Erik Reinertsen

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Education & Training

2019 - 2021 **Postdoctoral research fellowship**
Massachusetts General Hospital, MIT, and the Broad Institute

2012 - 2019 **M.D.**
Emory University School of Medicine

2014 - 2017 **Ph.D., Biomedical Engineering (minor in Statistics)**
Georgia Institute of Technology

2007 - 2012 **B.S., Bioengineering**
University of California, Los Angeles

Work experience

2021 - now **Director, Data Science and Engineering**
Prometheus Biosciences, Inc.
Create and lead a methods development and software engineering team that will enable Prometheus to leverage proprietary data and sophisticated analyses to obtain new insights into GI immune pathway biology to inform novel drug target and biomarker identification.

2019 - 2021 **Postdoctoral research fellow**
Cardiology Division, Massachusetts General Hospital
Research Laboratory of Electronics, MIT
Data Sciences Platform, Broad Institute
Led team to create machine learning pipeline in TensorFlow to stratify risk, predict outcomes, and discover phenotypes from multimodal physiological and clinical data. Lead effort between MGH, BWH, and the Broad Institute to extract, digitize, and analyze 9M+ 12-lead ECGs. Contributed to curation of 5000 echocardiograms, 300+ TB high-resolution ICU time series, EMR data, and outcomes. Managed five engineers, masters and PhD students, and postdoctoral researchers. Implemented software engineering best practices, version control, extensive documentation, and project management tools. Assembled and maintained five GPU workstations. Advised by Aaron Aguirre and Collin Stultz.

2018 Fall **Investment team intern**
Takeda Ventures (Palo Alto, CA)

Worked at early-stage life science investment arm of Takeda Pharmaceuticals. Supervised by senior partner David Shaywitz, MD, PhD. Focused on machine learning for drug discovery and clinical trials. Met with academic investigators and entrepreneurs to learn about research efforts to advance diagnostics and therapeutics. Evaluated new technologies via literature reviews, analysis of proprietary data, and conversations with subject matter experts. Presented analyses to R&D and investment team leadership.

2015 - 2016 **Medical student advisor**
Doximity (San Francisco, CA)
Provided feedback on new product concepts such as Residency Navigator and attended annual physician advisor meetings for the largest HIPAA-secure medical network in the United States.

2014 - 2016 **Cofounder**
Forge Health (Atlanta, GA)
Created 501(c)(3) non–profit that funded five startup pilots at Emory and the VA Medical Center. Led ten volunteers, raised $40,000, and organized the first two healthcare hackathons in Atlanta and dozens of smaller events. In 2016 merged with Sling Health, a medical technology incubator.

2009 - 2012 **President**
International Society for Pharmaceutical Engineering, UCLA Chapter
ISPE is a global organization that enhances industry efforts to develop, manufacture and reliably deliver quality medicines to patients. Founded and led UCLA chapter. Held skills workshops, site tours, and recruiting events to provide students with career opportunities in biotech.

2009 - 2012 **Undergraduate researcher**
Department of Bioengineering, UCLA
Developed fibrin hydrogels for dermal cell delivery, nanoparticle imaging of stem cells, and computational modeling of oxygen transport and cell growth.

Publications

Reinertsen E*, Song S*, Ong CS, Young K, Sundt T, Stultz CM, Aguirre AD. Prediction of mortality after cardiac surgical procedures using preoperative electrocardiograms and deep learning. *In preparation*

Schlesinger DE, Diamant N, Raghu A, , **Reinertsen E**, Young K, Batra P, Pomerantsev E, Stultz CM. A deep learning model for inferring elevated pulmonary artery and pulmonary capillary wedge pressures from the 12-lead electrocardiogram. *In review*

Ong CS*, **Reinertsen E***, Aguirre AD, Westover MB, Sundt TM. Machine learning predicts operative mortality for patients undergoing cardiac surgical procedures without established risk models. *In review*

*Authors contributed equally

Ong CS, **Reinertsen E**, Moonsamy P, Young K, Song S, Axtell AL, Mohan N, Jassar AS, Cameron DE, Aguirre AD, Sundt TM. Persistent new onset atrial fibrillation in patients undergoing surgical aortic valve replacement and the role of routine prophylactic concurrent intraoperative interventions. *In review*

Reinertsen E, Sabayon M, Riso MA, Lloyd M, Spektor B. Stellate ganglion blockade for treating refractory electrical storm: a single-institution case series. *In review*

Anastasio A, **Reinertsen E**, Anastasio G. Effect of medical student burnout and perception of competition amongst peers on development of specialty stereotypes. *In review*

