

BIOGRAPHICAL SKETCH

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NAME: Liao, Joseph C.

eRA COMMONS USER NAME (credential, e.g., agency login): JOSEPH.LIAO

POSITION TITLE: Professor and Vice Chair of Urology

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Harvard University, Cambridge, MA	A.B.	06/1993	Biology
Stanford University, Stanford, CA	M.D.	06/1997	Medicine
UCLA Medical Center, Los Angeles, CA	Internship/Residency	06/1999	General Surgery
UCLA Medical Center, Los Angeles, CA	Residency	06/2003	Urology
UCLA Sch. Engineering & Applied Science	Fellowship	06/2005	Molecular Diagnostics
UCLA Medical Center, Los Angeles, CA	Fellowship	06/2006	Endourology & Minimally Invasive Surgery

A. Personal Statement

I am a board-certified, fellowship-trained urological surgeon with clinical expertise in minimally invasive surgery and urologic oncology, particularly early stage high risk bladder and prostate cancer. Complementing my clinical practice, my research focuses on urine-based molecular diagnostics, optical imaging technologies, and image-guided cancer surgery. My research group has 1) developed molecular diagnostics for rapid profiling of resistant bacterial pathogens; 2) discovered and validated urinary nucleic acids as biomarkers for bladder cancer; 3) established application of confocal laser endomicroscopy for urological surgery; and 4) identified and validated CD47 as a molecular imaging and therapeutic target for bladder cancer. More recently, I have collaborated with engineering colleagues to develop computer vision and artificial intelligence tools for augmented imaging during bladder cancer surgery. I am experienced in leading complex interdisciplinary research teams that bridge biomedical and engineering disciplines for technology development and translation, as well as conducting human subject research and clinical trials.

B. Positions and Honors**Positions and Employment**

2006–2009 Clinical Instructor in Urology, UCLA Medical Center, Los Angeles, CA
 2006–2013 Assistant Professor of Urology, Stanford University School of Medicine, Stanford, CA
 2013–2021 Associate Professor of Urology (with tenure), Stanford University School of Medicine
 2006– Chief of Urology, Veterans Affairs Palo Alto Health Care System, Palo Alto, CA
 2006– Faculty, Bio-X Program, Stanford University
 2007– Member, Stanford Cancer Institute
 2009– Member, Stanford Institute of Immunity, Transplantation, and Infection
 2018– Director of Research, Department of Urology, Stanford University School of Medicine
 2019– Faculty, Stanford Center for Artificial Intelligence in Medicine and Imaging
 2021– Professor of Urology, Stanford University School of Medicine
 2021– Vice Chair for Academic Affairs, Department of Urology, Stanford University School of Medicine

Other Experience and Professional Memberships

- 2006– Member, American Urological Association, Society of Urologic Oncology, Endourology Society, SPIE, World Molecular Imaging Society, International Society for Endomicroscopy
- 2008– Diplomate, American Board of Urology
- 2010–2013 Ad Hoc Member, NIH Instrumentation and Systems Development (ISD) Study Section
- 2011– Member, NIH/NIAID/NIDDK Special Emphasis Panels: Partnership for Next Generation Biodefense Diagnostics (2011), Partnership for Biodefense (2011), NIAID Loan Repayment Program (2012), NIDDK U54 George M. O'Brien Urology Cooperative Research Centers (2013), "NIAID Clinical Trials Implementation Cooperative Agreement (2015), NIDDK P20 Developmental Centers for Benign Urology (2016); Nursing and Related Clinical Sciences (NRCS) Study Section (2019)
- 2015 Grant Reviewer, Cancer UK
- 2016 Grant Reviewer, Medical Research Council - UK
- 2013–2017 Standing Member, NIH Instrumentation and Systems Development (ISD) Study Section
- 2016–2017 Steering Committee, Albert Institute Bladder Cancer Symposium
- 2017– Organizing Committee, SPIE Photonics West – Therapeutics and Diagnostics in Urology
- 2018 Organizing Committee, IEEE-International Conference on Nano/Molecular Medicine and Engineering (NANOMED)

Awards and Honors

- 1993 *Magna cum laude* with Highest Honors, Harvard College
- 1994–1996 Medical Scholar Award, Stanford University School of Medicine
- 2003–2005 American Foundation for Urologic Disease Research Scholar
- 2003–2008 NIH/NIDDK Loan Repayment Award (LRP)
- 2005 Best Paper Award, Engineering and Urology Society Annual Meeting
- 2007 Diversity Faculty Fellowship Award, Stanford University School of Medicine
- 2007 Stanford Cancer Center Development Research Award
- 2007 Second Prize, Joseph F. McCarthy Physician Essay Contest, AUA Western Section
- 2008 Stanford University School of Medicine Faculty Fellow
- 2009 Third Prize, AUA/Gyrus Essay Contest (Clinical Research)
- 2009 First Prize, AUA/Gyrus Ambrose Reed Socioeconomics Essay Contest
- 2009 First Prize, AUA Foundation Young Investigator Research Forum
- 2012 Fellow, American Urological Association/Chinese Urological Association Academic Exchange Program
- 2013 Best New Innovation Paper Award, World Congress of Endourology Annual Meeting
- 2014 Visiting Faculty, Spinalis Foundation/Karolinska Institute, Stockholm, Sweden
- 2016 Best Poster, Infection & Inflammation Session, AUA Annual Meeting
- 2018 Best Poster, Bladder Cancer Session, AUA Annual Meeting

