BIOGRAPHICAL SKETCH

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NAME: EUBANK, STEPHEN G

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

POSITION TITLE: Deputy Director

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)	END DATE MM/YYYY	FIELD OF STUDY
Swarthmore College, Swarthmore, PA	BS	05/1979	Physics
University of Texas at Austin, Austin, TX	PHD	05/1986	Physics
La Jolla Institute, San Diego, CA	Postdoctoral Fellow	05/1987	Fluid Dynamics
Los Alamos National Laboratory, NM	Postdoctoral Fellow	05/1991	Nonlinear Dynamics

A. Personal Statement

My research focuses on mathematical and computational models of infectious disease. In general, I bring a mathematical physicist's background to modeling; in particular, I study the appropriate level of detail in networks representing complex social systems. I have been funded by NIH since 2004. Since 2000, I have led efforts to provide epidemiological modeling support to policymakers, at first for smallpox for the White House Office of Homeland Security and later for influenza as PI of one of the three original NIGMS-funded Modeling Infectious Disease Agents Study (MIDAS) research groups, and as a collaborator in the Defense Threat Reduction Agency's program to develop a Comprehensive National Incident Management System. I was a senior investigator in a CDC Center of Excellence in Medical Informatics led by the University of Utah devoted to incorporating models into public health practice at the local level. In 2022, I was a Jefferson Fellow at the State Dept.'s Office of International Health and Biodefense, learning about practical issues affecting policymakers' and response coordinators' use of epidemiological modeling. My primary role in the proposed project will be to advise on the curation of epidemiological datasets and on tools to connect data, modeling, and analyses.

1. Eubank S, Eckstrand I, Lewis B, Venkatramanan S, Marathe M, Barrett CL. Commentary on Ferguson, et al., "Impact of Non-pharmaceutical Interventions (NPIs) to Reduce COVID-19 Mortality and Healthcare Demand". Bull Math Biol. 2020 Apr 8;82(4):52. PubMed Central PMCID: PMC7140590.
2. Alexander KA, Sanderson CE, Marathe M, Lewis BL, Rivers CM, Shaman J, Drake JM, Lofgren E, Dato VM, Eisenberg MC, Eubank S. What factors might have led to the emergence of Ebola in West Africa?. PLoS Negl Trop Dis. 2015;9(6):e0003652. PubMed Central PMCID: PMC4456362.
3. Halloran ME, Ferguson NM, Eubank S, Longini IM Jr, Cummings DA, Lewis B, Xu S, Fraser C, Vullikanti A, Germann TC, Wagener D, Beckman R, Kadau K, Barrett C, Macken CA, Burke DS, Cooley P. Modeling targeted layered containment of an influenza pandemic in the United States. Proc Natl Acad Sci U S A. 2008 Mar 25;105(12):4639-44. PubMed Central PMCID: PMC2290797.
4. Eubank S, Guclu H, Kumar VS, Marathe MV, Srinivasan A, Toroczkai Z, Wang N. Modelling disease outbreaks in realistic urban social networks. Nature. 2004 May 13;429(6988):180-4. PubMed PMID: 15141212.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

2022 - 2022 Foreign Affairs Officer (expert), Office of International Health and Biodefense, Bureau of Oceans and International Environmental and Scientific Affairs, U.S. Department of State, Washington, DC

2019 - Professor, Department of Public Health Sciences, School of Medicine, University of Virginia,

	Charlottesville, VA
2018 -	Deputy Director, Network System Science and Advanced Computing Division, Biocomplexity Institute, University of Virginia, Charlottesville, VA
2014 - 2018	Professor, Department of Population Health Sciences, Virginia Tech, Blacksburg, VA
2005 - 2018	Deputy Director, Network Dynamics and Simulation Science Laboratory, Virginia Bioinformatics Institute, Virginia Tech, Blacksburg, VA
2005 - 2018	Adjunct Faculty, Physics Department, Virginia Tech, Blacksburg, VA
1997 - 2005	Staff Member, Basic and Applied Simulation Sciences Group, LANL, Los Alamos, NM
1995 - 1997	Invited Researcher, Interpreting Telecommunication Laboratory, ATR, Kyoto
1994 - 1995	Contractor, TRANSIMS project, Los Alamos National Laboratory, Los Alamos, NM
1994 - 1995	Complex Systems Associate (half time), Biosphere Space Ventures, Tucson, AZ
1991 - 1994	Co-Founder, Prediction Company, Santa Fe, NM

Honors

2022	Jefferson Science Fellowship, NASEM
2014	Best paper award, Blue Sky Ideas, Autonomous Agents and Multiagent Systems International Conference
2013	Army Patriot Award, Department of Defense
2011	Recognition for exceptional service and dedication in providing technical expertise and guidance to the Director, NIH, on a comprehensive risk assessment for the Boston NEIDL, NIH
1999	Distinguished Copyright award for TRANSIMS software, LANL
1997	Best paper award, Japanese Society for Artificial Intelligence, Spoken Language Special Interest Group meeting

C. Contribution to Science

1. As PI for a research project in the NIGMS MIDAS program, I advocated for bringing modern computational modeling to infectious disease epidemiology and, taking advantage of the power of these models, for incorporating more information about behavior at the individual level. Epidemiology at the time was dominated by mass-action, compartmental style models, and more complex models were viewed with extreme skepticism. By demonstrating to policymakers the possible advantages of complex models and the important shortcomings of simple models, and by backing up these demonstrations with peer-reviewed technical research in both areas, I helped create a more receptive environment for model-based decision making. For example, paper (c) below has received more than 2300 citations, according to Google Scholar.