Anastasio A, **Reinertsen E**, Anastasio G. Research reputation rank of US medical schools is inversely associated with increased competition amongst medical students. *In review*

Foy B, Carlson JT, **Reinertsen E**, Padros RV, Pallares RL, Palanques-Tost E, Mow C, Westover MB, Aguirre AD, Higgins JM. Association of red blood cell distribution width with mortality risk in adults hospitalized with COVID-19 infection. *JAMA Network Open.* 2020;3(9). doi:10.1001/jamanetworkopen.2020.22058

Sarma G[*], **Reinertsen E**[*], and the ML4CVD Group. Physiology as a lingua franca for clinical machine learning. *Patterns.* 2020; 1(2)). doi:10.1016/j.patter.2020.100017

Siegel B, Cakmak A, **Reinertsen E**, Benoit M, Figueroa J, Clifford GD, Phan H. Use of a wearable device to assess sleep and motor function in Duchenne muscular dystrophy. *Muscle & Nerve.* 2019; 61(2). doi:10.1002/mus.26759

Cakmak A, **Reinertsen E**, Taylor HA, Shah AJ, Clifford GD. Personalized heart failure severity estimates using passive smartphone data. *2018 IEEE International Conference on Big Data.* 2018; doi: 10.1109/BigData.2018.8621980

Lee MH, Perry L, **Reinertsen E**, Boyd JB, Granzow JW. Simple pedicled flaps for complex defects of the head, neck, and lower extremity. *Advances in Plastic and Reconstructive Surgery.* 2018.

Reinertsen E, Shashikumar, SP, Nemati S, Clifford GD. Multiscale network dynamics between heart rate and locomotor activity are altered in schizophrenia. *Physiological Measurement.* 2018;39(11). doi: 10.1088/1361-6579/aae1ed

Liu C, Oster J, **Reinertsen E**, Li Q, Zhao L, Nemati S, Clifford GD. Comparison of entropy approaches for atrial fibrillation discrimination. *Physiological Measurement.* 2018;39(7). doi:10.1088/1361-6579/aacc48

Reinertsen E, Clifford GD. A review of physiological and behavioral monitoring with digital sensors for neuropsychiatric illnesses. *Physiological Measurement.* 2018;39(5). doi:10.1088/1361-6579/aabf64

Reinertsen E, Mohan A, Fusaro A. An elective course for medical students on innovation and entrepreneurship. *bioRxiv* 148569. 2017

Reinertsen E, Neill SG, Nael K, Brat DJ, Hadjipanayis CG. Meningioma with tyrosine–rich crystalloids: a case report and review of the literature. *International Journal of Surgical Pathology.* 2018;26(2). doi:10.1088/1361-6579/aabf64

Reinertsen E, Osipov M, Liu C, Kane JM, Petrides G, Clifford GD. Continuous assessment of schizophrenia using accelerometer and heart rate data. *Physiological Measurement.* 2017;38(7). doi:10.1088/1361-6579/aabf64

DeSimone AK, Haydek JP, Sudduth CL, LaBarbera V, Desai Y, **Reinertsen E**, Manning KD. Encouraging student interest in teaching through a medical student teaching competition. *Academic Medicine.* 2017;92(8). doi:10.1097/ACM.0000000000001491

Reinertsen E, Nemati S, Vest AN, Vaccarino V, Lampert R, Shah AJ, Clifford GD. Heart rate–based window segmentation improves accuracy of classifying posttraumatic stress disorder using heart rate variability measures. *Physiological Measurement.* 2017;38(6). doi:10.1088/1361-6579/aabf64

Celano E, Salehani A, Malcolm JG, **Reinertsen E**, Hadjipanayis CG. Spinal cord ependymoma: a review of the literature and case series of ten patients. *Journal of Neuro–Oncology.* 2016;128(3). doi:10.1007/s11060-016-2135-8

Lee MH, **Reinertsen E**, McClure E, Lie S, Tanna N, Boyd JB, Granzow JW. Surgeon motivations behind the timing of breast reconstruction in patients requiring postmastectomy radiation therapy. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2015;68(11). doi:10.1016/j.bjps.2015.06.026

Lee MH, McClure E, **Reinertsen E**, Granzow JW. Lymphedema of the upper extremity following supraclavicular lymph node harvest. *Plastic and Reconstructive Surgery.* 2015;135(6). doi: 10.1097/PRS.0000000000001253

Reinertsen E, Skinner M, Wu, BM, Tawil B. Concentration of fibrin and presence of plasminogen affect proliferation, fibrinolytic activity, and morphology of human fibroblasts and keratinocytes in 3D fibrin constructs. *Tissue Engineering Part A.* 2014;20(21-22). doi:10.1089/ten.tea.2013.0423

Posters, Talks, and Abstracts

Reinertsen E. Introduction to deep learning. *Healthcare Transformation Lab, Massachusetts General Hospital (Boston, MA).* 2020.

