

# Erik Reinertsen

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## Education & Training

- 2019 - now **Postdoctoral Research Fellowship**  
**Massachusetts General Hospital & MIT**  
*Advisors:* Aaron Aguirre, Collin Stultz
- 2012 - 2019 **M.D.**  
**Emory University School of Medicine**
- 2014 - 2017 **Ph.D., Biomedical Engineering (minor in Statistics)**  
**Georgia Institute of Technology**  
*Thesis:* Dichotomizing illness from cardiovascular & locomotor activity time series  
*Advisors:* Gari Clifford, Shamim Nemati, Amit Shah
- 2007 - 2012 **B.S. in Bioengineering**  
**University of California, Los Angeles**

## Research positions

- 2019 - now **Postdoctoral Research Fellow**  
**Massachusetts General Hospital, Cardiology Division**  
**MIT, Research Laboratory of Electronics**  
We develop computational approaches to stratify risk, predict outcomes, and discover phenotypes from electronic medical record data and complex physiological signals including ECGs and invasive hemodynamic measurements.
- 2014 - 2017 **Graduate student researcher**  
**Georgia Tech, Department of Biomedical Engineering**  
Extracted features from heart rate and accelerometer data using signal processing, classified illness from these features with machine learning, and improved performance by analyzing information during specific times, over several time scales, and between signals.
- 2009 - 2012 **Undergraduate researcher**  
**UCLA, Department of Bioengineering**  
Developed fibrin hydrogels for dermal cell delivery, nanoparticle imaging of stem cells, and computational modeling of oxygen transport and cell growth. Supervised by Bill Tawil and Benjamin Wu.

## Publications

- In preparation Reinertsen E\*, Ong CS\*, Song S, Young K, Schlesinger D, Sundt TM, Aguirre AD, Stultz CM. Deep learning predicts mortality after cardiac surgical procedures from the pre-operative 12-lead ECG
- In preparation Sabayon M, Reinertsen E, Riso MA, Lloyd M, Spektor B. Stellate ganglion blockade for treating refractory electrical storm: a single-institution case series.
- In preparation Ong CS, Reinertsen E, Song S, Young K, Aguirre AD, Stultz CM, Sundt TM. Predictors of long-term atrial fibrillation after aortic valve replacement.
- Under review Ong CS\*, Reinertsen E\*, Aguirre AD, Westover MB, Sundt TM. Using machine learning to predict operative mortality for patients undergoing cardiac surgical procedures that do not have established risk models.
- Under review Anastasio A, Reinertsen E, Anastasio G. Medical student perception of peers interested in competitive versus less competitive specialties.
- Under review Anastasio A, Reinertsen E, Anastasio G. Research reputation rank of US medical schools is inversely associated with increased competition amongst medical students.
- 2020 Reinertsen E, Fusaro A. An elective course for medical students on innovation and entrepreneurship. [medRxiv 2020.08.22](#).
- 2020 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. Accepted for publication.
- 2020 Sarma G\*, Reinertsen E\*, and the ML4CVD Group. Physiology as a lingua franca for clinical machine learning. *Patterns* (Cell Press).
- 2019 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*.
- 2018 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 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*.

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\*Co-first authors

- 2018 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 Reinertsen E, Clifford GD. A review of physiological and behavioral monitoring with digital sensors for neuropsychiatric illnesses. *Physiological Measurement*.
- 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*.
- 2017 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 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*.
- 2016 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*.
- 2016 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*.
- 2015 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 Lee MH, McClure E, Reinertsen E, Granzow JW. Lymphedema of the upper extremity following supraclavicular lymph node harvest. *Plastic and Reconstructive Surgery*.
- 2014 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*.

### **Posters, Talks, and Abstracts**

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

- 2018 Cakmak A, Reinertsen E, Nemati S, Clifford GD. Benchmarking change-point detection algorithms on cardiac time series. Southern Data Science Conference. Orlando, FL.
- 2017 Siegel B, Cakmak A, Reinertsen E, Benoit M, Figueroa J, Clifford GD, Phan H. Rest-activity patterns in Duchenne muscular dystrophy. Parent Project Muscular Dystrophy Connect Conference. Chicago, IL.
- 2015 Reinertsen E. Forging collaboration between entrepreneurs, clinicians, engineers, and patients. Stanford Medicine X. Stanford, CA. [Link to video.](#)
- 2015 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 Medicine and Chronobiology Summer School at the Sleep and Circadian Neuroscience Institute. 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.
- 2014 Reinertsen E. How to win the Inventathon: thoughts on innovation, unmet clinical needs, and leadership. UCLA Inventathon. Los Angeles, CA.
- 2011 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.
- 2010 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.

## Patents

- 2018 Clifford GD, Cakmak A, Shah AJ, Reinertsen E. System for assessing health severity and predicting readmissions. United States Provisional Patent Application No. 62/777,029.
- 2016 Clifford GD, Reinertsen E, Shah AJ, Nemati S. System for tracking cardiovascular stress and PTSD. United States Provisional Patent Application No. 62/433,066 / International PCT Application No. PCT/US2017/059490.

## Teaching

- 18 Apr 2019 **Tweetorial**  
Reinertsen E, Dolan R. [Why is lactate elevated in sepsis or septic shock?](#) 108,391 impressions.
- 2015 - 2016 **Graduate student teaching assistant**  
**Georgia Institution of Technology**  
BMED 3520: 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 the first medical student teaching competition (MSTC). Eight medical students selected from dozens of applicants were paired with faculty coach to prepare and deliver an eight-minute presentation to a panel of seven attending and resident judges. Organized effort to collect data and publish this activity in a 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 each preclinical lecture is recorded. Students subscribe to the service, transcribe audio recordings to text, and outline key learning objectives as study aids. Subscribers access these resources. Organized and maintained this service, developed a simple economic model to minimize supply-demand mismatch between subscribers and transcribers, and migrated sign-up system and data sharing to a 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.

### **Industry positions**

Fall 2018 **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 501c3 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.

## Leadership and Service

- 2019 - present **Reviewer**  
Physiological Measurement.  
npj Digital Medicine.
- 2016 - 2017 **Advisor**  
**Medicine X, Stanford University**  
Served as an advisor to the annual Medicine X conference. Organized break-out 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 emerging scientists, engineers, health-care professionals, academics, start-up professionals, and industry professionals from Korean and Korean-American backgrounds. 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**  
The USJ is a student-run academic journal funded and supported by the Howard Hughes Medical Institute. The USJ features original research articles and review articles written by UCLA undergraduates, exposes students to the intricate UCLA research community, and provides a new venue for interaction between faculty and students. Reviewed the research content of dozens of submitted articles, provided critical feedback to authors and our editor, and contributed to decisions whether to reject or accept submissions.

## Licensure & Boards

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

## 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 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.