



Todd Coleman

Associate Professor of Bioengineering and, by courtesy, of Electrical Engineering

Bio

BIO

Todd P. Coleman is an Associate Professor in the Department of Bioengineering, and by courtesy, Electrical Engineering at Stanford University. He received B.S. degrees in electrical engineering (summa cum laude), as well as computer engineering (summa cum laude) from the University of Michigan. He received M.S. and Ph.D. degrees from MIT in electrical engineering and computer science. He did postdoctoral studies at MIT and Mass General Hospital in quantitative neuroscience. He previously was a faculty member in the Departments of Electrical & Computer Engineering and Bioengineering at the University of Illinois, Urbana-Champaign, and the University of California, San Diego, respectively. Dr. Coleman's research is very multi-disciplinary, using tools from applied probability, physiology, and bioelectronics. Examples include, for instance, optimal transport methods in high-dimensional uncertainty quantification and developing technologies and algorithms to monitor and modulate physiology of the nervous systems in the brain and visceral organs. He has served as a Principal Investigator on grants from the NSF, NIH, Department of Defense, and multiple private foundations. Dr. Coleman is an inventor on 10 granted US patents. He has been selected as a Gilbreth Lecturer for the National Academy of Engineering, a TEDMED speaker, and a Fellow of IEEE as well as the American Institute for Medical and Biological Engineering. He is currently the Chair of the National Academies Standing Committee on Biotechnology Capabilities and National Security Needs.

ACADEMIC APPOINTMENTS

- Associate Professor, Bioengineering
- Associate Professor (By courtesy), Electrical Engineering
- Member, Bio-X
- Member, Wu Tsai Human Performance Alliance
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Executive Committee Member, Wu Tsai Human Performance Alliance, Stanford University, (2021- present)

HONORS AND AWARDS

- Fellow, IEEE (2022)
- Fellow, American Institute for Medical and Biological Engineering (2019)
- Gilbreth Lecturer, National Academy of Engineering (2015)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Editorial Board Member, Annual Review of Biomedical Engineering (2022 - present)
- Chair, National Academies Standing Committee Biotechnology Capabilities and National Security Needs (2021 - present)
- Advisory Committee Member, Burroughs-Wellcome Fund, Career Award at the Scientific Interface (2019 - present)

Teaching

COURSES

2021-22

- Diagnostic Devices Lab: BIOE 201C, BIOE 301C (Spr)

STANFORD ADVISEES

Postdoctoral Faculty Sponsor

Alexis Allegra, Jonas Kurniawan, Sandya Subramanian

Doctoral Dissertation Advisor (AC)

Andrew Perley

Doctoral (Program)

Ziv Lautman

Publications

PUBLICATIONS

- **Peripheral Nerve Magnetoneurography With Optically Pumped Magnetometers.** *Frontiers in physiology*
Bu, Y., Prince, J., Mojtahed, H., Kimball, D., Shah, V., Coleman, T., Sarkar, M., Rao, R., Huang, M., Schwindt, P., Borna, A., Lerman, I.
2022; 13: 798376
- **Robust Regression and Optimal Transport Methods to Predict Gastrointestinal Disease Etiology from High Resolution EGG and Symptom Severity** *IEEE Transactions on Biomedical Engineering*
Agrusa, A. S., Kunkel, D. C., Coleman, T. P.
2022
- **Electrochemical performance study of Ag/AgCl and Au flexible electrodes for unobtrusive monitoring of human biopotentials** *Nano Select*
Kurniawan, J. F., Allegra, A., Pham, T., Nguyen, A. K., Sit, N. L., Tjhia, B., Shin, A. J., Coleman, T. P.
2022
- **Passive longitudinal weight and cardiopulmonary monitoring in the home bed.** *Scientific reports*
Harrington, N., Bui, Q. M., Wei, Z., Hernandez-Pacheco, B., DeYoung, P. N., Wassell, A., Duwaik, B., Desai, A. S., Bhatt, D. L., Agnihotri, P., Owens, R. L., Coleman, T. P., King, et al
1800; 11 (1): 24376
- **Macrophage calcium reporter mice reveal immune cell communication in vitro and in vivo.** *Cell reports methods*
Taghdiri, N., Calcagno, D. M., Fu, Z., Huang, K., Kohler, R. H., Weissleder, R., Coleman, T. P., King, K. R.
1800; 1 (8)
- **Statistical uncertainty quantification to augment clinical decision support: a first implementation in sleep medicine.** *NPJ digital medicine*
Kang, D. Y., DeYoung, P. N., Tantiengloc, J., Coleman, T. P., Owens, R. L.
2021; 4 (1): 142
- **Miniaturized wireless gastric pacing via inductive power transfer with non-invasive monitoring using cutaneous Electrogastrography.** *Bioelectronic medicine*
Perley, A., Roustaei, M., Aguilar-Rivera, M., Kunkel, D. C., Hsiai, T. K., Coleman, T. P., Abiri, P.
2021; 7 (1): 12
- **An Adhesive-Integrated Stretchable Silver-Silver Chloride Electrode Array for Unobtrusive Monitoring of Gastric Neuromuscular Activity** *ADVANCED MATERIALS TECHNOLOGIES*
Kurniawan, J. F., Tjhia, B., Wu, V. M., Shin, A., Sit, N. J., Pham, T., Nguyen, A., Li, C., Kumar, R., Aguilar-Rivera, M., Lerman, I., Kunkel, D. C., Coleman, et al
2021; 6 (5)

