

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 and Mechanical Engineering
July 2014 – present	Founding Director, Abdul Latif Jameel Water and Food Systems Lab
July 2008 – April 2012	Associate Head, Mechanical Engineering Department
Feb 2009 – June 2014	Samuel C. Collins Professor of Mechanical Engineering
July 2008 – Nov. 2017	Founding Director, Center for Clean Water and Clean Energy
July 1997 – present	Director, Rohsenow Kendall Heat Transfer Laboratory
Jan 1988 – present	MIT faculty member

Recent Papers

Z. H. Foo, T. Lee, J. M. Wegmueller, S. M. Heath, J. H. Lienhard, “Towards a Circular Lithium Economy with Electrodialysis: Upcycling Spent Battery Leachates with Selective and Bipolar Ion-Exchange Membranes,” *Environmental Science & Technology*, accepted for publication, 8 October 2024.

K.I. McKee and J.H. Lienhard V, “Symmetry criteria for the equality of interior and exterior shape factors with exact solutions,” *ASME J. Heat Mass Transfer*, accepted, 20 May 2024. ([open access](#)).

A. Deshmukh, A.D. Wilson, and J.H. Lienhard, “Electrically-Driven Membraneless Water Extraction from Hypersaline Brines using Dimethyl Ether,” *Industrial and Engineering Chemistry Research*, **63**(18):8341–8356, 23 April 2024. ([doi](#))

C.D. Díaz-Marín, A. Deshmukh, M.A. Roper, J.H. Lienhard V, and G. Chen, “Dynamic Water Absorption-Desorption by Aqueous Salt Solutions,” *Cell Reports Physical Sci.*, **5**:101929, May 2024. ([open access](#))

Z.H. Foo, A. Deshmukh, A.D. Wilson, and J.H. Lienhard, “Harnessing Dimethyl Ether with Ultra-Low-Grade Heat for Scaling-Resistant Brine Concentration and Fractional Crystallization,” *Chemical Engineering Journal*, **489**:151159, 1 June 2024. ([doi](#))

R. Zhou, M.M. Swisher, A. Deshmukh, C. Sun, J.H. Lienhard, and N.G. Hadjiconstantinou, “Dense fluid transport through nanoporous graphene membranes in the limit of steric exclusion,” *Physical Review Fluids*, **9**(4):044202, 9 April 2024. ([doi](#))

D. Rehman and J.H. Lienhard, “Physics-informed deep learning for multi-species membrane separations,” *Chemical Engineering Journal* **485**:149806, 1 April 2024. ([doi](#))

A. Deshmukh, J.H. Lienhard, and M. Elimelech, “Heat Diffusion During Thin-Film Composite Membrane Formation,” *J. Membrane Science*, **696**:122493, March 2024. ([doi](#)) **Editor’s Choice Article for Jan 2024.**

X. Liu, D. Rehman, Y. Shu, B. Liu, L. Wang L. Li, M. Wang, K. Wang, Q. Han, L. Zang, J.H. Lienhard, Z. Wang, “Selective Fluoride Removal from Groundwater Using CNT-CeO₂ Electrodes in Capacitive Deionization (CDI),” *Chemical Engineering Journal*, **482**:49097, 15 February 2024. ([doi](#))

A.D. Wilson, Z.H. Foo, A.S. Jayasinghe, C. Stetson, H. Lee, H.W. Rollins, A. Deshmukh, C. Orme, and J.H. Lienhard, “Modeling Henry’s Law and Phase Separations of Water-NaCl-Organic Mixtures with Solvation and Ion-Pairing,” *Physical Chemistry Chemical Physics*, **26**(2):749-759, 14 January 2024. ([doi](#))

Z.H. Foo, J.B. Thomas, S.M. Heath, J.A. Garcia, and J.H. Lienhard, “Sustainable Lithium Recovery from Hypersaline Salt-lakes by Selective Electrodialysis: Transport and Thermodynamics,” *Environmental Science & Technology*, **57**(39):14747–14759, 18 Sept. 2023. ([doi](#))

Eleven Other Significant Papers (of >300 peer-reviewed papers; N>30000, G>170, H>80, GoogleScholar).

