

V I R T U A L
W O R K S H O P

A Workshop on Cancer
CONVERGENCE
and
INTERCEPTION

MONDAY & TUESDAY
JULY 19 – 20, 2021



The National Science Foundation and Stand Up To Cancer

are joining forces to hold a virtual workshop, featuring the movement of scientists from many diverse disciplines and social sciences into the biological sciences – CONVERGENCE.

The talents, abilities, and innovations from the biological, mathematical, physical and computer sciences, and engineering are now being applied to the development of new technologies that address important questions in biotechnology and biomedical sciences and will fuel growth in the bioeconomy.

The theme of the virtual workshop will be CANCER INTERCEPTION, an area that is benefiting from the convergence of diverse scientists. This movement is having a big impact, not only in the advancement of medical sciences, but also creating economic growth, developing new technologies and industries.

Cooperation and collaboration among academia, industry, and the government is an important part of this initiative.

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A Workshop on Cancer
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MONDAY & TUESDAY
JULY 19 – 20, 2021

Co-Hosted by



SCHEDULE

Monday, July 19, 2021 • *Morning*



9:00AM – 9:10AM (EASTERN STANDARD TIME)

WELCOME REMARKS

Krastan Blagoev

Physics of Living Systems, Division of Physics, NSF
Department of Biophysics, Johns Hopkins University

Theresa Good

Molecular and Cellular Biosciences, NSF

Sung Poblete

Stand Up To Cancer



9:10AM – 9:50AM

Jamie Blundell

Cambridge University

Understanding Blood Cancers Through the Lens of Evolution



9:50AM – 10:30AM

Raul Rabadan

Columbia University

Random Matrix Theory



10:30AM – 11:10AM

Kurt Schalper

Yale University

Decoding the Tumor Immune Microenvironment of Human Lung Cancer



11:10AM – 11:30AM

COFFEE BREAK



11:30AM – 12:10PM

Harlan Robins

Adaptive Biotechnologies

T-cell Receptors, AI and Cancer

SCHEDULE

Monday, July 19, 2021 • Afternoon



12:10PM – 1:00PM

LUNCH BREAK



1:00PM – 1:40PM

Regina Barzilay

MIT

Rethinking Cancer Diagnosis and Cure with AI



1:40PM – 2:20PM

Tommi Jaakkola

MIT

AI Driven Molecular Design and Therapeutics



2:20PM – 2:30PM

COFFEE BREAK



2:30PM – 3:10PM

Mickey Atwal

Cold Spring Harbor Laboratory / Regeneron

*Multiomic Single Cell Sequencing Facilitates Accurate
Deep Learning Prediction of TCR-Antigen Binding*



3:10PM – 3:50PM

Julie Sutcliffe

UC Davis

Detect and Treat: A Theranostic Approach



3:50PM – 4:00PM

FINAL BREAK



4:00PM – 4:40PM

Kevan Shokat

UC San Francisco

First and Next Generation Direct KRAS Inhibitors

SCHEDULE

Tuesday, July 20, 2021 • Morning



9:00AM – 10:00AM (EASTERN STANDARD TIME)

PANEL & DISCUSSION

Cathy Bradley

University of Colorado

Medical Innovation: Considerations for Health Disparities and Economic Outcomes

Edith Mitchell

Sidney Kimmel Cancer Center, Thomas Jefferson U

Improved Survival but Continued Disparities in Cancer: Planning the Future with Precision Oncology but Assessing the Past through the Rear-View Mirror

Barbara Herr Harthorn

UC Santa Barbara

Trust, Access and Justice: Three Key Themes in US Public Views on the Pros and Cons of New (Bio)technologies