- **Sampling, variational Bayesian inference, and conditioned stochastic differential equations**
Coleman, T. P., Raginsky, M., IEEE
IEEE.2021: 3054-3059
- **Building a Simple and Versatile Illumination System for Optogenetic Experiments** *JOVE-JOURNAL OF VISUALIZED EXPERIMENTS*
Kyriakakis, P., de Cossio, L., Howard, P., Kouv, S., Catanho, M., Hu, V. J., Kyriakakis, R., Allen, M. E., Ma, Y., Aguilar-Rivera, M., Coleman, T. P.
2021
- **Interoceptive insular cortex participates in sensory processing of gastrointestinal malaise and associated behaviors** *SCIENTIFIC REPORTS*
Aguilar-Rivera, M., Kim, S., Coleman, T. P., Maldonado, P. E., Torrealba, F.
2020; 10 (1): 21642
- **Data-driven noise modeling of digital DNA melting analysis enables prediction of sequence discriminating power** *BIOINFORMATICS*
Langouche, L., Aralar, A., Sinha, M., Lawrence, S. M., Fraley, S., Coleman, T. P.
2020; 36 (22-23): 5337-5343
- **Direct and Indirect Effects-An Information Theoretic Perspective** *ENTROPY*
Schamberg, G., Chapman, W., Xie, S., Coleman, T. P.
2020; 22 (8)
- **Measuring Sample Path Causal Influences With Relative Entropy** *IEEE TRANSACTIONS ON INFORMATION THEORY*
Schamberg, G., Coleman, T. P.
2020; 66 (5): 2777-2798
- **Smart Electronic Eyedrop Bottle for Unobtrusive Monitoring of Glaucoma Medication Adherence** *SENSORS*
Aguilar-Rivera, M., Erudaitius, D. T., Wu, V. M., Tantiogloc, J. C., Kang, D. Y., Coleman, T. P., Baxter, S. L., Weinreb, R. N.
2020; 20 (9)
- **A Deep Convolutional Neural Network Approach to Classify Normal and Abnormal Gastric Slow Wave Initiation From the High Resolution Electrogastragram** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*
Agrusa, A. S., Gharibans, A. A., Allegra, A. A., Kunkel, D. C., Coleman, T. P.
2020; 67 (3): 854-867
- **Spatial Patterns From High-Resolution Electrogastrography Correlate With Severity of Symptoms in Patients With Functional Dyspepsia and Gastroparesis** *CLINICAL GASTROENTEROLOGY AND HEPATOLOGY*
Gharibans, A. A., Coleman, T. P., Mousa, H., Kunkel, D. C.
2019; 17 (13): 2668-2677
- **Bayesian inverse methods for spatiotemporal characterization of gastric electrical activity from cutaneous multi-electrode recordings** *PLOS ONE*
Allegra, A. B., Gharibans, A. A., Schamberg, G. E., Kunkel, D. C., Coleman, T. P.
2019; 14 (10): e0220315
- **High-density surface electromyography: A visualization method of laryngeal muscle activity**
Bracken, D. J., Ornelas, G., Coleman, T. P., Weissbrod, P. A.
WILEY.2019: 2347-2353
- **A Distributed Framework for the Construction of Transport Maps.** *Neural computation*
Mesa, D. A., Tantiogloc, J. n., Mendoza, M. n., Kim, S. n., P Coleman, T. n.
2019; 31 (4): 613-52
- **A flexible likelihood approach for predicting neural spiking activity from oscillatory phase** *JOURNAL OF NEUROSCIENCE METHODS*
Johnson, T. D., Coleman, T. P., Rangel, L. M.
2019; 311: 307-317
- **A High-Resolution Digital DNA Melting Platform for Robust Sequence Profiling and Enhanced Genotype Discrimination** *SLAS TECHNOLOGY*
Sinha, M., Mack, H., Coleman, T. P., Fraley, S.
2018; 23 (6): 580-591
- **The activity of discrete sets of neurons in the posterior insula correlates with the behavioral expression and extinction of conditioned fear** *JOURNAL OF NEUROPHYSIOLOGY*

