

John H. Lienhard V
Abdul Latif Jameel Professor, Department of Mechanical Engineering
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Education

B.S. in Engineering with concentration in Thermal Engineering, *Summa cum laude*
Dept. Chemical, Nuclear, and Thermal Engineering, University of California at Los Angeles, 1982
M.S. in Heat and Mass Transfer
Dept. Chemical, Nuclear, and Thermal Engineering, University of California at Los Angeles, 1984
Ph.D. in Fluid Dynamics
Dept. Applied Mechanics and Engineering Sciences, University of California at San Diego, 1988

Academic Appointments (selected)

July 2014 – present	Abdul Latif Jameel Professor of Water
July 2014 – present	Director, Abdul Latif Jameel World Water and Food Security Lab
July 2008 – April 2012	Associate Head, Mechanical Engineering Department
July 2008 – Nov. 2017	Director, Center for Clean Water and Clean Energy
July 2005 – April 2012	Undergraduate Officer, Mechanical Engineering Department
July 1997 – present	Director, Rohsenow Kendall Heat Transfer Laboratory
January 1988 – present	MIT faculty member

Ten Recent Papers

J. Swaminathan, H.W. Chung, D.M. Warsinger, J.H. Lienhard V, “Energy efficiency of membrane distillation at high salinity: evaluating critical system size and optimal membrane thickness,” *Applied Energy*, **211**:715–734, 1 Feb. 2018. ([doi link](#))

G.P. Thiel, A. Kumar, A. Gómez-González, and J.H. Lienhard V, “Utilization of Seawater Desalination Brine for Sodium Hydroxide Production: Technologies, Engineering Principles, Recovery Limits and Future Directions,” *ACS Sustainable Chemistry & Engineering*, **5**(12):11147–11162, 2017. ([doi link](#))

E.W. Tow and J.H. Lienhard V, “Unpacking compaction: effect of hydraulic pressure on alginate fouling,” *J. Membrane Sci.*, online 8 Sept. 2017, **544C**:221-233, 15 Dec. 2017. ([doi link](#))

Y. Roy, D. Warsinger, and J.H. Lienhard V, “Effect of temperature on ion transport in nanofiltration membranes: diffusion, convection, and electromigration,” *Desalination*, **420**:241–257, 15 Oct. 2017. ([doi link](#))

D.M. Warsinger, A. Servi, G. Connors, M.O. Mavukkandy, H.A. Arafat, K.K. Gleason, and J.H. Lienhard V, “Reversing wetting in membrane distillation: comparing dryout to backwashing with pressurized air,” *Environmental Science: Water Research & Technology*, **3**(5):930-939, 13 July 2017. ([doi link](#))

K.M. Chehayeb, D.M. Farhat, K.G. Nayar, J.H. Lienhard V, “Optimal design and operation of electro dialysis for brackish-water desalination and for high-salinity brine concentration,” *Desalination*, **420**:167-182, 15 Oct. 2017. ([doi link](#))

J.H. Lienhard V, K.H. Mistry, M.H. Sharqawy, and G.P. Thiel, “Thermodynamics, Exergy, and Energy Efficiency in Desalination Systems,” in *Desalination Sustainability: A Technical, Socioeconomic, and Environmental Approach*, Chpt. 5, H.A. Arafat, ed. Elsevier, June 2017. ([preprint](#))

Q.J. Wei, R.K. McGovern, and J.H. Lienhard V, “Saving energy with an optimized two-stage reverse osmosis system,” *Environmental Science: Water Research & Technology*, **3**(4):659-670, July 2017. ([doi link](#))

O. Labban, T. Chen, A.F. Ghoniem, J.H. Lienhard V, and L.K. Norford, “Next-Generation HVAC: Prospects for and Limitations of Desiccant and Membrane-Based Dehumidification and Cooling,” *Applied Energy*, **200**: 330–346, 15 August 2017. ([doi link](#))

K.M. Chehayeb and J.H. Lienhard V, “Entropy generation analysis of electro dialysis,” *Desalination*, **413**:184-198, 1 July 2017. ([doi link](#))

Twelve Other Significant Papers (from ~200 peer-reviewed papers; N≈9400, H=38, GoogleScholar).

