

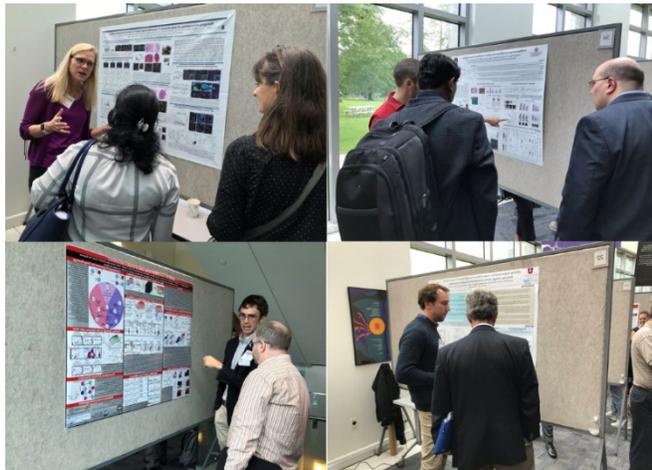
## Summary of the 2018 NCI Cancer Systems Biology Consortium and Physical Sciences – Oncology Network Joint Annual Meeting

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From September 25 – 28, 2018, over 300 cancer researchers from across the country gathered at the NIH Natcher Conference Center for the National Cancer Institute (NCI) [Cancer Systems Biology Consortium \(CSBC\)](#) and [Physical Sciences - Oncology Network \(PS-ON\)](#) Joint Annual Meeting (#CSBCPSON2018).

The Deputy Director of the [NCI Division of Cancer Biology](#), Dr. Daniel Gallahan, opened the meeting with an overview of the CSBC and PS-ON programs. He described the CSBC as a research consortium that uses systems biology approaches, including the combination of multidimensional data and computational modeling, to address complexities in cancer biology. The PS-ON is a research network that integrates ideas from physics, engineering, and other physical sciences with cancer research. Dr. Gallahan explained that both transdisciplinary programs are addressing challenging research questions, as well as performing education and outreach activities to inform the public about their unique and complementary approaches to basic research in cancer. Moving forward, these programs will continue to bring new approaches and discoveries across the broad landscape of cancer biology and translational cancer research.

Investigators from 23 research centers ([U54s](#)), more than 20 research projects ([U01s](#)), and the CSBC/PS-ON data coordinating center ([U24](#)) shared details about their work by giving 3-minute “lightning talks” throughout the meeting. These presentations provided quick overviews of the research being done across the programs, including studies of tumor heterogeneity, cancer evolution, tumor immunity, responses to cancer treatments, tumor-microenvironment interactions, and metastasis. There were also poster sessions and networking opportunities during the conference where scientists discussed their work and explored potential collaboration opportunities. In addition to the lightning talks and poster sessions, which were sprinkled throughout the meeting, 25 investigators shared more detailed stories about their PS-ON and CSBC-supported research within 5 research-focused podium sessions.



Poster presentations at the CSBC and PS-ON Joint Annual Meeting (credit: @NCIsysbio)

The first research session of the meeting focused on the effects of the microenvironment and tumor metabolism on cancer progression. Dr. Laura Heiser (Oregon Health and Science University) and Dr. Pam Kreeger (University of Wisconsin-Madison) showed that microenvironmental factors contribute to heterogeneous responses and metastasis of breast and ovarian cancer. Studies indicating that cancer

stem cells and metastatic cancer cells undergo metabolic reprogramming were presented by Dr. Gary Luker (University of Michigan) and Dr. Xiling Shen (Duke University), respectively.

The next set of research talks centered around the use of computational modeling to understand the biology of tumors and enhance cancer treatments. Dr. Andrew Gentles (Stanford University) and Dr. Kristin Swanson (Mayo Clinic – Phoenix) described how computational frameworks can be used to understand and predict tumor progression and metastasis. Similarly, the utility of mathematical models to improve targeted cancer therapies and overcome drug resistance was discussed by Dr. Sandy Anderson (H. Lee Moffitt Cancer Center) and Dr. John Lowengrub (University of California, Irvine).