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- Patricio Casanova, J., Aguilar-Rivera, M., de los Angeles Rodriguez, M., Coleman, T. P., Torrealba, F.
2018; 120 (4): 1906-1913
- **A Modularized Efficient Framework for Non-Markov Time Series Estimation** *IEEE TRANSACTIONS ON SIGNAL PROCESSING*
Schamberg, G., Ba, D., Coleman, T. P.
2018; 66 (12): 3140-3154
 - **A State Space and Density Estimation Framework for Sleep Staging in Obstructive Sleep Apnea** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*
Kang, D. Y., DeYoung, P. N., Malhotra, A., Owens, R. L., Coleman, T. P.
2018; 65 (6): 1201-1212
 - **Epidermal Electrode Technology for Detecting Ultrasonic Perturbation of Sensory Brain Activity** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*
Huang, S., Fisher, J. N., Ye, M., Kim, Y., Ma, R., Nabili, M., Krauthamer, V., Myers, M. R., Coleman, T. P., Welle, C. G.
2018; 65 (6): 1272-1280
 - **In-Home Sleep Recordings in Military Veterans With Posttraumatic Stress Disorder Reveal Less REM and Deep Sleep < 1 Hz** *FRONTIERS IN HUMAN NEUROSCIENCE*
Onton, J. A., Matthews, S. C., Kang, D. Y., Coleman, T. P.
2018; 12: 196
 - **Emerging Technologies for Molecular Diagnosis of Sepsis** *CLINICAL MICROBIOLOGY REVIEWS*
Sinha, M., Jupe, J., Mack, H., Coleman, T. P., Lawrence, S. M., Fraley, S. I.
2018; 31 (2)
 - **Artifact Rejection Methodology Enables Continuous, Noninvasive Measurement of Gastric Myoelectric Activity in Ambulatory Subjects** *SCIENTIFIC REPORTS*
Gharibans, A. A., Smarr, B. L., Kunkel, D. C., Kriegsfeld, L. J., Mousa, H. M., Coleman, T. P.
2018; 8: 5019
 - **Biosynthesis of Orthogonal Molecules Using Ferredoxin and Ferredoxin-NADP(+) Reductase Systems Enables Genetically Encoded PhyB Optogenetics** *ACS SYNTHETIC BIOLOGY*
Kyriakakis, P., Catanho, M., Hoffner, N., Thavarajah, W., Hu, V. J., Chao, S., Hsu, A., Pham, V., Naghavian, L., Dozier, L. E., Patrick, G. N., Coleman, T. P.
2018; 7 (2): 706-717
 - **Scalable Manufacturing of Solderable and Stretchable Physiologic Sensing Systems** *ADVANCED MATERIALS*
Kim, Y., Lu, J., Shih, B., Gharibans, A., Zou, Z., Matsuno, K., Aguilera, R., Han, Y., Meek, A., Xiao, J., Tolley, M. T., Coleman, T. P.
2017; 29 (39)
 - **High-Resolution Electrogastrogram: A Novel, Noninvasive Method for Determining Gastric Slow-Wave Direction and Speed** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*
Gharibans, A. A., Kim, S., Kunkel, D. C., Coleman, T. P.
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 - **An Information and Control Framework for Optimizing User-Compliant Human-Computer Interfaces** *PROCEEDINGS OF THE IEEE*
Tantiongloc, J., Mesa, D. A., Ma, R., Kim, S., Alzate, C. H., Camacho, J. J., Manian, V., Coleman, T. P.
2017; 105 (2): 273-285
 - **The Use of Cardiac Orienting Responses as an Early and Scalable Biomarker of Alcohol-Related Neurodevelopmental Impairment** *ALCOHOLISM-CLINICAL AND EXPERIMENTAL RESEARCH*
Mesa, D. A., Kable, J. A., Coles, C. D., Jones, K., Yevtushok, L., Kulikovskiy, Y., Wertelecki, W., Coleman, T. P., Chambers, C. D., CIFASD
2017; 41 (1): 128-138
 - **Visualization of Whole-Night Sleep EEG From 2-Channel Mobile Recording Device Reveals Distinct Deep Sleep Stages with Differential Electrodermal Activity** *FRONTIERS IN HUMAN NEUROSCIENCE*
Onton, J. A., Kang, D. Y., Coleman, T. P.
2016; 10: 605
 - **Learning Minimal Latent Directed Information Polytrees** *NEURAL COMPUTATION*