William Hait

J&J Innovation

Towards a World without Disease



10:00AM – 10:40AM

Scott Manalis

MIT

Novel Instrumentation for Cancer Research



10:40AM – 11:20AM

Michael Fischbach

Stanford

Inducing Antigen-specific T-cells with Engineered Commensals



11:20AM – 11:40AM

COFFEE BREAK



11:40AM – 12:20PM

Drew Pardoll

Johns Hopkins

Single Cell Sequencing Uncovers the Immune System's Response to Tumors

SCHEDULE

Tuesday, July 20, 2021 • *Afternoon*



12:20PM – 1:20PM

LUNCH BREAK



1:20PM – 2:00PM

QUESTIONS, DISCUSSIONS & SUGGESTIONS

PANEL

Krastan Blagoev

Physics of Living Systems, Division of Physics, NSF
Department of Biophysics, Johns Hopkins University

Regina Dugan

Wellcome Leap

William Hait

J&J Innovation

Arnold Levine, MODERATOR

Institute for Advanced Study

William Nelson

Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins



2:00PM

END OF PROGRAM

PLEASE NOTE

Each presentation includes a 10-15 minute Q&A

BIOGRAPHICAL SKETCHES

Speakers & Panelists (in Order of Presentation)



JAMIE BLUNDELL

Jamie Blundell, M.A., M.Sci., Ph.D., College Lecturer and Anthony L. Lyster Fellow in Biological Natural Sciences, is a UKRI Future Leaders Fellow at the University of Cambridge and a research group leader in the CRUK Cambridge Centre Early Detection Programme. After he obtained his Ph.D. in theoretical physics, Dr. Blundell did postdoctoral research at Stanford, applying methods from statistical physics and population genetics to understand the evolution of microbial populations. His lab now develops ultra-sensitive sequencing technologies and applies these to large cohorts of longitudinal blood samples collected before cancer diagnosis. Analysing these data using quantitative principles from evolutionary theory, his lab aims to develop personalized “forecasts” of future cancer risk and identify those most in need of intervention. The lab is also interested in adaptive immune repertoire dynamics in cancer and other diseases.



RAUL RABADAN

Raul Rabadan, Ph.D., is the Gerald and Janet Carrus Professor in the Departments of Systems Biology, Biomedical Informatics and Surgery at Columbia University. He is the director of the Program for Mathematical Genomics at Columbia University and the NCI Center for Topology of Cancer Evolution and Heterogeneity. Dr. Rabadan’s interests focus on uncovering patterns of evolution in biological systems through the lens of genomics, and the development of mathematical approaches to uncover the evolution of cancer and infectious diseases, including topological data analysis and Random Matrix Theory, among others.



KURT SCHALPER

Kurt Schalper, M.D., Ph.D., Assistant Professor of Pathology; Director, Translational Immunooncology Laboratory, Yale University. Dr. Schalper trained as a cell/molecular biologist and surgical pathologist. His professional

experience includes clinical molecular diagnostics and development of cancer biomarkers. His laboratory focuses on understanding dominant immune evasion pathways in human solid tumors and deciphering the structural/functional determinants of the tumor immune microenvironment. At the Translational Immuno-oncology Lab he leads standardized analysis of biomarkers in clinical trials using advanced cell/tissue analysis platforms.



HARLAN ROBINS

Harlan Robins, Ph.D., is the Chief Scientific Officer and Co-Founder of Adaptive Biotechnologies in Seattle, Washington prior to which he headed the Computational Biology Program at the Fred Hutchinson Cancer Research Center (FHCRC) program. Dr. Robins obtained his bachelor's degree at Harvard University as a physics major and his Ph.D. in theoretical physics from the University of California Berkeley with a visiting appointment to the California Institute of Technology. He did postdoctoral research in theoretical physics at the Weizmann Institute of Science in Israel followed

by a postdoctoral appointment at the Institute for Advanced Study in Princeton where he developed bioinformatic algorithms for micro RNA targets and bacterial genome analysis.



REGINA BARZILAY

Regina Barzilay, Ph.D., is a School of Engineering Distinguished Professor for AI and Health in the Department of Electrical Engineering and Computer Science and a member of the Computer Science and Artificial Intelligence Laboratory at the Massachusetts Institute of Technology. She is an AI faculty lead for Jameel Clinic, an MIT center for Machine Learning in Health. Her research interests are in natural language processing and applications of deep learning to chemistry and oncology.