- K.G. Nayar, M.H. Sharqawy, L.D. Banchik, and J.H. Lienhard V, "Thermophysical properties of seawater: A review & new correlations that include pressure dependence," *Desalination*, **390**:1-24, July 2016. ([doi](#))
- D.M. Warsinger, J. Swaminathan, E. Guillen, H.A. Arafat, and J.H. Lienhard V, "Scaling and Fouling In Membrane Distillation for Desalination Applications," *Desalination*, **356**:294-313, 15 Jan. 2015. ([doi](#))
- 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](#))
- 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](#))
- 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](#))
- 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. Industrial involvement: Co-founder, Gradient Corporation, desalination technology for treatment of industrial wastewaters. 42 issued US Patents and many more international patents, most licensed by the desalination and water treatment industry.
2. Research: Directed several large, multi-PI research programs in water, energy, and food, valued at more than \$100M. Direct supervisor of more than 100 graduate theses and postdoctoral associates. Author of more than 300 peer-reviewed research papers. Research group received 15 best paper/poster/presentation awards from journals and natl./intl. conferences during 2011-2019. More than 180 invited lectures. Has had funded international research collaborations in Chile, China, India, Israel, Kuwait, Saudi Arabia, Singapore, Spain, United Arab Emirates, and elsewhere.
3. 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)
4. Textbooks/Teaching: Author of textbooks on [heat transfer](#), on [thermal modeling](#), and on [measurement & instrumentation](#). Heat transfer book has been online at no charge since 2002, and hundreds of thousands of copies have been downloaded worldwide. Measurements book has sold more than 130,000 copies. Created new courses on desalination, thermal modeling, and compressible flow. Managed ABET accreditation for MIT MechE department's 3 degrees (2007).
5. Professional Memberships. Board of Directors, International Desalination Association; Fellow, American Society of Mechanical Engineers; Fellow, American Association for the Advancement of Science; Fellow, American Society of Thermal & Fluid Engineers; Scientific Council, Intl. Centre for Heat & Mass Transfer; Tau Beta Pi; Sigma Xi; Registered Professional Engineer (Mechanical), MA&VT
6. Selected Honors & Awards. 1988, Presidential Young Investigator Award, NSF; 1991, Best Paper Award, 26th ASME/AIChE Heat Transfer Conf.; 1992, Ralph R. Teetor Award, SAE; 1993, Spira Teaching Award, MIT School of Engng; 1994, Graduate Student Council Teaching Award, MIT; 2003, Den Hartog Distinguished Educator, MIT; 2012, ASME Technical Communities Globalization Medal; 2015, ASME Heat Transfer Memorial Award; 2018, MIT Committed to Caring Award (grad. advising); 2018, Chief Guest, IIT Ropar Convocation; 2019, ASME E.F. Obert Award (best thermo paper); 2021 AIChE D.Q. Kern Award (outstanding contributions to process engineering in transport phenomena).

Biographical sketch

John H. Lienhard V is the Abdul Latif Jameel Professor and the founding Director of the Abdul Latif Jameel Water and Food Systems Lab at MIT ([J-WAFS](#)). During more than 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 wind-tunnel experiments on thermally stratified turbulent flows. Lienhard's research on water purification has included humidification-dehumidification desalination, membrane distillation desalination, nanofiltration, electrodialysis, forward and reverse osmosis, solvent extraction, solar desalination, bubble columns, scale formation and membrane fouling, salinity gradient power, management of high salinity brines, and thermodynamic and energy efficiency analysis of desalination cycles. Lienhard has also done research on high heat flux engineering, liquid jet impingement cooling, and electronics thermal management. Lienhard has directly supervised more than 100 graduate theses and postdoctoral associates, and he is the author of more than 300 peer-reviewed publications. He has been issued more than 40 US patents, most of which have been commercialized through start-up companies. Lienhard is a registered professional engineer in Massachusetts and Vermont.

Lienhard is a Fellow of the American Society of Mechanical Engineers (ASME), a Fellow of the American Association for the Advancement of Science (AAAS), and a Fellow of the American Society of Thermal and Fluid Engineers (ASTFE). 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, the 2019 ASME Edward F. Obert Award, and the 2021 AIChE/ASME Donald Q. Kern Award. Lienhard and his students received fifteen best paper, poster, or presentation awards at national and international conferences and from journals for their desalination research during 2011-2019, and more since then. His 2020 study of flat-plate boundary layers was 2021's most accessed paper in the *Journal of Heat Transfer*.

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 130,000 copies. He has created new courses on desalination, on thermal modeling, and on compressible fluid mechanics. He has 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. His YouTube video on [entropy](#) has been viewed more than 400,000 times. 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 100 varied service roles at MIT.

Professor Lienhard has directed the MIT Rohsenow Kendall Heat Transfer Laboratory since 1997 ([RKLab](#)), and he was the founding Director of the Center for Clean Water & Clean Energy and the Ibn Khaldun Fellowship for Saudi Arabian Women ([IBK](#)). As Director of J-WAFS, he has sponsored millions of dollars of research on food and water supply for a growing population on a rapidly warming planet.

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