- R.K. McGovern and J.H. Lienhard V, "On the potential of forward osmosis to energetically outperform reverse osmosis desalination," *J. Membrane Sci.*, **469**:245-250, Nov. 2014. ([doi](#))
- D. Cohen-Tanugi, R.K. McGovern, S. Dave, J.H. Lienhard V, and J.C. Grossman, "Quantifying the Potential of Ultra-permeable Desalination Membranes," *Energy Environ. Sci.*, **7**(3):1134-1141, Feb. 2014. ([doi](#))
- A.K. Plappally and J.H. Lienhard V, "Energy Requirements for Water Production, Treatment, End Use, Reclamation, and Discharge," *Renewable & Sustain. Energy Rev.*, **16**(7):4818-4848, Sept. 2012. ([doi](#))
- R. Saffarini, E.K. Summers, H.A. Arafat, J.H. Lienhard V, "Technical evaluation of stand-alone solar-powered membrane distillation systems," *Desalination*, **286**:332-341, Jan. 2012. ([doi](#))
- K.H. Mistry, R.K. McGovern, G.P. Thiel, E.K. Summers, S.M. Zubair, and J.H. Lienhard V, "Entropy generation analysis of desalination technologies," *Entropy*, **13**(10):1829-1864, Sept. 2011 ([pdf](#)).
- G.P. Narayan, M.H. Sharqawy, E.K. Summers, J.H. Lienhard V, S.M. Zubair, and M.A. Antar, "The potential of solar-driven humidification-dehumidification desalination for small-scale decentralized water production," *Renewable & Sustainable Energy Reviews*, **14**(4):1187-1201, May 2010. ([doi](#))
- M.H. Sharqawy, J.H. Lienhard V, and S.M. Zubair, "The thermophysical properties of seawater: A review of existing correlations and data," *Desal. & Water Treatment*, **16**:354-380, April 2010. ([pdf](#)) ([codes](#))
- A.E. Bergles, J.H. Lienhard V, G.E. Kendall, and P. Griffith, "Boiling and Evaporation in Small Diameter Channels," *Heat Transfer Engineering*, **24**(1):18-40, 2003. ([pdf](#))
- J.H. Lienhard V, "Liquid Jet Impingement," in *Annual Review of Heat Transfer*, C.L.Tien, ed., Vol.6, Chpt.4. New York: Begell House, 1995, pp.199-270. ([pdf](#))
- X. Liu and J.H. Lienhard V, "The Hydraulic Jump in Circular Liquid Jet Impingement and in Other Thin Films," *Expts. Fluids*, **15**:108-116, 1993. ([pdf](#))
- X. Liu, J.H. Lienhard V, and J.S. Lombara, "Convective Heat Transfer by Impingement of Circular Liquid Jets," *J. Heat Transfer*, **113**(3):571-582, 1991. ([pdf](#))
- J.H. Lienhard V and C.W. Van Atta, "The decay of turbulence in thermally stratified flow," *J. Fluid Mechanics*, **210**:57-112, Jan. 1990. ([pdf](#))

Synergistic Activities

1. Editorial boards: *Experimental Heat Transfer* (1995-present); *Acta Mechanica* (2003-2011); *Journal of Heat Transfer* (2003-2006); *Desalination & Water Treatment* (2009-present); *Frontiers of Heat & Mass Transfer* (2010-present); *Intl. J. Thermal Sciences* (2010-present); *Desalination* (2011-present)
2. Industrial involvement: Co-founder, Gradient Corporation, desalination technology for remediation of industrial wastewaters. Scientific advisor, Sandymount Technologies. 23 issued US Patents and more than 17 current nonprovisional applications, mainly in desalination and water treatment.
3. Professional Memberships. Advisory Board Member, UAE Water Aid Foundation (Suqia); Director, Global Clean Water Desalination Alliance; Fellow, American Society of Mechanical Engineers; American Society of Thermal and Fluid Engineers; Scientific Council of the International Centre for Heat and Mass Transfer; International Desalination Association; American Association for the Advancement of Science; Tau Beta Pi; Registered Professional Engineer (Mechanical), Massachusetts; State Implementation Planning Board for Ozone Reduction, Massachusetts.
4. Teaching. Created new MIT subjects on Desalination, Compressible Fluid Dynamics, and Thermal Modeling and Approximation. Author of textbooks on [heat transfer](#) (*free*), on [thermal modeling](#), and on [measurement and instrumentation](#). Directed MIT undergraduate mechanical engineering program for eight years, including accreditation. Recipient of several MIT teaching awards.
5. Selected Honors & Awards. 1988, Presidential Young Investigator Award, NSF; 1991, Best Paper Award, 26th ASME/AIChE National Heat Transfer Conf.; 1992, Ralph R. Teeter Award, SAE; 1993, Ruth and Joel Spira Teaching Award, MIT School of Engineering; 1994, Graduate Student Council Teaching Award, MIT; 1997, R&D 100 Award; 2000, Fellow, ASME; 2003, Den Hartog Distinguished Educator, MIT; 2011-2017, Twelve Best Paper, Poster, and Presentation Awards to Lienhard Research Group members (national and international confs.); 2012, ASME Technical Communities Globalization Medal; 2015, Best Paper Award, *Entropy*; 2015, ASME Heat Transfer Memorial Award.