TOMMI JAAKKOLA

Tommi Jaakkola, Ph.D., is the Thomas Siebel Professor of Electrical Engineering and Computer Science and the Institute for Data, Systems, and Society MIT Computer Science and Artificial Intelligence Laboratory. Dr. Jaakkola's research advances how

machines can learn, predict or control, at scale and in an efficient, principled, and interpretable manner. His group designs new methods, theory and algorithms to automate use and generation of semi-structured data such as natural language text, images, molecules, or strategies. They apply and develop their algorithms to solve multifaceted recommender, retrieval, or inferential tasks such as design and optimization of molecules or reactions for the purpose of drug design.



MICKEY ATWAL

Mickey Atwal, Ph.D., Vice President, Head of Molecular Profiling and Data Science at Regeneron, Adjunct Associate Professor, Cold Spring Harbor Laboratory, leads a highly interdisciplinary group of physicists, bioinformaticians, computer scientists, and biologists to develop novel genomic assays, machine learning tools, and data architecture solutions to advance the molecular science of human disease and help accelerate the therapeutic discovery process. Dr. Atwal did his undergraduate degree in Cambridge, received his Ph.D.

from Cornell in physics, and did post-doctoral research at Princeton, followed by a post-doctoral appointment in Systems Biology at the Institute for Advanced Study.



JULIE SUTCLIFFE

Julie Sutcliffe, Ph.D., is a Professor of Internal Medicine and Biomedical Engineering at the University of California Davis. She serves as the co-director of the Center for Molecular and Genomic imaging and as the director of radiochemistry. Dr. Sutcliffe is the leader of a multidisciplinary translational research team that is recognized nationally for its contributions to the field of Molecular Imaging. Dr. Sutcliffe is the Principal Investigator of 3 active clinical trials, she is the Principal Investigator of the UC Davis U01 Pancreatic Cancer Detection Consortium and is the leader of the UC Davis Lustgarten Foundation/StandupToCancer Pancreatic Cancer Collective Research Team. She is a Fellow of the Society of Nuclear Medicine and Molecular Imaging, a Fellow of the World Molecular Imaging Society, and Fellow of the

American Institute for Medical and Biological Engineering. She is the immediate past-president of the World Molecular Imaging Society.



KEVAN SHOKAT

Kevan Shokat, Ph.D., is Professor in the Department of Cellular and Molecular Pharmacology at UC San Francisco, Professor in the Department of Chemistry at UC Berkeley, and Investigator of the Howard Hughes Medical Institute. His research focuses on discovering new chemical-based tools to decipher cellular signaling networks, with emphasis on protein kinases and recently, GTPases. His laboratory solved a fundamental difficulty of developing highly selective chemical probes of protein kinases — posed by the fact that 500 protein kinases share highly homologous ATP binding pockets — by developing a strategy based on a combination of protein engineering and organic synthesis, termed chemical genetics.



CATHY BRADLEY

Cathy Bradley, Ph.D., is the Associate Dean for Research in the Colorado School of Public Health

and the Deputy Director of the University of Colorado Cancer Center. She holds the Grohne Chair for Cancer Prevention and Control Research. Prior to joining the University of Colorado, she was the founding Chair of the Department of Healthcare Policy and Research, and Associate Director of Cancer Prevention and Control at Virginia Commonwealth University School of Medicine. Dr. Bradley is an internationally recognized expert in health services research and health economics.



EDITH MITCHELL

Edith Mitchell, M.D., MACP, FCPP, FRCP, is Clinical Professor, Department of Medicine and Medical Oncology at Sidney Kimmel Medical College and Associate Director for Diversity Programs and Director of the Center to Eliminate Cancer Disparities for the Sidney Kimmel Cancer Center at Thomas Jefferson University. She has spent her medical career helping individuals in medically underserved areas. Dr. Mitchell's research in breast, colorectal and pancreatic cancers and other GI malignancies involves

new drug evaluation and chemotherapy, development of new therapeutic regimens, chemoradiation strategies for combined modality therapy, patient selection criteria and supportive care for patients with gastrointestinal cancer.