Patents

1. Haake DA, Churchill BM, **Liao JC**, Suchard MA, Li Y, Mastali M. Probes and methods for detection of pathogens and antibiotic resistance. US2008/0199863A1. Published Aug. 21, 2008.
2. Chae J, Appel J, **Liao JC**. Method of Screening Cancer Cells Using Wrinkle Patterns on A Thin Membrane. US2017/0191989A1. Published Jul. 6, 2017.
3. Lurie K, Zlatev D, **Liao JC**, Bowden AK, Angst R. 3D Reconstruction and Registration of Endoscopic Data. US2017/0046833A1. Published Feb. 16, 2017.
4. **Liao JC**, Mach K, Sin MLY. Methods for diagnosis of bladder cancer. US 2018/0172689 A1. Published Jun. 21, 2018.
5. **Liao JC**, **Xing L**, Shkolyar E, Jia X. Methods and Systems for Cystoscopic Imaging Incorporating Machine Learning. US 62/828,924. Provisional patent filed April, 10, 2019.

C. Contributions to Science

1. **Molecular diagnostics for rapid diagnosis of bacterial infections using biosensor technologies.** A major focus of my group is development of molecular diagnostics for bacterial urinary tract infection (UTI), the most common healthcare-associated infection and a significant source of multidrug resistant pathogens. Our goal has been to translate technology platforms to enable for rapid pathogen identification and

antimicrobial susceptibility testing, thereby enabling evidence-based utilization of antibiotics. We have made important advances in molecular probe design targeting bacterial 16S rRNA, sample preparation techniques to reduce matrix effects of biological samples, and clinical translation of integrated biosensor and microfluidics technologies.

- a. Mach KE, Mohan R, Baron EJ, Shih MC, Gau V, Wong PK, **Liao JC**. A biosensor platform for rapid antimicrobial susceptibility testing directly from clinical samples. *J Urol*. 2011 Jan;185(1):148-53. doi: 10.1016/j.juro.2010.09.022. Epub 2010 Nov 12. PubMed PMID: 21074208; PubMed Central PMCID: PMC4051414.
- b. Altobelli E, Mohan R, Mach KE, Sin MLY, Anikst V, Buscarini M, Wong PK, Gau V, Banaei N, **Liao JC**. Integrated Biosensor Assay for Rapid Uropathogen Identification and Phenotypic Antimicrobial Susceptibility Testing. *Eur Urol Focus*. 2017 Apr;3(2-3):293-299. doi: 10.1016/j.euf.2015.12.010. Epub 2016 Jan 15. PubMed PMID: 28753748; PubMed Central PMCID: PMC5538928.
- c. Mach KE, Kaushik AM, Hsieh K, Wong PK, Wang TH, **Liao JC**. Optimizing peptide nucleic acid probes for hybridization-based detection and identification of bacterial pathogens. *Analyst*. 2019 Jan 18. doi: 10.1039/c8an02194e. [Epub ahead of print] PubMed PMID: 3065629.
- d. Kaushik AM, Hsieh K, Mach KE, Lewis S, Puleo CM, Carroll KC, **Liao JC** Wang TH. Droplet-based single-cell measurements of 16S rRNA enable integrated bacteria identification and pheno-molecular antimicrobial susceptibility testing from clinical samples in 30 min. *Advanced Science*. 2021 Feb 1. doi: 10.1002/advs.202003419.

2. **Optical biopsy of urological cancer using confocal laser endomicroscopy.** My group has pioneered the application of confocal laser endomicroscopy (CLE), an *in vivo* cellular imaging technology, during urologic cancer surgery. Our focus has been primarily bladder cancer and to use CLE to provide *in vivo* characterization of suspicious lesions on cystoscopy. We have demonstrated initial feasibility, technique, imaging diagnostic criteria (e.g. cancer vs. non-cancer, high vs. low grade), and integration of the technology during endoscopic bladder surgery. More recently, we have expanded applications to upper tract urothelial carcinoma and prostate cancer, as well as robot-assisted surgery. Our studies provided critical contributions towards approval of the technology for clinical use in Europe and U.S.

