

Systems Biology at the NCI

Shannon Hughes, Ph.D.

Program Director

Division of Cancer Biology

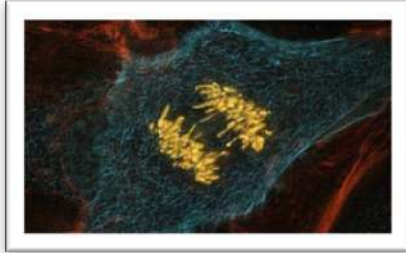
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shannon.hughes@nih.gov

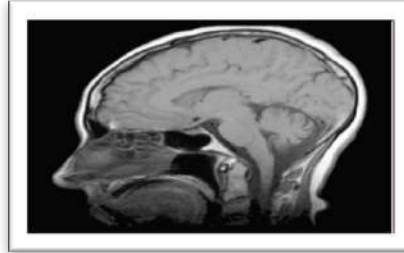
1. *Systems Biology & Data Science at NCI*
2. *Overview of the CSBC Science*
3. *Examples (3) of pathway-based systems biology approaches in the CSBC*
4. *DREAM / Next generation CSB*

The NCI supports a full spectrum of cancer research

Biology



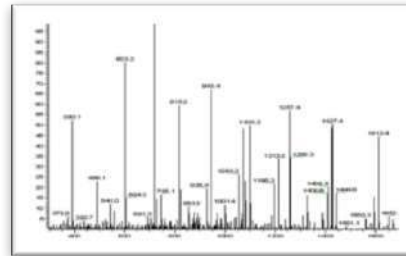
Diagnosis



Outreach



Prevention



Treatment



Population Science

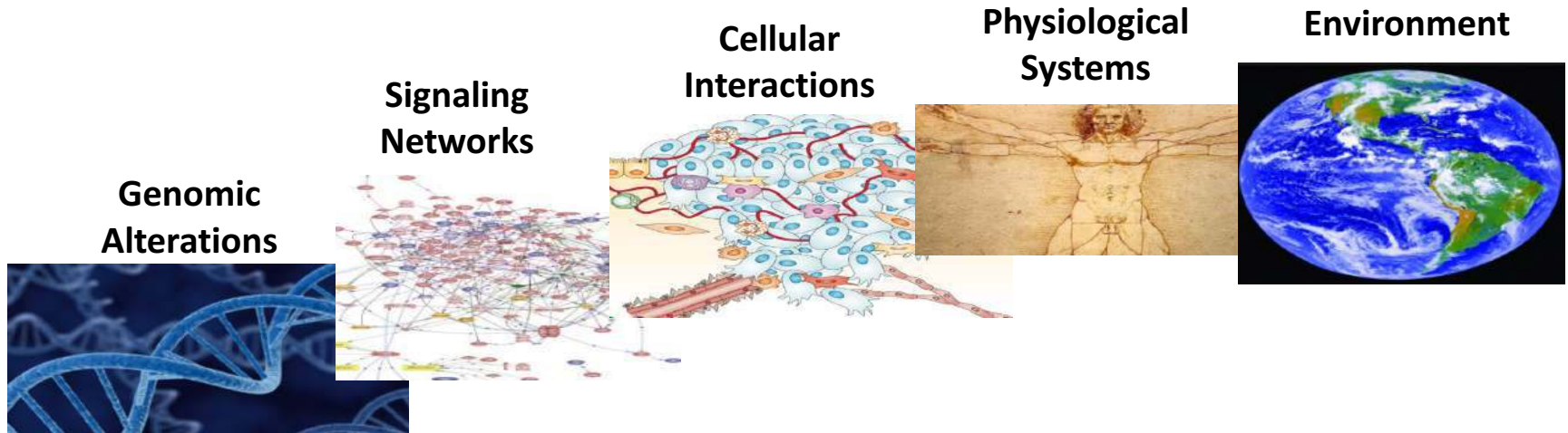
Multi-pronged approach to cancer data science at NCI:

- The Cancer Genome Atlas ([TCGA](#))
- Clinical Proteomics Tumor Analysis Consortium ([CPTAC](#))
- The Cancer Imaging Archive ([TCIA](#))
- Surveillance, Epidemiology, and End Results Program ([SEER](#))
- Cancer Target Discovery and Development ([CTD²](#))
- Informatics Technology for Cancer Research ([ITCR](#))
- Cancer Intervention and Surveillance Modeling Network ([CISNET](#))
- Physical Science in Oncology Network ([PS-ON](#))
- **Cancer Systems Biology Consortium ([CSBC](#))**

NCI, Division of Cancer Biology

Our Mission:

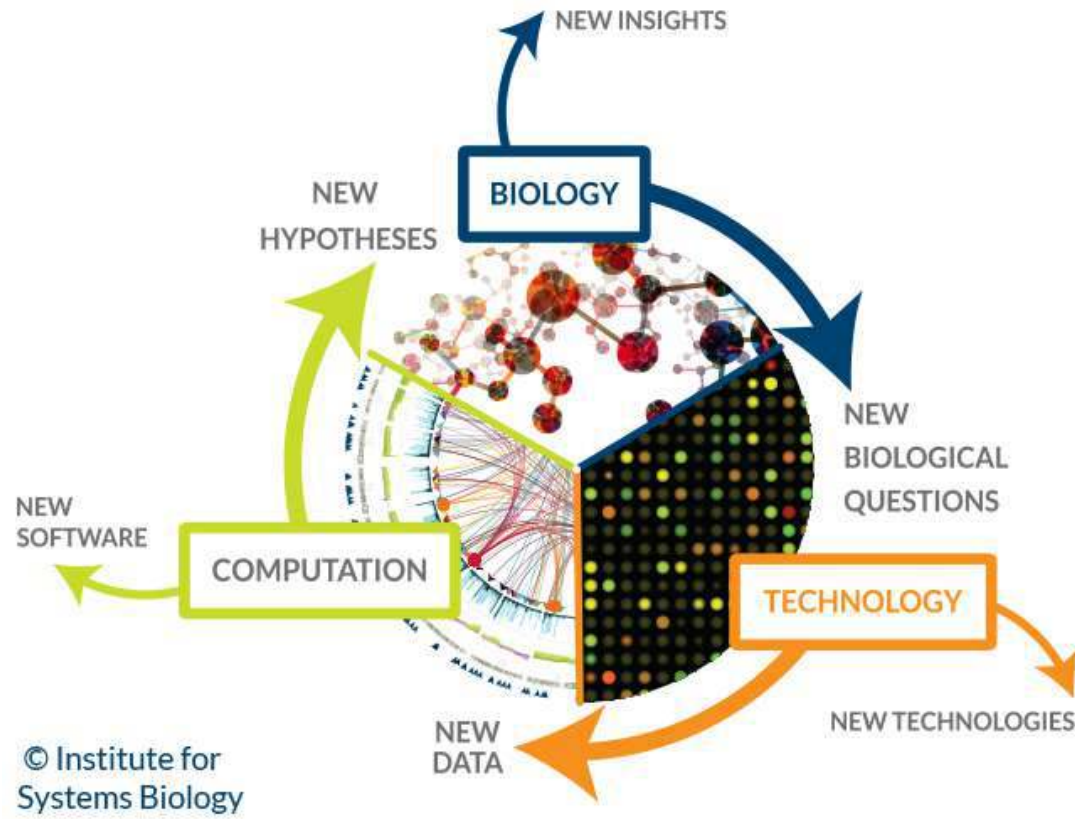
- *To ensure continuity and stability in basic cancer research while encouraging and facilitating the emergence of new ideas, concepts, technologies and possibilities through a broad portfolio of Investigator initiated research and specialized NCI programs.*



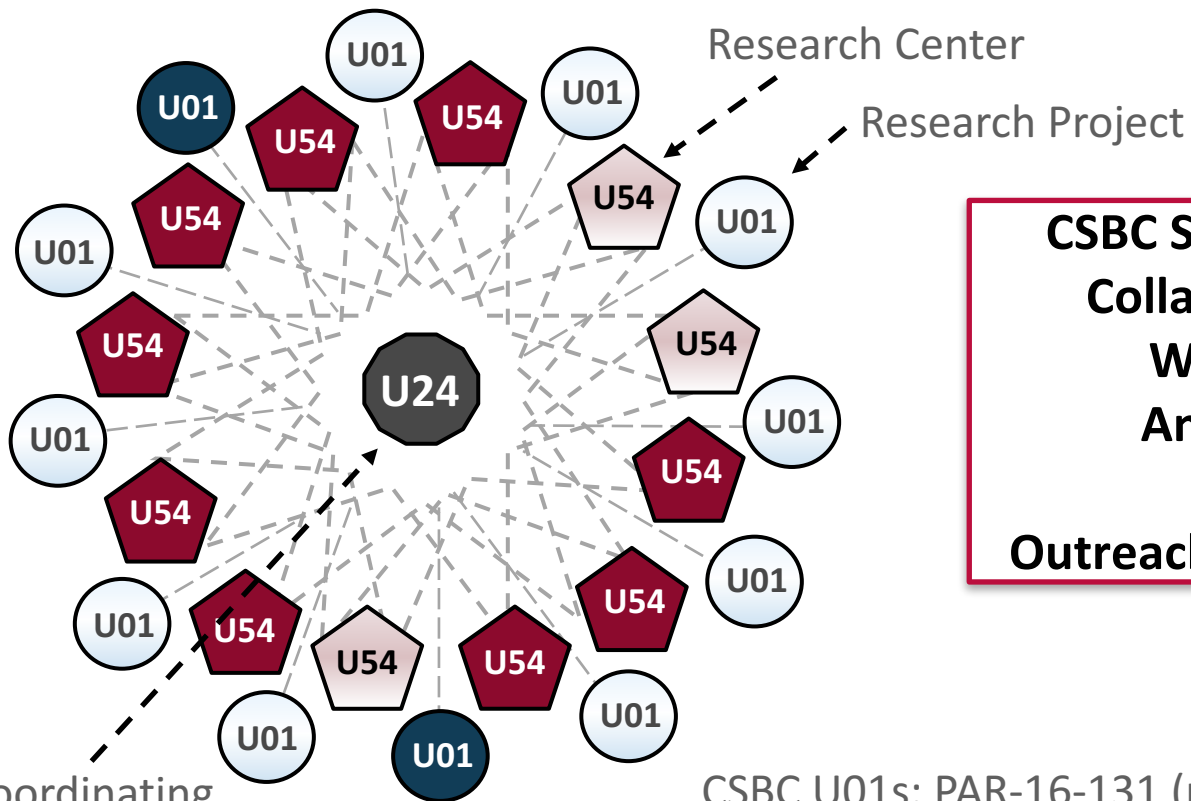
The CSBC is a community of systems biologists who aim to integrate experimental biology and computational models across multiple temporal and spatial scales towards a better understanding of cancer.