BARBARA HERR HARTHORN

Barbara Herr Harthorn, Ph.D., is a Professor, Department of Anthropology, at the University of California at Santa Barbara, where she served as Director (2005-2017) of the NSF Nanoscale Science and Engineering Center: Center for Nanotechnology in Society at UCSB. Her current collaborative research examines emergent US public risk and benefit perceptions and views on responsible innovation of bottom-up synthetic cells, with an emphasis on understanding how social location and past experiences of inequality affect the way people make sense of both the promises and potential pitfalls of new technologies.



WILLIAM N. HAIT

William N. Hait, M.D., Ph.D. is Global Head, Johnson & Johnson Global External Innovation. Dr.

Hait joined J&J in 2007 and served as Global Therapeutic Area Head for Oncology and then as Global Head, Janssen Research & Development. His team strives to identify disruptive technologies and cutting-edge early innovations in disease areas of emphasis at J&J, to eliminate disease through prevention, interception and cures. Prior to joining J&J, Dr. Hait was founding Director of The (Rutgers) Cancer Institute of New Jersey, Professor of Medicine and Pharmacology and Associate Dean for Oncology Programs at the University of Medicine and Dentistry of New Jersey -- Robert Wood Johnson Medical School.



SCOTT MANALIS

Scott Manalis, Ph.D., is the Andrew and Erna Viterbi Professor of Biological Engineering, the Associate Head of the Department of Biological Engineering, and a member of the Koch Institute for Integrative Cancer Research. He has been a faculty member at Massachusetts Institute of Technology since 1999 and prior to that he received his undergraduate and graduate degrees in physics

and applied physics at University of California at Santa Barbara and Stanford, respectively. His lab is interested in developing precision measurement approaches for biological and clinical applications.



MICHAEL FISCHBACH

Michael Fischbach, Ph.D., is an Associate Professor in the Departments of Bioengineering and Microbiology & Immunology at Stanford University, an Institute Scholar of Stanford ChEM-H, and the director of the Stanford Microbiome Therapies Initiative. Fischbach received his Ph.D. in chemistry, studying the role of iron acquisition in bacterial pathogenesis and the biosynthesis of antibiotics. After two years as an independent fellow at Massachusetts General Hospital, Fischbach joined the faculty at UCSF, where he founded his lab before moving to Stanford in 2017. His laboratory uses a combination of genomics and chemistry to identify and characterize small molecules from microbes, with an emphasis on the human microbiome.



DREW PARDOLL

Drew Pardoll, M.D., Ph.D., is the Abeloff Professor of Oncology, Medicine, Pathology and Molecular Biology and Genetics at the Johns Hopkins University, School of Medicine and Director of the Bloomberg-Kimmel Institute for Cancer Immunotherapy. Dr. Pardoll studies mechanisms by which cancer cells evade elimination by the immune system and has invented a number of immunotherapies, including GVAX cancer vaccines and *Listeria monocytogenes*-based cancer vaccines. He elucidated the role of Stat3 signaling in tumor immune evasion and in Th17 development, and discovered one of the two ligands for the PD-1 inhibitory receptor and leads the Hopkins cancer immunology program that developed PD-1 pathway-targeted antibodies.



KRASTAN B. BLAGOEV

Krastan B. Blagoev, Ph.D., is Program Director, Physics of Living Systems, Division of Physics, at the NSF, and an Associate Research Scientist, Department of Biophysics,

at Johns Hopkins University. Dr. Blagoev received a Ph.D. from the Physics Department at Boston College in 1998 and continued his research on superconductivity and magnetism at University of Cambridge as a postdoctoral fellow. In 1999 he moved to Harvard University Medical School working on mathematical models of ultrasound propagation in the brain. In 2002 he joined the Theoretical Division of Los Alamos National Laboratory as a staff member working on condensed matter physics as well as mathematical models of telomere dynamics and its influence on aging and cancer. Dr. Blagoev moved to the National Science Foundation as a Program Director in the Division of Physics in 2007, where he currently directs the Physics of Living Systems program.



