BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Pekkan, Kerem	
Web Pages www.linkedin.com/in/kerempekkan http://www.facebook.com/pekkan.lab http://bio-fluids.org www.cmu.edu/biofluids *(old web site)*	Professor of Biomedical and Mechanical Engineering orcid.org/0000-0001-7637-4445

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Middle East Technical University	B.S.	07/92	Mechanical Engineering
Middle East Technical University	MSc	02/95	Experimental Fluid Dynamics
Middle East Technical University	PhD	11/00	Computational Fluid Dynamics
Purdue University	Post Doctoral	7/03	Cellular Biomechanics and Propulsion
Georgia Institute of Technology	Post Doctoral	12/06	Cardiovascular Fluid Mechanics

A. Personal Statement

Dr. Kerem Pekkan studies biological fluid dynamics and biomechanics, having major contributions in pediatric cardiovascular engineering and embryonic cardiovascular development. Kerem Pekkan received his PhD at the Middle East Technical University, focusing computational and experimental fluid dynamics for moving/reactive interfaces and worked in aerospace industry for 5 years at an active R&D unit. Through his post-doctoral studies at Purdue -Innovative Propulsion Systems Laboratory, together with NASA-Glenn, he developed unsteady gas-turbine systems and wave rotors. In parallel, he investigated chondrocyte biofluid dynamics. At Georgia Institute of Technology, School of Biomedical Engineering, he completed a second post-doctoral study at the Cardiovascular Fluid Mechanics Laboratory, before his promotion to Research Assistant Professor at Georgia Tech. He completed computational and experimental research studies in complex cardiovascular flow regimes and devices. His work at Georgia Tech contributed to the physiological understanding of pediatric cardiovascular surgeries, with his articles appearing on the covers of top clinical and engineering journals, including two articles in Circulation. In 2006, he received the Prof. Dr.-Ing. Helmut Reul young investigator award. At Carnegie Mellon University, as an associate professor, he established the new research field of embryonic cardiovascular mechanics. He published extensively on fetal/pediatric hemodynamics, cardiovascular optimization and theory, neonatal cardiopulmonary by-pass, caval flow regulation, cardiovascular biomimetics, micro-velocimetry, cilia mechanics and flagellar propulsion, over 85 peer-reviewed publications and four US patents. As a Principal Investigator, his research is sponsored through prestigious awards of American Heart Association, National Science Foundation CAREER program, PITA, Dowd foundation and through the European Research Council (ERC) Consolidator Grant, FP7-CIG, as well as European Molecular Biology (EMBO) YIP/IG program. The courses he has taught include Introduction to Biomechanics, Biological Fluid Dynamics, Cardiovascular Mechanics, Gas Dynamics, Professional Issues in Biomedical Engineering, Biomimetic Engineering Analysis and Design, Mechanical Design, Machine Design and Finite Element Analysis.

h-index: 31 (Harzing's Publish or Perish Jan. 2011); 327 citations in 2013, 2000 citations; 80 Pubmed publications. Supervisor or Co-Supervisor of 20 PhD, 13 MS and 39 research undergraduate students.

B. Positions and Honors

Positions and Employment

2012 -	Associate Professor, Mechanical Engineering Department, Koc University, Turkey
2012 - 2016	Associate Professor, Biomedical/Mechanical Engineering, Carnegie Mellon University
2007 - 2012	Assistant Professor, Biomedical Engineering Department, Carnegie Mellon University
2007 - 2012	Assistant Professor, Mechanical Engineering Department, Carnegie Mellon University
2005 - 2007	Research Assistant Professor, Cardiovascular Fluid Mechanics Laboratory, Biomedical Engineering Department, Georgia Institute of Technology, Atlanta, USA
1996 - 2000	Propulsion Engineer, R&D Department, Roketsan (Aerospace Industries Inc.), Turkey

1991 - 1996 Teaching Assistant, Middle East Technical University, Ankara, Turkey

Other Experience and Professional Memberships

2013-2018	European Molecular Biology Organization (EMBO) YIP/IG Program faculty
2017-	Clinical research and ethics committee board member (Koc University)
2013	American Physical Society 66th DFD Meeting organizing committee member
2013	Guest Editor on "Fetal Hemodynamics" for Cardiovascular Engineering and Technology Journal (a BMES Journal)
2011-2012	ASME Bioengineering Conference Student Paper Competition Committee Co-chair
2008- present	Member, American Heart Association Cardiac Development & BioE Review panels
2007- present	Member, NSF Bioengineering review panels
2004- present	Reviewer, Major cardiovascular and biomedical engineering journals (JTCVS, ATS, ABME, JBM, JBME, Circulation, PNAS, PLOS, GCMB, MBEC)