Etesami, J., Kiyavash, N., Coleman, T.
2016; 28 (9): 1723-1768
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- **Directed Information Graphs** *IEEE TRANSACTIONS ON INFORMATION THEORY*
Quinn, C. J., Kiyavash, N., Coleman, T. P.
2015; 61 (12): 6887-6909
- **Scalable Microfabrication Procedures for Adhesive-Integrated Flexible and Stretchable Electronic Sensors** *SENSORS*
Kang, D. Y., Kim, Y., Ornelas, G., Sinha, M., Naidu, K., Coleman, T. P.
2015; 15 (9): 23459-23476
- **Large-scale spatiotemporal spike patterning consistent with wave propagation in motor cortex** *NATURE COMMUNICATIONS*
Takahashi, K., Kim, S., Coleman, T. P., Brown, K. A., Suminski, A. J., Best, M. D., Hatsopoulos, N. G.
2015; 6: 7169
- **An Optimizer's Approach to Stochastic Control Problems With Nonclassical Information Structures** *IEEE TRANSACTIONS ON AUTOMATIC CONTROL*
Kulkarni, A. A., Coleman, T. P.
2015; 60 (4): 937-949
- **Efficient Total Probability Prediction via Convex Optimization and Optimal Transport**
Kim, S., Mesa, D., Coleman, T., IEEE
IEEE.2015: 681-685
- **A Scalable Framework to Transform Samples from One Continuous Distribution to Another**
Mesa, D., Kim, S., Coleman, T., IEEE
IEEE.2015: 676-680
- **EEG Gamma Band Oscillations Differentiate the Planning of Spatially Directed Movements of the Arm Versus Eye: Multivariate Empirical Mode Decomposition Analysis** *IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION ENGINEERING*
Park, C., Plank, M., Snider, J., Kim, S., Huang, H., Gepshtein, S., Coleman, T. P., Poizner, H.
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- **Dynamic and Succinct Statistical Analysis of Neuroscience Data** *PROCEEDINGS OF THE IEEE*
Kim, S., Quinn, C. J., Kiyavash, N., Coleman, T. P.
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- **Fractal design concepts for stretchable electronics** *NATURE COMMUNICATIONS*
Fan, J. A., Yeo, W., Su, Y., Hattori, Y., Lee, W., Jung, S., Zhang, Y., Liu, Z., Cheng, H., Falgout, L., Bajema, M., Coleman, T., Gregoire, et al
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- **Grand Challenges in Mapping the Human Brain: NSF Workshop Report** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*
He, B., Coleman, T., Genin, G. M., Glover, G., Hu, X., Johnson, N., Liu, T., Makeig, S., Sajda, P., Ye, K.
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- **Efficient Methods to Compute Optimal Tree Approximations of Directed Information Graphs** *IEEE TRANSACTIONS ON SIGNAL PROCESSING*
Quinn, C. J., Kiyavash, N., Coleman, T. P.
2013; 61 (12): 3173-3182
- **A Timing Channel Spyware for the CSMA/CA Protocol** *IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY*
Kiyavash, N., Koushanfar, F., Coleman, T. P., Rodrigues, M.
2013; 8 (3): 477-487
- **Bit-Wise Unequal Error Protection for Variable-Length Block Codes With Feedback** *IEEE TRANSACTIONS ON INFORMATION THEORY*
Nakiboglu, B., Gorantla, S. K., Zheng, L., Coleman, T. P.
2013; 59 (3): 1475-1504
- **Robust Directed Tree Approximations for Networks of Stochastic Processes**
Quinn, C. J., Etesami, J., Kiyavash, N., Coleman, T. P., IEEE
IEEE.2013: 2254-2258
- **Circadian Rhythm of Redox State Regulates Excitability in Suprachiasmatic Nucleus Neurons** *SCIENCE*
Wang, T. A., Yu, Y. V., Govindaiah, G., Ye, X., Artinian, L., Coleman, T. P., Sweedler, J. V., Cox, C. L., Gillette, M. U.
