tin Mak	Sylvia Yu	Paul Esslinger
Jacob Herbers	Colin Bain	Maddy Wagner
Kyle Knofczynski	Jordan Wallace	

Staff Scientists

T. Brian Darr (1995-2010)
John Norman (1998-2001)
Brian Korniski (2001-2002)
Dale Carlquist (2000-2002)

Research Grants *(current funding in italics)*

2/1/94-1/31/95, “Matching Funds for the Purchase of a Freeze Dryer,” Minnesota Medical Foundation, (PI), $10,000.

3/1/95-2/28/96, “Application of Magnetic Resonance Imaging to Water and Cryoprotectant Transport,” Minnesota Medical Foundation, (PI), $3,500.

9/1/94-8/31/96, “Determination of Water and Cryoprotectant Transport in Engineered Tissues Using Magnetic Resonance Imaging,” National Science Foundation, BES9410428, Hubel(PI), Hammer (Co-I), $18,000.

9/1/95-8/31/96, “Thermoregulation and Heat Exchange in a Non-uniform Thermal Environment During Simulated EVA,” National Aeronautics and Space Administration, Koscheyev(PI), Leon (Co-I), Hubel (Co-I), $441,000.

10/1/95-6/30/97, “Progenitor and Somatic Cell Processing/Preservation Project,” Baxter Healthcare Corporation, McCullough (PI), Hubel (Co-I), $150,000.

2/1/97-1/31/98, “Development of a Tissue Engineered Corneal Prosthesis,” Minnesota Medical Foundation, (PI), $10,000.

3/1/96-2/28/98, “Analysis of the Cryobiophysical Effects of Arabinogalactin,” Larex, Inc, (PI), $56,000.

9/15/94-8/31/99, “Training Grant: Characterization of Cell Behavior in Biological Matrices,” National Science Foundation, BIO9413241, Tirrell (PI), Hubel (Co-I), $180,000.

2/1/97-6/30/99, “Technical Testing of Cellsep Cell Separation Media,” and “Methods Development: Large Scale Lymphocyte Separation Protocol,” Larex, Inc, (PI), $32,000.

11/1/96-10/31/99, “Cryopreservation of Blood Products for Research and Therapeutic Purposes,” SOTA TEC Fund, Blandin Foundation, (PI), $200,000.

1/1/95-12/31/99, “Large Scale Production of Blood and Bone Marrow Cells,” National Institutes of Health P01-HD32652, McCullough (PI), Hubel (Co-I), $720,879.

11/1/97-6/30/99, “Lease of Virtis Freezemobile Freeze Dryer,” (PI), Cellex, Inc, $8,500.

2/1/00-1/31/01, “Cryopreservation of Neuronal Progenitor Cell,” SOTA TEC Fund, Blandin Foundation, (PI), $65,000.

9/30/96-8/31/01, “Cryobiophysical Characteristics of Spheroids,” National Institutes of Health R29-GM544886, (PI), $551,250. <*NIH First Award*>

7/1/01-6/30/02 “Multipotent Adult Progenitor Cells for the Treatment of Corneal Surface Defects,” Academic Health Center Faculty Seed Grant, (PI), $24,576.

3/1/01-12/31/02, “Cord Blood Short-Term Storage Project,” American Red Cross, McCullough (PI), Hubel (Co-I), $130,000.

7/1/02-6/30/03, “Anhydrobiotic Preservation of Cells,” Biomedical Engineering Institute, (PI), $33,000.

6/1/04-6/30/07 “Visualization of Biological Events at Ideal Near Infrared Wavelengths,” Digital Technology Center, (PI), $24,570.

7/1/04-1/15/06, Microfluidic Approach to Cell Processing,” University of Minnesota Grant-in-Aid, Hubel (PI), Longmire (Co-I), $24,961.

12/16/03-12/15/07, “Numerical and Experimental Investigation of Solidification in Biological Systems,” NASA, Hubel (PI), $200,000.

7/1/05-6/30/06, “Post-Thaw Processing of Hematopoietic Stem Cells Products,” National Blood Foundation, Hubel (PI), Longmire (Co-I), McKenna (Co-I), $50,000.