Honors

2018: Invited talk: University of Madison, Biomedical Engineering Department
2018: Ground Rounds Lectures at Mayo Clinic Minnesota
2017: Invited Talk, 53rd Annual Meeting of Japanese Society of Pediatric Cardiology/Surgery, Japan
2017: Featured Article: Motile cilia mediated flow improves sensitivity and temporal resolution of olfactory computations, *Current Biology* (with Yaksi-Lab, Norway)
2016: Invited Talk, Engineering Frontiers in Pediatric and Congenital Heart Disease, Florida
2015: Invited Talk, North American Vascular Biology Organization (NAVBO) Meeting, Boston
2015: Invited Talk, Virginia Tech Biomedical Engineering Department, Blacksburg
2014: BMES Meeting NSF Special Session on Research in Biomedical Engineering and Grant Writing
2013-14: Invited talks: University of Florida, University of Limerick, Texas A&M, Kyoto University, IUPUI
2013: **Associate Editor**: Cardiovascular Engineering and Technology (BMES Journal), Artificial Organs and Frontiers in Pediatrics (EPFL)
2012: **Recipient of ERC Consolidator Grant** Award to study embryonic cardiovascular morphomechnics
2012: Invited talk, 3rd International Conference on Engineering Frontiers in Pediatric and Congenital Heart Disease, Stanford University, Palo Alto California
2011: NIH-International Conference on Mathematical Modeling and Computer Simulation of Cardiovascular and Cardiopulmonary Dynamics, Williamsburg VA, Invited lecture
2011: Invited talk, World Society for Pediatric and Congenital Heart Surgery, 3rd Scientific Meeting
2011: Keynote talk, 17th Bioengineering in Ireland Conference
2010: **NSF-CAREER Award**: Internal biofluid dynamics in embryonic cardiovascular development
2009: Invited Talk, 5th Pediatric Mechanical Circulatory Support Systems Conference, Dallas
2005: Prof. Dr. -Ing. Helmut Reul Young Investigators Award
2005: Session Chair: Hemodynamics APS Division of Fluid Dynamics 58th Annual Meeting, Chicago
2004: Invited Talk, Biomedical Engineering Society (BMES) Annual Fall Meeting, Philadelphia
1992: BS Graduation with rank 7 out of the class of 256 mechanical engineering students

C. Selected Peer-reviewed Publications *(Selected from **92 peer-reviewed** publications)*

Most relevant to the current emphasis

1. **Pekkan K**, Piskin S, Hemodynamic cardiovascular surgical planning - a practical toolkit with open source tools, (*contract signed with Springer*), 2017/18 – BOOK
2. **Pekkan K**, Aka IB, Tutsak E, Emek E, Balim H, Lazoglu I, Turkoz R, In vitro validation of a self-driving aortic-turbine venous-assist device for Fontan patients, Journal of Thoracic and Cardiovascular Surgery, in press, 2018
3. Karakaya C, Goktas S, Celik M, Keller B, **Pekkan K**, Symmetry in Mechanosensitive Gene Expression during Aortic Arch Morphogenesis. Nature - Scientific Reports, accepted, 2018
4. Yigit B, **Pekkan K**, Non-dimensional physics of pulsatile cardiovascular networks and energy efficiency, *Journal of Royal Society Interface*, 13(114): 20151019, 2016