REGINA DUGAN

Regina Dugan, Ph.D., is CEO of Wellcome Leap, a U.S.-based non-profit organization founded by the Wellcome Trust to accelerate innovations that benefit global health. Dr. Dugan served as the 19th Director of the Defense

Advanced Research Projects Agency (DARPA), where she oversaw an annual \$3B portfolio of projects ranging from hypersonics to RNA-based vaccines. An experienced Silicon Valley executive, she also built and led advanced project organizations at Google and Facebook. She holds her Ph.D. from Caltech, where she is a Distinguished Alumnus (one of 256 historical honorees including Carver Mead and Gordon Moore) and her BS/MS from Virginia Tech, where she was inducted into the Academy of Engineering Excellence.



ARNOLD J. LEVINE

Arnold J. Levine, Ph.D., Professor Emeritus, Institute for Advanced Study, is a molecular biologist who established the Simons Center for Systems Biology at the Institute, concentrating on research at the interface of molecular biology and the physical sciences. Recognizing the potential of convergence research, he inaugurated a program of collaborations, in partnership with NSF, Stand Up To Cancer, and others, bringing together quantitative scientists from theoretical physics, computer science, and

mathematics, with biologists and clinicians, to develop novel approaches to solve important problems in cancer research. He leads the NSF-sponsored Cancer Convergence Education Network, and focuses on fostering convergence research to produce fundamental insights in the areas of immunology and infectious diseases.



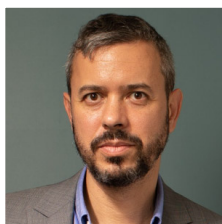
WILLIAM G. NELSON

William G. Nelson V, M.D., Ph.D., is the Marion I. Knott Professor of Oncology and Director of the Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins, and a recognized leader in translational cancer research. Dr. Nelson's laboratory discovered the most common known somatic genome alteration in human prostatic carcinoma cells. The DNA lesion — hypermethylation of deoxycytidine nucleotides in the promoter of a carcinogen-defense enzyme gene — appears to inactivate the gene, making prostatic cells more vulnerable to carcinogens. The discovery led to new diagnostic tests for the disease and has fueled interest in new drug discovery and other treatment options, now ongoing.

Speakers & Panelists



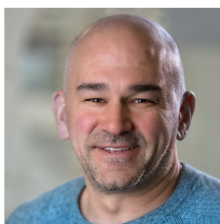
Jamie Blundell



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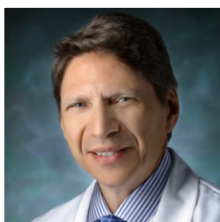
William Hait



Scott Manalis



Michael Fischbach



Drew Pardoll



Krastan B. Blagoev



Regina Dugan



Arnold J. Levine

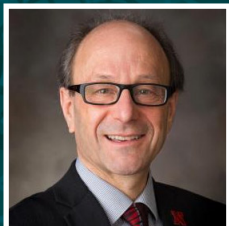


William G. Nelson

ORGANIZING COMMITTEE

A Workshop on Cancer **CONVERGENCE** *and* **INTERCEPTION**

- ✧ David Berkowitz
- ✧ Krastan B. Blagoev
- ✧ Theresa Good
- ✧ Arnold J. Levine
- ✧ Sung Poblete
- ✧ Phillip Sharp



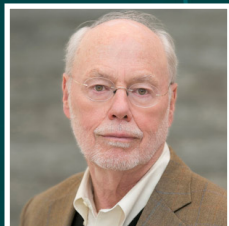
David Berkowitz



Theresa Good



Sung Poblete



Phillip Sharp



DAVID B. BERKOWITZ

David B. Berkowitz, Ph.D., is the Director of the Division of Chemistry at the National Science Foundation, where he oversees a staff of 40 and an annual budget of approximately \$250 M dedicated to funding fundamental science in chemistry that bears on many other disciplines and that is directed at training the next generation of scientists. Berkowitz is also Willa Cather Professor of Chemistry at the University of Nebraska-Lincoln where he leads an active research group engaged in science at the chemistry/biology interface. He is a AAAS Fellow (2015), a Japan Society for the Promotion of Science (JSPS) Fellow (2008) and an Alfred P. Sloan Fellow (1997). In 2018, Berkowitz chaired the international Gordon Research Conference on Biocatalysis. Berkowitz currently serves on the Chemical Sciences Roundtable at the National Academy of Sciences.