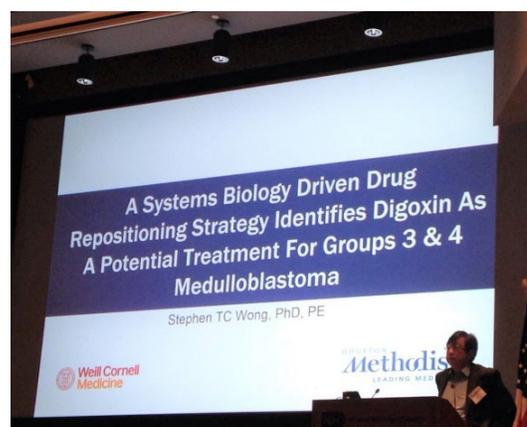
The theme of the third scientific session was investigating molecular interactions to determine potential treatments and drivers of cancer. Research exploiting metabolic networks and cooperative signaling dependencies to inform the design of more effective cancer therapies was detailed by Dr. Melissa Kemp (Georgia Institute of Technology) and Dr. Jean-Philippe Coppé (University of California, San Francisco). *In vivo* experimental models and computational frameworks for studying regulatory networks at the gene and protein level were presented by Dr. Sidi Chen (Yale University) and Dr. Diana Murray (Columbia University).

The role of nuclear structural modifications in cancer development were discussed during the fourth scientific session. Dr. John Marko (Northwestern University) and Dr. Jason Liu (University of Texas Health Science Center – San Antonio) showed that changes in chromatin structure can change nuclear morphology and promote treatment resistance. Also, the effects of structural changes to the nucleus on DNA damage and cancer cell migration were presented by Dr. Dennis Discher (University of Pennsylvania) and Dr. Jan Lammerding (Cornell University).

The last research talks elaborated on quantitative physical and systems biology approaches for studies of cancer treatments. Discovery of preclinical single and combination therapies for tumors through the integration of computational approaches and experimental biology was highlighted by Dr. Vito Quaranta (Vanderbilt University) and Dr. Stephen Wong (Houston Methodist Cancer Center). Further, Dr. Scott Manalis (Massachusetts Institute of Technology) and Dr. Mauro Ferrari (Houston Methodist Research Institute) presented work identifying mechanisms of cancer drug delivery and treatment responses from links between biophysical properties of cells and extracellular factors.



Dr. Kristin Swanson presenting her research using modeling to predict glioblastoma outcomes (credit: Claire McCarthy)



Dr. Stephen Wong giving a talk about his cancer systems biology studies (credit: Claire McCarthy)

Along with presentations about CSBC and PS-ON research projects, invited speakers, specifically Dr. Mikael Pittett (Harvard Medical School), Dr. Trey Ideker (University of California, San Francisco), Dr. Michael Bassik (Stanford University), Dr. Jane Skok (New York University School of Medicine), and Dr. Fred Lang (MD Anderson Cancer Center), showed new experimental approaches to study and treat cancer that ranged from imaging techniques to investigate the effectiveness of immunotherapy to the use of a virus as a brain cancer therapy.

Patient advocacy and collaborations between artists, advocates, and researchers were also highlighted at the CSBC and PS-ON Meeting. Dr. Carole Baas, a patient advocate with the PS-ON, described the importance of patient advocates in scientific research, such as communicating scientific discoveries to the public and helping investigators “think outside the box.” Dr. Carlo Maley (University of Arizona) showed projects combining artistic pursuits, specifically gardening, graphics, and music, with science that provide a window into cancer biology for the general public. Bodystorming, where scientists work with dancers to gain knowledge about cellular and molecular processes through choreography and movement, was discussed by Dr. David Odde (University of Minnesota). These presentations demonstrated how creativity can lead to innovation in studies investigating cancer complexities.

Overall, many exciting results and novel experimental and computational interdisciplinary approaches in cancer research were discussed by attendees of the CSBC and PS-ON meeting. The Director of the NCI, Dr. Ned Sharpless, remarked that the integrative work supported by these programs is essential for basic and translational studies of cancer. With growing advances in technology and big data, joint efforts combining quantitative tools with biology are needed to address challenging questions about cancer. He said, “There are currently many active cancer drugs; however, there aren’t rational ways to decide who should get what treatment, in what sequence, and on what schedule.” From his perspective, this research challenge is not going to be solved by multiple clinical trials, but through integrative studies combining computational and mathematical methods with experimentation.

**Footnote:** To join CSBC and PS-ON conversations on Twitter, follow @NCIsysbio and @NCIPhySci, respectively. Also, see what people were saying about the CSBC/PS-ON Junior Investigator’s Meeting (#CSBCPSONJI2018) on social media at <http://wke.lt/w/s/p0D8u>.



Mutated cactus in the Endless Forms Most Beautiful Garden of the University of Arizona (credit: @NCIsysbio)



The NCI Director, Dr. Ned Sharpless, discussing the importance of mathematical and computational approaches in cancer research (credit: @NCIPhySci)