5. Lashkarinia SS, Piskin S, Bozkaya TA, Salihoglu E, Yerebakan C, **Pekkan K**, Parametric limits of computational pre-surgical pulmonary artery patch reconstruction framework, Annals of Biomedical Engineering, 2018, in press,
6. Donmezov S, Piskin S, **Pekkan K**, Non-invasive in vivo determination of residual strains and stresses, *Journal of Biomechanical Engineering*, 137(6): 061011, 2015
7. Goktas S, Chen CY, Kowalski WJ, Pekkan K. Hemodynamic Flow Visualization of Early Embryonic Great Vessels Using μPIV, Methods in Molecular Biology: Tissue Morphogenesis, Editor Celeste Nelson, 1189:17-30, Springer, 2015
8. Lindsey SE, Kowalski WJ, Shekhar A, Butcher JT, **Pekkan K**, Growth and hemodynamics after early embryonic aortic arch occlusion, *Biomechanics and Modeling in Mechanobiology*, 14(4): 735-51, 2015
9. Yigit B, Kowalski W, Hutchon D, **Pekkan K**, Transition from the fetal to neonatal circulation: Modeling the effects of umbilical cord clamping, *Journal of Biomechanics*, 48(9):1662-70, 2015
10. Piskin S, Undar A, **Pekkan K**, Neonatal cardiopulmonary bypass hemodynamics with detailed Circle of Willis anatomy, *Artificial Organs*, 39(10):E164-75, 2015
11. Yap CH, Liu X, **Pekkan K**, Characterization of the vessel geometry, flow mechanics and wall shear stress in the great arteries of wild-type mouse embryo, *PlosONE*, 9(1):e86878, 2014
12. Menon PG, Antaki JF, Undar A, **Pekkan K**, Aortic Outflow Cannula Tip Design and Orientation Impacts Cerebral Perfusion During Pediatric Cardiopulmonary Bypass Procedures, *Annals of Biomedical Engineering*, 41(12):2588-602, 2013
13. Kowalski W, Dur O, Wang Y, Patrick M, Tinney J, Keller B, **Pekkan K**, Critical transitions in early embryonic aortic arch patterning and hemodynamics, *PlosONE*, 8(3): e60271, 2013
14. Chen C, Menon PG, Kowalski W, **Pekkan K**, Time-resolved OCT-μPIV: A new microscopic PIV technique for noninvasive depth-resolved pulsatile flow profile acquisition, *Experiments in Fluids*, 54:1426, 2013
15. Menon PG, Teslovich N, Chen CY, Undar A, **Pekkan K**. Characterization of neonatal aortic cannula jet flow regimes for improved cardiopulmonary bypass, 46(2):362-72, *Journal of Biomechanics*, 2013

Additional recent publications of importance to the field

1. Tenekecioglu E, Torii R, Katagiri T, et. al. Post-implantation shear stress assessment: An emerging tool for differentiation of bioresorbable scaffolds, The International Journal of Cardiovascular Imaging, accepted, 2018
2. Pasta S, Chod J, Dur O, **Pekkan K**, Vorp DA, Computer modeling for the prediction of thoracic aortic stent graft collapse, *Journal of Vascular Surgery*, 57(5):1353-61, 2013
3. Dur O, Coskun T, Kara B, **Pekkan K**. Computer-aided patient-specific coronary artery graft design improvements using CFD coupled shape optimizer, *Cardiovascular Engineering and Technology*, 2(1); 35-47, 2011 (**Top downloaded paper of CVET at all times**)
4. Patrick MJ, Chen CY, Frakes DH, Dur O, **Pekkan K.** Cellular-level near-wall unsteadiness of high-hematocrit erythrocyte flow using confocal μPIV, Experiments in Fluids, 50(4): 887-904, 2011.
5. Kowalski WJ, Teslovich NJ, Dur O, Keller BB, **Pekkan K**, Computational hemodynamic optimization predicts dominant aortic arch selection is driven by embryonic outflow tract orientation in the chick embryo, Biomechanics and Modeling in Mechanobiology, 11(7):1057-73, 2012
6. Zelicourt D, Jung P, Horner M, **Pekkan K**, Kanter KR, Yoganathan AP, Cannulation strategy for aortic arch reconstruction using deep hyphothermic circulatory arrest, Annals of Thoracic Surgery, 94(2):614-20, 2012
7. **Pekkan K**, Dur O, Kanter K, Sundareswaran K, Fogel M, Yoganathan A, **Ündar A**, Neonatal Aortic Arch Hemodynamics and Perfusion during Cardiopulmonary Bypass, Journal of Biomechanical Engineering, 130(6):061012, 2008.
8. Chen C, **Pekkan K**, High-speed three-dimensional characterization of fluid flows induced by micro-objects in deep micro-channels, Biochip Journal, 7(2), 2013
9. **Pekkan K**, Kitajima H., Forbess J, Fogel M, Kanter K, Parks JM, Sharma S, Yoganathan AP, Total Cavopulmonary Connection Flow with Functional Left Pulmonary Artery Stenosis – Fenestration and Angioplasty in Vitro, Circulation, Vol 112, Issue 21, pp. 3264-71, 2005.
10. **Pekkan K**, Whited B, Kanter K, Sharma S, Krishnankutty R, Sundareswaran K, Frakes D, Rossignac J, Yoganathan AP, Patient-specific surgical planning and hemodynamic computational fluid dynamics optimization through free-form haptic anatomy editing tool (SURGEM), 46(11):1139-52, Medical & Biological Engineering & Computing, Patient-Specific Modeling Special Issue, 2008