7/1/2006-12/7/07, “Nanostructured contrast agent for imaging breast tumors,” Office of Vice President for Research, Hubel (PI), Kortshagen (Co-I), Yee (Co-I), Wang (Co-I), $82,500.

2/1/06-1/31/09, “Cell graft engineering using microfluidics,” National Institutes of Health (R21EB004857-02), Hubel (PI), Longmire (Co-I), McKenna (Co-I), $411,000.

9/1/06-12/31/08, “Cryopreservation solution testing,” SurModics, Inc., (PI), $30,000.

7/1/2007-6/30/2008, “Center for biotransport,” Institute for Engineering in Medicine, Bischof (PI), Hubel (Co-I), Aksan (Co-I), $200,000.

1/1/2008-12/31/2009, “Microfluidic processing of small cell samples for preservation,” Medical Device Center, (PI), $49,827.

03/01/2010-02/28/2013, State of MN, “Novel silica hybrid for corneal replacement,” (PI), $577,826.

09/01/2010-08/31/2013 AHC/IEM/CSE, “Biopreservation Core Resource Start Up,” (PI), $225,000.

04/01/2012-03/31/2016, Veterans Administration (1I01BX001657-01), CSF Clearance of Intracranial Debris from Traumatic Brain Injury, Lam (PI), Hubel (Co-I), $918,000.

04/01/2012-03/31/2014, NIH (1R21HL112653), Post thaw assessment of umbilical cord blood, Hubel (PI), McKenna (Co-I), $228,000.

09/01/2012-08/31/2013, NIH (PACT contract, Wagner, PI), “Optimize MSC cryopreservation methods”, Hubel (Co-I),$150,000.

07/01/2013-06/30/2014, CTSI-ODAT, “Microfluidic device for removal of DMSO from frozen and thawed cell therapy products”, (PI), $50,000.

08/01/2013-07/31/2016, NIH (R21EB016247), Technology platform for development of multi-component preservation solution”, Hubel (PI), Dosa (Co-I), McKenna (Co-I), $468,357.

01/01/2015-12/31/2014 MN Drive-Entrepreneurship program, “Commercialization of a microfluidic device”, (PI), $30,000.

01/01/2010-12/31/2014, MN-Drive-Exploratory program, “Consortium for 3D printing of medical devices, (PI), $40,000.

04/01/2015-03/31/2019, NIH (U01HL127479), MN-REACH Research Evaluation and Commercialization Hub. (REACH), Muscoplat (Co-PI), Gurvich (Co-PI), Hubel (Co-PI), He (Co-PI), $6,117,426.

08/31/2015-05/31/2020, NIH (R25HL128372), “Integrated training in development and clinical practice of cell-based therapies”, Hubel (Co-PI), McKenna (Co-PI), $553,347.

06/01/2016-05/31/2017, NSF (1560894), “Mentoring and networking workshop for women faculty in the Big Ten, (PI)”, $49,500.

09/01/2016-08/30/2017, NIH (R43HL130123), “Development of a microfluidic device for removal of glycerol from cultured red blood cells, (PI of subcontract), $66,670.

08/03/2017-04/30/2020, NIH (R01EB023880), “Multicomponent solutions for the preservation of cell therapy products (PI), $1,118,000*. Competing renewal was scored in fundable range.*

04/01/2020-03/31/2024, NIH (R24OD028444), “Development of a novel method for the cryopreservation of Drosophila melanogaster”, $2,401,505. Grants was scored in fundable range.

Service to Government or Professional Organizations

Proposal Reviews/Study Sections

National Institutes of Health (eligible for continuous submission: 2013-2015)
National Science Foundation
Canadian Institutes of Health Research
Council for Life and Earth Sciences, the Netherlands
Maryland Sea Grant
American Institute of Biological Sciences
Agency for Science, Technology and Research, Singapore
Food and Drug Administration