- a. Sonn GA, Jones SN, Tarin TV, Du CB, Mach KE, Jensen KC, **Liao JC**. Optical biopsy of human bladder neoplasia with *in vivo* confocal laser endomicroscopy. *J Urol*. 2009 Oct;182(4):1299-305. PubMed PMID: 19683270.
- b. Wu K, Liu JJ, Adams W, Sonn GA, Mach KE, Pan Y, Beck AH, Jensen KC, **Liao JC**. Dynamic real-time microscopy of the urinary tract using confocal laser endomicroscopy. *Urology*. 2011 Jul;78(1):225-31. PubMed PMID: 21601243; PubMed Central PMCID: PMC4038103.
- c. Bui D, Mach KE, Zlatev DV, Rouse RV, Leppert JT, **Liao JC**. A Pilot Study of *In Vivo* Confocal Laser Endomicroscopy of Upper Tract Urothelial Carcinoma. *J Endourol*. 2015 Dec;29(12):1418-23. doi: 10.1089/end.2015.0523. Epub 2015 Oct 6. PubMed PMID: 26413927; PubMed Central PMCID: PMC4677518.
- d. Lopez A, Zlatev DV, Mach KE, Bui D, Liu JJ, Rouse RV, Harris T, Leppert JT, **Liao JC**. Intraoperative Optical Biopsy During Robotic-Assisted Radical Prostatectomy Using Confocal Endomicroscopy. *J Urol*. 2015 Nov 25; PubMed PMID: 26626214.

3. **Molecular imaging and therapeutic targets for bladder cancer.** To improve the precision of current strategies of bladder cancer imaging and therapy, we have pursued pre-clinical development of molecular imaging and therapeutic agents using patient-derived tissue samples and clinically relevant mouse models. Of particular interest is CD47, an innate immune checkpoint highly expressed by human bladder cancer cells and a recognized cancer therapeutic target. We identified CD47 as a promising optical molecular imaging target and validated using various labeling strategies for molecular imaging agents based a monoclonal antibody against CD47. Our goal is to translate these findings from pre-clinical phase to clinical trials.

- a. Pan Y, Volkmer JP, Mach KE, Rouse RV, Liu JJ, Sahoo D, Chang TC, Metzner TJ, Kang L, van de Rijn M, Skinner EC, Gambhir SS, Weissman IL, **Liao JC**. Endoscopic molecular imaging of human bladder cancer using a CD47 antibody. *Sci Transl Med*. 2014 Oct 29;6(260):260ra148. PubMed PMID: 25355698.
- b. Pan Y, Chang T, Marcq G, Liu C, Kiss B, Rouse R, Mach KE, Cheng Z, **Liao JC**. *In vivo* biodistribution and toxicity of intravesical administration of quantum dots for optical molecular imaging of bladder

cancer. Sci Rep. 2017 Aug 24;7(1):9309. doi: 10.1038/s41598-017-08591-w. PubMed PMID: 28839158; PubMed Central PMCID: PMC5571179.

- c. Davis RM, Kiss B, Trivedi DR, Metzner TJ, **Liao JC**, Gambhir SS. Surface-Enhanced Raman Scattering Nanoparticles for Multiplexed Imaging of Bladder Cancer Tissue Permeability and Molecular Phenotype. ACS Nano. 2018 Oct 23;12(10):9669-9679. doi: 10.1021/acsnano.8b03217. Epub 2018 Sep 11. PMID: 30203645; PMCID: PMC6202635.
 - d. Kiss B, van den Berg NS, Ertsey R, McKenna K, Mach KE, Zhang CA, Volkmer JP, Weissman IL, Rosenthal EL, **Liao JC**. CD47-Targeted Near-infrared Photoimmunotherapy for Human Bladder Cancer. Clin Cancer Res. 2019 Mar 19;. doi: 10.1158/1078-0432.CCR-18-3267. [Epub ahead of print] PubMed PMID: 30890547; NIHMSID:NIHMS1523811.
4. **Urine-based molecular diagnostics for bladder cancer using tumor-derived nucleic acids.** Given its abundance and ease of sample collection, urine is ideally suited as the source for development of bladder cancer molecular diagnostics. We applied high throughput sequencing and multiplex quantitative PCR to identify cancer-specific and ultrasensitive detection of tumor-derived RNA and cell-free DNA.
- a. Sin MLY, Mach KE, Sinha R, Wu F, Trivedi DR, Altobelli E, Jensen KC, Sahoo D, Lu Y, **Liao JC**. Deep Sequencing of Urinary RNAs for Bladder Cancer Molecular Diagnostics. Clin Cancer Res. 2017 Jul 15;23(14):3700-3710. PubMed PMID: 28193625; PubMed Central PMCID: PMC5873297.
 - b. Wallace E, Higuchi R, Satya M, McCann L, Sin MLY, Bridge JA, Wei H, Zhang J, Wong E, Hiar A, Mach KE, Scherr D, Egerdie RB, Ohta S, Sexton WJ, Meng MV, Weizer AZ, Woods M, Jansz GK, Zadra J, Lotan Y, Goldfarb B, **Liao JC**. Development of a 90-Minute Integrated Noninvasive Urinary Assay for Bladder Cancer Detection. J Urol. 2018 Mar;199(3):655-662. PubMed PMID: 29061538.
 - c. Dudley JC, Schroers-Martin J, Lazzareschi DV, Shi WY, Chen SB, Esfahani MS, Trivedi D, Chabon JJ, Chaudhuri AA, Stehr H, Liu CL, Lim H, Costa HA, Nabet BY, Sin MLY, **Liao JC**, Alizadeh AA, Diehn M. Detection and surveillance of bladder cancer using urine tumor DNA. Cancer Discov. 2018 Dec 21. pii: CD-18-0825. PubMed PMID: 30578357.
 - d. Shkolyar E, Zhao Q, Mach KE, Teslovich NC, Lee TJ, Cox S, Skinner EC, Lu Y, **Liao JC**. Bladder cancer risk stratification using a urinary mRNA biomarker panel - A path towards cystoscopy triaging. Urol Oncol. 2021 Mar 22;. doi: 10.1016/j.urolonc.2021.02.011. [Epub ahead of print] PubMed PMID: 33766467.