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- **Characterizing the Efficacy of the NRL Network Pump in Mitigating Covert Timing Channels** *IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY*
Gorantla, S. K., Kadloor, S., Kiyavash, N., Coleman, T. P., Moskowicz, I. S., Kang, M. H.
2012; 7 (1): 64-75
- **An Optimizer's Approach to Stochastic Control Problems with Nonclassical Information Structures**
Kulkarni, A. A., Coleman, T. P., IEEE
IEEE.2012: 154-159
- **A Stochastic Control Approach to Optimally Designing Hierarchical Flash Sets in P300 Communication Prostheses** *IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION ENGINEERING*
Ma, R., Aghasadeghi, N., Jarzebowski, J., Bretl, T., Coleman, T. P.
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- **A Message-Passing Approach to Combating Desynchronization Attacks** *IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY*
Sadasivam, S., Moulin, P., Coleman, T. P.
2011; 6 (3): 894-905
- **Epidermal Electronics** *SCIENCE*
Kim, D., Lu, N., Ma, R., Kim, Y., Kim, R., Wang, S., Wu, J., Won, S., Tao, H., Islam, A., Yu, K., Kim, T., Chowdhury, et al
2011; 333 (6044): 838-843
- **Estimating the directed information to infer causal relationships in ensemble neural spike train recordings** *JOURNAL OF COMPUTATIONAL NEUROSCIENCE*
Quinn, C. J., Coleman, T. P., Kiyavash, N., Hatsopoulos, N. G.
2011; 30 (1): 17-44
- **A Feedback Information-Theoretic Approach to the Design of Brain-Computer Interfaces** *INTERNATIONAL JOURNAL OF HUMAN-COMPUTER INTERACTION*
Omar, C., Akce, A., Johnson, M., Bretl, T., Ma, R., Maclin, E., McCormick, M., Coleman, T. P.
2011; 27 (1): 5-23
- **A Computationally Efficient Method for Nonparametric Modeling of Neural Spiking Activity with Point Processes** *NEURAL COMPUTATION*
Coleman, T. P., Sarma, S. S.
2010; 22 (8): 2002-2030
- **A dynamical point process model of auditory nerve spiking in response to complex sounds** *JOURNAL OF COMPUTATIONAL NEUROSCIENCE*
Trevino, A., Coleman, T. P., Allen, J.
2010; 29 (1-2): 193-201
- **Introduction to the Special Issue on Information Theory in Molecular Biology and Neuroscience** *IEEE TRANSACTIONS ON INFORMATION THEORY*
Milenkovic, O., Alterovitz, G., Battail, G., Coleman, T. P., Hagenauer, J., Meyn, S. P., Price, N., Ramoni, M. F., Shmulevich, I., Szpankowski, W.
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- **Joint Source-Channel Coding for Transmitting Correlated Sources Over Broadcast Networks**
Coleman, T. P., Martinian, E., Ordentlich, E.
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- **A Low-Complexity Universal Scheme for Rate-Constrained Distributed Regression Using a Wireless Sensor Network**
Fernandes, A. L., Raginsky, M., Coleman, T. P.
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- **Low-complexity approaches to Slepian-Wolf near-lossless distributed data compression**
Coleman, T. P., Lee, A. H., Medard, M., Effros, M.
IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC.2006: 3546-3561
- **A distributed scheme for achieving energy-delay tradeoffs with multiple service classes over a dynamically varying network** *IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS*
Coleman, T. P., Medard, M.
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- **Capacity of time-slotted ALOHA packetized multiple-access systems over the AWGN channel** *IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS*
Medard, M., Huang, J. Y., Goldsmith, A. J., Meyn, S. P., Coleman, T. P.
2004; 3 (2): 486-499