Scientific Journals

Acta Materialia Haematologica

Annals of Biomedical Engineering	International Journal of Heat and Mass Transfer
Biochemistry and Cell Biology	Investigative Ophthalmology & Visual Science
Biochimica Biophysica Acta	Journal of Analytical Chemistry
Biomaterials	Journal of Biomechanical Engineering
Biomicrofluidics	Journal of Biomaterials
Biophysical Journal	Journal of Cellular Physiology
Biopreservation & Biobanking	Journal of Functional Biomaterials
BioProcess International	Journal of Microscopy
Biotechnology & Bioengineering	Journal of Tissue Engr & Regenerative Medicine
Biotechnology Journal	Lab on a Chip
Biotechnology Progress	Nanotechnology
Blood	Ophthalmic Research
Cell Preservation Technology	PLoS ONE
Cryobiology	Scientific Reports
Cryo-Letters	Stem Cells Translational Medicine
Cytotherapy	Tissue Engineering
Expert Reviews in Medical Devices	Transfusion

Professional Organizations and Activities

Society for Cryobiology (1985-present)
- Board of Governors, 2002-2008
- Membership Committee (Chair), 2002
- Program Committee (Member and Chair), 2004-2006, 2019
- Annual meeting (Co-Chair), 2005

American Society for Mechanical Engineers (1987-present)
- K17 Committee (Member, 1987-present)
- Session chair, 1990

American Society of the Testing of Materials
- Subcommittee on the Preservation of Tissue Engineered Medical Products (Chair), 2000-2003

Biomedical Engineering Society, (1997-2008)

International Society for Cell Therapy, (2002-2008, 2017)

International Society for Biological and Environmental Repositories (2010-present)
- Publications committee (2013-2017)
- Biospecimen science working group (2014-2017)
- Co-Chair for ISBER North American regional meeting (2019)

All of us, President's Precision Medicine Initiative Workshop (co-organizer) (2017)

US Pharmacopeia (2011-2012)

American Institute for Medical and Biological Engineers (2013-present)

Big Ten Women's Workshop
- Organizing committee (2010, 2013)
- Workshop chair (2016)

Big Ten Academic Alliance
- Academic Leadership Program (2017)

National Heart, Lung and Blood Institute
- Future of short-term training programs workshop (2018)

Editorial Activities

Biopreservation & Bioengineering (2012-2015, deputy editor)
ASME Advances in Bioengineering 1999, 2003 (associate editor)
Transfusion Medicine and Hemotherapy 2008 (co-editor of special issue)
Journal of Biomechanical Engineering 2009 (co-editor of special issue)

Service at U of Minnesota

University-wide Committees

Selection of a new licensing associate for patents and licensing group at Patents and Technology Marketing (1999-2004)
Medical School Planning Group (1997)
Medical School Technology Transfer Committee (1997)
Openness in Research (2014-present)
Interdisciplinary Fellowship Committee (2015-present)
MN Futures Committee (2016)
U of MN Infrastructure Grant Committee (2017)
Search for Executive Director of Technology Commercialization (Chair)

College-level

Promotion and Tenure Committee (2016-present)

Departmental

Biomedical Engineering

Admissions Committee (1995, 1998, 2004, 2007)
Summer Internship Admissions Committee (1995, 1998, 2001)
Curriculum Committee (1997)
Faculty Recruiting Committee (chair 1998, member 2002, 2007)

Mechanical Engineering

Mechanical Engineering Measurement and Instrumentation Committee (2002, 2012-2014)
Written Preliminary Examination Committee, member and chair (2004-2005)
Undergraduate Laboratory Equipment Committee (2003-2006, 2011-present)
Graduate Student Fellowship Committee (2008)
Medical Device Faculty Search Committee (2008)
Director of Graduate Studies (2008-2010)
Faculty Search Committee (2010, 2012)
Departmental Fellowship Committee (2016, 2017)

Institute for Engineering in Medicine

Executive committee (2013-2018)

Academic courses taught

BMEn 5001 Biomaterials
BMEn 5002 Biological Aspects of Biomaterials
BMEn 5003/5041 Tissue Engineering*
ME 3324 Introduction to Thermal Sciences
ME 3331 Thermal Sciences I
ME 3333 Thermal Sciences III
ME 4031 Basic Mechanical Measurements Laboratory
ME 4054 Design Projects
ME 4331 Thermal Energy Engineering Laboratory
ME 5666 Modern Thermodynamics

Professional courses developed/taught

Preservation of molecular, cellular and tissue biospecimens
Preservation of cellular therapies
Med Tech Commercialization Bootcamp
Med Tech Value Proposition Workshops
Med Tech Strategy Clinics

Date: 08March2020