Complete List of Published Work in MyBibliography:

<https://www.ncbi.nlm.nih.gov/sites/myncbi/joseph.liao.1/bibliography/40621274/public/?sort=date&direction=descending>

D. Additional Information: Research Support and/or Scholastic Performance Ongoing Research Support

I01 BX004962 (**Liao**)

10/01/2020-09/30/2024

VA BLR&D Merit Review

Role: PI

Personalized assessment of bladder cancer treatment response using urinary molecular biomarkers

The goal of this project to validate a panel of urinary mRNA biomarkers for bladder cancer screening, surveillance, and treatment response assessment.

R01CA244526 (Diehn/**Liao**/Alizadeh)

07/01/2020-06/30/2025

NIH/NCI

Role: Multi-PI

Analysis of urine tumor nucleic acids for detection and personalized surveillance of bladder cancer

The project aims to develop and validate a bladder cancer diagnostic assay called urine tumor DNA Cancer Personalized Profiling by Deep Sequencing (uCAPP-Seq) to assess treatment response in patients with high risk non-muscle invasive and muscle invasive bladder cancer.

R01AI153133 (Yang/Wong)

06/15/2020-05/31/2025

NIH/NIAID

Role: Co-I

Changing Cultures in Sepsis: Rapid single cell pathogen identification and antibiotic susceptibility testing directly from whole blood

The project aims to develop a microfluidic system that integrates single cell pathogen identification and antimicrobial susceptibility testing for bloodstream infection.

N/A 02/01/2019-01/31/2022
Photocure, Inc.
Role: Site PI

Cysview® Blue Light Cystoscopy Registry

The goal of this project is to establish a local registry of bladder cancer patients who underwent hexaminolevulinate-assisted blue light cystoscopy to improve bladder cancer detection and surveillance.

Completed Research Support

R01AI117032 (Wang/Liao) 04/01/2015-03/31/2021
NIH/NIAID

Role: Multi-PI

A Droplet-Based Single Cell Platform Identification and AST

The goal of this research project is to develop and validate a high throughput, droplet-based microfluidic platform capable of performing integrated bacterial pathogen identification and antibiotic susceptibility testing.

DISC2-11105 (Beachy) 02/01/2019-01/31/2021
California Institute for Regenerative Medicine
Role: Co-I

Pluripotent stem cell-derived bladder epithelial progenitors for definitive cell replacement therapy of bladder cancer

The goal of this project is to generate bladder progenitors from pluripotent stem cells (hPSCs) in mouse models with the intent of replacing the bladder epithelium of cancer subjects with healthy bladder progenitors.

R01 CA160986 Liao (PI) 08/01/11 – 05/31/16 2.4 CM
NIH/NCI

Optical Imaging of Bladder Cancer with Molecular Contrast Agents

The goal of this project is to develop and validate optical molecular imaging agents to improve diagnosis and resection of bladder cancer. We have identified CD47 as molecular imaging target for bladder cancer and validated variety of optical imaging technologies.

U01 AI082457 Liao (PI) 3/15/09 – 2/28/15 2.4 CM
NIH/NIAID

An Integrated Diagnostic Biochip for Point of Care Pathogen Identification

The major goal of this project was to develop an integrated electrochemical biosensor for point-of-care urinary diagnostics in nontraditional health care settings.