Reinertsen E. Predicting mortality after cardiac surgery from ECGs using a convolutional neural network. *Medical Electronic Device Realization Center at MIT (Cambridge, MA).* 2020.

Reinertsen E. Predicting outcomes of cardiac surgical procedures using machine learning. *ML4CVD Sync, Data Sciences Platform, Broad Institute of MIT and Harvard (Cambridge, MA)*. 2020.

Cakmak A, Lanier H, **Reinertsen E**, Harzand A, Zafari M, Hammoud MA, Alrohaibani A, Wakwe C, Appeadu M, Clifford GD, Shah AJ. Passive smartphone actigraphy data predicts heart failure decompensation. *Circulation (AHA Scientific Sessions; Philadelphia, PA)*. 2019.

Cakmak A, **Reinertsen E**, Nemati S, Clifford GD. Benchmarking changepoint detection algorithms on cardiac time series. *Southern Data Science Conference (Orlando, FL)*. 2018.

Siegel B, Cakmak A, **Reinertsen E**, Benoit M, Figueroa J, Clifford GD, Phan H. Rest–activity patterns in Duchenne muscular dystrophy. *Parent Project Muscular Dystropy Connect Conference (Chicago, IL)*. 2017.

Reinertsen E. Forging collaboration between entrepreneurs, clinicians, engineers, and patients. *Stanford Medicine X (Stanford, CA)*. 2015. Link to video.

Reinertsen E, Palmius N, Song C, Danon L, Saemundsdottir G, Magnusson O, Vigfusson Y, Clifford GD. Mobile phone activity and population movement during an influenza A(H1N1) outbreak in Iceland. *Sleep and Circadian Neuroscience Institute at Oxford University (Oxford, UK)*. 2015.

Reinertsen E, Rawal A, Saldanha C. A novel EMR user interface with integrated physician task management. *Spring Convergence Innovation Competition Finalists Showcase (Atlanta, GA)*. 2015.

Reinertsen E. How to win the Inventathon: thoughts on innovation, unmet clinical needs, and leadership. UCLA Inventathon (Los Angeles, CA). 2014.

Reinertsen E, Wu BM. Enhancing cell viability by controlling oxygen diffusion–consumption via cell distribution. *Amgen Scholars US Symposium (Los Angeles, CA)*. 2011.

Reinertsen E, Skinner M, Wu BM, Tawil B. Comparison of fibrinolytic protease activity and collagen production of keratinocytes and fibroblasts cultured in 3D fibrin matrices. *Wound Healing Society Annual Meeting (Orlando, FL)*. 2011.

Reinertsen E, Duong H, Wu BM, Tawil B. 3D fibrin composition affects human fibroblast proliferation and fibrinolysis. *Tissue Engineering and Regenerative Medicine International Society (Orlando, FL)*. 2010.

Patents

Clifford GD, Cakmak A, Shah AJ, **Reinertsen E**. System for assessing health severity and predicting readmissions. US Provisional Patent Application No. 62/777,029. 2018.

Clifford GD, **Reinertsen E**, Shah AJ, Nemati S. Using heartrate information to classify PTSD. US Application No. 16/469,001. 2018. International Application No. PCT/US2017/059490.

Leadership and Service

2019 - present **Reviewer**
IEEE Journal of Biomedical and Health Informatics
Physiological Measurement
npj Digital Medicine

2016 - 2017 **Advisor**
Medicine X, Stanford University
Served as an advisor to the annual Medicine X conference. Organized breakout sessions on how to understand and solve unmet clinical needs using design and engineering principles. Medicine X is a catalyst for new ideas about the future of medicine and health care. The initiative explores how emerging technologies will advance the practice of medicine, improve health, and empower patients to be active participants in their own care.

2011 - 2017 **Conference organizer**
Korean–American Scientists and Engineers Association
Served on planning committees for "Young Generation Technical and Leadership Conference" and "Korean–American Technology Entrepreneurship Forum". These annual events are for Korean-American scientists, engineers, healthcare professionals, academics, founders, and industry professionals. Organized research presentations, poster sessions, and pitch competitions from startup companies. Events were held in Boston, Los Angeles, Philadelphia, San Francisco, Seattle, Orlando, and Dallas.