David Berkowitz studied at the University of Chicago (B.S.-Phi Beta Kappa), Harvard/ETH-Zürich (Ph.D.) and Yale (PD). His honoraria include Visiting

Professorships at the the Université de Paris (2016), the Max Planck Institute (Dortmund, Germany, 2006) and the Université de Rouen (Normandy, France, 2005). He has delivered keynote lectures at the National Medicinal Chemistry Symposium (Nashville, 2018), the EMBO Conference on Enzyme Mechanisms (2014, Manchester, UK), the World Congress on Catalytic Asymmetric Synthesis (2010, Beijing, China) and Sanofi's Visions in Chemistry Symposium (2009).



KRASTAN B. BLAGOEV

(Biography available on pg 13)



THERESA GOOD

Theresa Good, Ph.D., is currently the Division Director in the Division of Molecular and Cellular Biosciences at the National Science Foundation. She is trained in Chemical Engineering with her B.S., M.S. and Ph.D. from Bucknell, Cornell, and the University of Wisconsin Madison. She spent over 20 years in academia, first on the faculty of Chemical Engineering at Texas

A&M, then at the University of Maryland Baltimore County. Her research focused on the application of engineering tools to solve biomedical problems with an emphasis on Alzheimer's disease. She was the recipient of an NSF CAREER award, and has received funding from NIH, NSF, NASA, FDA and private foundations. She was the chair of the Food, Pharmaceutical and Bioengineering Division of AIChE and the Biochemical Technology Division of ACS. Since 2010, Dr. Good has served science as either a rotating or permanent program director at NSF, first in the Biotechnology and Biochemical Engineering program in the Division of Chemical, Bioengineering, Environmental and Transport Systems, and then in the Systems and Synthetic Biology program in the Division of Molecular and Cellular Biosciences (MCB), and then part of the leadership of MCB. At NSF, she leads the Bioeconomy Coordinating Committee as well as interagency activities related to synthetic biology. She is also on the board of trustees of the Human Frontiers Science Program.



ARNOLD J. LEVINE

(Biography available on pg 14)



SUNG POBLETE

Sung Poblete, Ph.D., R.N., is Chief Executive Officer of Stand Up To Cancer (SU2C) and a visiting associate professor at the Rutgers University School of Nursing. Previously, Poblete was the Director of Clinical and Translational Programs at the American Association for Cancer Research, a VP of Operations for a subsidiary of Fresenius Medical Care, and Executive Director of the Oxford Health Plans Foundation. Poblete now serves on the Executive Board of the Osteosarcoma Institute, the Stand Up To Cancer – Canada Board of Directors, the Medically Home Group Board of Directors and the Preparedness and Treatment Equity Coalition Board of Directors, and as co-chair of #NoGoingBack, a movement dedicated to preserving the progress made in clinical research and to keep clinical trials moving forward.



PHILLIP SHARP

Phillip A. Sharp, Ph.D., is an Institute Professor at the Massachusetts Institute of Technology, member (and past head) of the Department of Biology and member (and past Director) of the Koch Institute for Integrative Cancer Research, and was founding director of the McGovern Institute. He is a co-founder of both Biogen and Alnylam Pharmaceuticals Inc. Dr. Sharp received his Ph.D. in chemistry from the University of

Illinois, Urbana-Champaign. His research interests have centered on the molecular biology of gene expression relevant to cancer and the mechanisms of RNA splicing. His landmark work in 1977 provided the first indications of discontinuous genes in mammalian cells, a discovery that fundamentally changed scientists' understanding of gene structure and earned Dr. Sharp the 1993 Nobel Prize in Physiology or Medicine. Among his many service contributions, Dr. Sharp chairs the Scientific Advisory Committee of Stand Up To Cancer.

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