    a. Alexander K, Carlson C, Lewis B, Getz W, Marathe M, Eubank S, Sanderson C, Blackburn J. The Connections Between Ecology and Infectious Disease. 1 ed. Hurst CJ, editor. eBook: Springer, Cham; 2018. The Ecology of Pathogen Spillover and Disease Emergence at the Human-Wildlife-Environment Interface; p.267-298. DOI: 10.1007%2F978-3-319-92373-4_8

    b. Lofgren ET, Halloran ME, Rivers CM, Drake JM, Porco TC, Lewis B, Yang W, Vespignani A, Shaman J, Eisenberg JN, Eisenberg MC, Marathe M, Scarpino SV, Alexander KA, Meza R, Ferrari MJ, Hyman JM, Meyers LA, Eubank S. Opinion: Mathematical models: a key tool for outbreak response. Proc Natl Acad Sci U S A. 2014 Dec 23;111(51):18095-6. PubMed Central PMCID: PMC4280577.

    c. Toroczkai Z, Eubank S. Agent-based Modeling as a Decision Making Tool. Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2005 [Internet] Washington, DC: The National Academies Press; 2005. p.99-107.

    d. Eubank S. The Mathematical Sciences' Role in Homeland Security. Washington, DC: National Academies Press; 2004. p.166-187.

2. Bringing insights from computer science, physics, engineering and math to complex network science: I have extended the theory and applications of the concept of network reliability introduced by Moore and Shannon, integrated it with insights from computational complexity theory and critical phenomena in physics, and applied it to computational epidemiology. These methods provide a powerful framework for

understanding how the structure of complex networks affects dynamical processes taking place on those networks.

a. Mishra R, Eubank S, Nath M, Amundsen M, Adiga A. Complex Networks and Their Applications XI. Cherifi H, Montegna RN, Rocha LM, Cherifi C, Micciche S, editors. Cham, Switzerland: Springer; 2023. Community Detection Using Moore-Shannon Network Reliability: Application to Food Networks; p.271-282. DOI: 10.1007/978-3-031-21131-7
b. Nath M, Ren Y, Eubank S. An approach to structural analysis using Moore-Shannon network reliability. Aiello L., Cherifi C., Cherifi H., Lambiotte R., Lió P., Rocha L. (eds) Complex Networks and Their Applications VII. COMPLEX NETWORKS 2018. Studies in Computational Intelligence. 2018 December 02; 812. DOI: 10.1007/978-3-030-05411-3_44
c. Khorramzadeh Y, Youssef M, Eubank S, Mowlaei S. Analyzing network reliability using structural motifs. Phys Rev E Stat Nonlin Soft Matter Phys. 2015 Apr;91(4):042814. PubMed Central PMCID: PMC4495667.
d. Youssef M, Khorramzadeh Y, Eubank S. Network reliability: the effect of local network structure on diffusive processes. Phys Rev E Stat Nonlin Soft Matter Phys. 2013 Nov;88(5):052810. PubMed Central PMCID: PMC3977845.

3. Immune system modeling I led development of the Enteric Immunity Simulator (ENISI). This high-performance-computing enabled, agent-based simulation of interactions among spatially distributed epithelial cells, T-cells, macrophages, and bacteria, including the concentrations of intercellular cytokines and chemotaxis set a benchmark for immune system modeling. It transformed the way we think about modeling such systems and the ways modelers contribute to transdisciplinary approaches to immunology.

a. Deodhar S, Bisset K, Chen J, Ma Y, Marathe M. IHI '12 Proceedings of the 2nd ACM SIGHIT International Health Informatics Symposium. New York: ACM; 2012. Enhancing user-productivity and capability through integration of distinct software in epidemiological systems; p.171-180.
b. Wendelsdorf K, Bassaganya-Riera J, Bisset K, Eubank S, Hontecillas R, Marathe M. ENteric Immunity SImulator: A tool for in silico study of gut immunopathologies (166.15). The Journal of Immunology. 2011 April 01; 186(1_Supplement). DOI: 10.4049/jimmunol.186.Supp.166.15

4. Time series prediction in nonlinear and chaotic dynamical systems: As a post-doc at Los Alamos, I was part of a small group working on novel methods to identify chaos in experimental data and to make use of deterministic chaos to improve noise reduction and time series prediction. The methods included reconstructing multi-dimensional state spaces from scalar time series and applying locally linear models. Several ideas that emerged from this group turned out to be very useful in the field. For example, a paper on the method of surrogate data suggested by Theiler and developed by the group has received over 4600 citations, according to Google Scholar.

a. Gibson J, Doyne Farmer J, Casdagli M, Eubank S. An analytic approach to practical state space reconstruction. Physica D: Nonlinear Phenomena. 1992; 57(1-2):1-30. DOI: 10.1016/0167-2789(92)90085-2
b. Theiler J, Eubank S, Longtin A, Galdrikian B, Doyne Farmer J. Testing for nonlinearity in time series: the method of surrogate data. Physica D: Nonlinear Phenomena. 1992; 58(1-4):77-94. DOI: 10.1016/0167-2789(92)90102-S
c. Casdagli M, Eubank S, Farmer JD, Gibson . State space reconstruction in the presence of noise. Physica D: Nonlinear Phenomena. 1991; 51(1-3):52-98. DOI: 10.1016/0167-2789(91)90222-U
d. Eubank S, Farmer D. An introduction to chaos and randomness. In:Jen E, editor. 1989 complex systems summer school;. 1989 lectures in complex systems. Proceedings: Lectures, Volume 2; 1989 June 05; Santa Fe, NM. Redwood City, CA: Addison-Wesley Publishing Company; c1990.

Complete List of Published Work in My Bibliography:
https://www.ncbi.nlm.nih.gov/myncbi/stephen.eubank.1/bibliography/public/