2011 **Assistant research editor**
Undergraduate Science Journal at UCLA
Student-run academic journal funded and supported by Howard Hughes Medical Institute. Features original research articles and review articles written by UCLA undergraduates, exposes students to UCLA research community, and provides new venue for interaction between faculty and students. Reviewed research content of dozens of submitted articles, provided feedback to authors and editor, and contributed to publication decisions.

Licensure & Boards

2018 USMLE Step 2 CK
2018 USMLE Step 2 CS
2014 USMLE Step 1

Teaching

2015 - 2016 **Graduate student teaching assistant**
Georgia Institution of Technology
Systems Biology and Computational Modeling. Course topics included linear algebra, differential equations, graph theory, probabilistic models, parameter estimation, and metabolomics. Delivered lectures, facilitated twice-weekly problem set sessions, set grading policy, led team of three undergraduate graders. Rated 4.5/5.0 in Fall 2015 (link to evals) and 4.6/5.0 in Spring 2016 (link to evals).

Fall 2017 **Teaching assistant, evidence-based medicine**
Emory University School of Medicine
Substituted for faculty to serve as facilitators for several problem-based learning small group sessions on biostatistics and epidemiology.

2014 - 2015 **Founding instructor, IEMed**
Emory University School of Medicine
Developed and co-taught "Innovation and Entrepreneurship in Medicine" (IEMed), an elective designed to expose medical students to technology innovation and entrepreneurship. In the second year of IEMed, administered surveys to assess student feedback and perceptions of innovation and entrepreneurship as it relates to career goals in medicine. Described these data and our experience in an academic article.

2014 - 2016 **Cofounder of the Medical Student Teaching Competition**
Emory University School of Medicine
Led team of medical students to develop and implement first medical student teaching competition (MSTC). Eight medical students selected from dozens of applicants paired with faculty coach to prepare and deliver eight-minute presentation to panel of attending and resident judges. Organized effort to collect data and publish in peer-reviewed journal. Advised successor committee members to establish what is now an annual tradition entering its seventh year. Link to 2019 MSTC video

2012 - 2013 **Director of the Transcript and Learning Objectives Service**
Emory University School of Medicine
Elected to lead institution-supported pre-clinical education initiative. Audio from preclinical lectures were recorded. Students subscribed to service, transcribed audio recordings to text, and outlined key learning objectives. Subscribers accessed these resources. Organized and maintained this service, developed a simple model to minimize supply-demand mismatch between subscribers and transcribers, and migrated system to secure cloud platform.

2011 - 2012 **Undergraduate tutor**
UCLA School of Engineering
Tutored engineering students via 1:1 sessions and small group lectures. Covered lower division courses in Mathematics, Physics, and Chemistry, and BioEng 110: Biotransport and Bioreaction Processes.

Other activities

Spring 2012 **Study abroad**
Introductory Korean. Korea University. Seongbuk-gu, Seoul, South Korea

2010 - 2012 **Emergency Medicine Research Associate**
Department of Emergency Medicine, UCLA
Emergency Medicine Research Associates (EMRA) is a primarily student-run, faculty-supported volunteer clinical research program at UCLA. Forty undergraduate students assist with screening, consenting, and enrolling patients in clinical trials and observational studies at the Ronald Reagan UCLA Medical Center.

Summer 2010 **US Student Ambassador**
Young Generation Forum leadership conference. Daegu, South Korea

Awards

2016 Korean–American Scientists and Engineers Association Graduate Scholarship
2016 Finalist, Paul & Daisy Soros Fellowship for New Americans
2015 David Cowan Scholarship, Georgia Healthcare Information & Management Systems Society
2015 Stanford Medicine X Student Leadership Program Scholarship
2015 Amgen Scholars Alumni Travel Award
2015 Phoenix Award for Best Industry & Academic Collaboration, Georgia Bio
2012 - 2019 Medical Scientist Training Program T32 grant, Emory University
2012 Cum Laude, UCLA
2012 Edie Wasserman Memorial Senior Prize, UCLA
2011 Tau Beta Pi
2011 Amgen Scholar
2011 Engineering Achievement Award for Student Welfare, UCLA
2011 Dean's Prize for Research, UCLA
2011 Korean–American Scientists & Engineers Association Undergraduate Scholarship
2010 Oppenheimer Foundation Scholar, UCLA
2009 - 2011 Dean's List, UCLA
2009 Undergraduate Research Fellowship, UCLA
2006 Eagle Scout with Silver Palm

Press mentions

2018 AI Doesn't Ask Why - But Physicians And Drug Developers Want To Know. Forbes.

2017 What smartwatches and other wearables can't track today - but might in the future. CNBC.

2017 Big data with heart, for psychiatric disorders. Emory University.

2014 Tech, Emory students launch medical technology incubator. Georgia Tech.