11. **Pekkan K**, Dasi LP, de Zélicourt D, Sundareswaran KS, Fogel MA, Kanter KR, Yoganathan AP. Hemodynamic performance of stage-2 univentricular reconstruction: Glenn vs. hemi-Fontan templates. Annals of Biomedical Engineering, 37(1):50-63. 2009
12. Dur O, Lara M, Vandenberghe S, Keller B, **Pekkan K**, Pulsatile in vitro simulation of the pediatric uni-ventricular circulation for evaluation of cardiopulmonary assist scenarios, 33(11):967-76, Artif Organs, 2009
13. Dur O, Yoshida M, Manor P, Mayfield A, Wearden PD, Morell VO, **Pekkan K**, In vitro evaluation of right ventricular outflow tract reconstruction with bicuspid valved polytetrafluoroethylene conduit, Artificial Organs,34(11):1010-1016, 2010

D. Spin-off Companies from Pekkan Lab

Cureistic (iTMC), mobile health for three-dimensional craniofacial surgery and dental medicine, 2015
Hemodyn Inc, hemodynamic pre-surgical planning of reconstructive pediatric heart surgeries, 2013
Quant MD, is a healthcare startup dedicated to diagnosing coronary heart disease, 2011
PecaLabs Inc, medical device development for pediatric and rare diseases (Masa Valves), 2011

E. Ongoing Research Support

European Molecular Biology Organization (EMBO) Pekkan (PI) 01/01/13-01/01/18
Installation Grant to study embryonic myocyte function its biomechanics and high-speed confocal microscopy. €250,000

European Research Council Proof of Concept Grant Pekkan (PI) 01/01/15-01/01/17
KidsSurgicalPlan: An Internet enterprise for sketch-based cardiovascular pre-surgical planning, early stage tech commercialization grant €150,000

EU FP7 Marie-Curie CIG Pekkan (PI) 02/01/12-02/01/16
CardioFluidMechanics: Analyzing internal biofluid dynamics in embryonic cardiovascular development, reduced-order vascular growth models, (Koc University, Istanbul Turkey). The major goal is to study novel, comparative biomimetic circulation systems numerically that are found in nature (excludes humans and disease applications). A lumped-parameter circulation network model will be integrated to 1D vascular growth models. €100,000

ERC Consolidator Grant Pekkan (PI) 01/01/13-01/01/18
VascularGrowth: Bioengineering prediction of three-dimensional vascular growth and remodeling in embryonic great-vessel development (host: Koc University, Istanbul Turkey). *First ERC grant recipient of Turkey* €2,000,000

University of Bath (UK) – Koc University (TR) Pekkan and Fraser (joint PI) 03/01/16-03/01/17
Seed grant for collaborative research on **computational analysis on cardiovascular device development** €25,000

Turkish National Science Foundation (TUBITAK) Pekkan (PI) 08/01/16-08/01/19
Priority Area Grant 1003, **Pre-surgical planning of patch design for complex congenital heart diseases**, €500,000

National Institutes of Health T32 Training Grant Sacks (PI) 07/01/11-06/30/16
Cardiovascular Biomechanics in Regenerative Medicine,
Participating Faculty Mentor

<u>Completed Research Support (Partial List)</u>

NSF – CAREER Pekkan (PI) 05/15/10-05/15/15
(Including an NSF REU Supplement, 2011)
Internal Biofluid dynamics in embryonic cardiovascular development, Morphomechanics and comparative ontogeny

Pennsylvania Infrastructure Technology Alliance (PITA) Pekkan (PI) 03/01/13 – 03/01/14
Bridging computational multi-scale myocyte mechanics with ventricle function for customized heart valve design tool. Role: PI

R01HL089456-01A2 Antaki (PI) 02/01/09-01/31/14
Multi-Scale Model of Thrombosis in Pediatric Ventricle Assist Devices
The goal is the development of numerical blood trauma models as applied to pediatric VADs
Role: Co-I

Dowd-ICES fellowship, Pekkan (PI) 05/08/11-05/08/12
Hemodynamic control of aortic outflow cannula jet flow regimes for improved neonatal cardiopulmonary bypass using CFD. Support for a top graduate student

American Heart Association Beginning-Grant-in-Aid (0765284U) Pekkan (PI) 07/01/07-06/30/10
Bioengineering Analysis of Embryonic Hypoplastic Aortic Arch During the Period of Arterial Morphogenesis. This grant provided the funds to initiate our research program in AA morphogenesis and biomechanics.
Role: PI

Pennsylvania Infrastructure Technology Alliance (PITA) Pekkan (PI) 03/01/08 – 03/01/09
Pre-surgical planning and patient-specific CFD optimization of valve sparing aortic root reconstruction surgeries. This grant adapted CFD approaches for patient-specific applications.
Role: PI

NIH R01HL67622 Yoganathan (PI) 07/01/02 – 06/31/07
Understanding/Improving Flow Dynamics in Fontan Surgeries. This grant established a robust CFD approach to analyzing complex single ventricle venous flow anatomies.
Role: co-Investigator