Biographical sketch

John H. Lienhard V is the Abdul Latif Jameel Professor and the founding Director of the Abdul Latif Jameel World Water and Food Security Lab at MIT. During almost three decades on the MIT faculty, Lienhard's research and educational efforts have focused on heat and mass transfer, water purification and desalination, and thermodynamics. He has also filled a number of administrative roles at MIT.

Lienhard received his bachelor's and master's degrees in thermal engineering at UCLA from the Chemical, Nuclear, and Thermal Engineering Department, where he worked on buoyant instabilities in solar collectors and evaporating meniscus measurements for MED desalination systems. He joined MIT immediately after completing his PhD in the Applied Mechanics and Engineering Science Department at UC San Diego, where he did experimental work on thermally stratified turbulent flows. Lienhard's research on water purification includes humidification-dehumidification desalination, membrane distillation desalination, forward and reverse osmosis, nanofiltration, electrodialysis, solar-driven desalination, bubble columns, scale formation and membrane fouling, salinity gradient power, management of high salinity brines, thermodynamic and energy efficiency analysis of desalination cycles, remediation of wastewater from oil/gas operations, and energy-water nexus issues. Lienhard has also done research on high heat flux engineering, liquid jet impingement cooling, and electronics thermal management. Lienhard has directly supervised more than 85 graduate theses and postdoctoral associates, and is author of approximately 200 peer-reviewed publications. He holds more than 40 US Patents and pending applications, most of which have been commercialized in the water and electronics industries.

Lienhard is a Fellow of the American Society of Mechanical Engineers (ASME), and he is a recipient of the 1988 National Science Foundation Presidential Young Investigator Award, the 1992 SAE Teetor Award, a 1997 R&D 100 Award, the 2012 ASME Technical Communities Globalization Medal, and the 2015 ASME Heat Transfer Memorial Award. Lienhard and his students received thirteen best paper, poster, or presentation awards at national and international conferences and from journals for their desalination research during 2011-2017.

Lienhard is the co-author of textbooks on heat transfer, on measurement and instrumentation, and on thermal modeling. His heat transfer book has been available online at no charge since 2002, and hundreds of thousand copies have been downloaded worldwide (ahtt.mit.edu). His measurements book has sold more than 100,000 copies. He has created new courses on desalination, on thermal modeling, and on compressible fluid mechanics. He has also received several teaching awards at MIT, including the Ruth and Joel Spira Award, the Den Hartog Distinguished Educator Award, and the Graduate Student Council Teaching Award. He has also been recognized by MIT for outstanding graduate student mentorship.

Lienhard has served as Associate Head and Undergraduate Officer of the MIT Department of Mechanical Engineering, and was responsible for ABET accreditation of the department's three SB degrees. He has filled approximately 100 varied service roles at MIT.

Professor Lienhard has been the Director of the Rohsenow Kendall Heat Transfer Laboratory since 1997, and he is the founding Director of the Center for Clean Water and Clean Energy and of the Ibn Khaldun Fellowship program for Saudi Arabian Women ([IBK](#)). His research collaborations have extended to Saudi Arabia, United Arab Emirates, Singapore, Kuwait, India, Israel, Chile, Spain, and elsewhere.