In the CSBC we define systems biology as the **explicit integration of experimental biology and computational or mathematical modeling** to build, test and/or validate hypotheses or ideas.

The CSBC defines systems biology by its iterative approach



Structure of the Cancer Systems Biology Consortium Initiative



Coordinating
Center

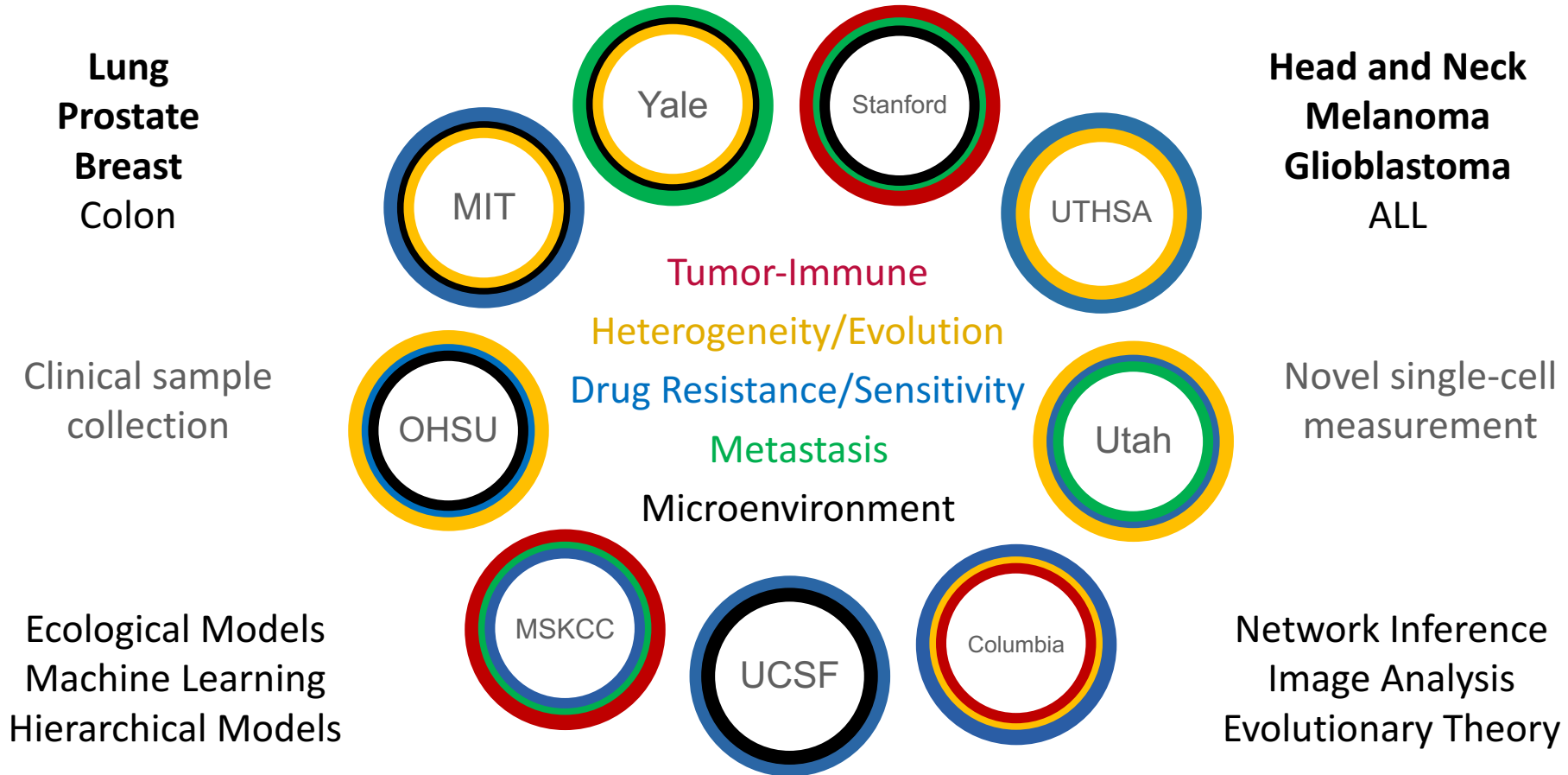
CSBC Steering Committee
Collaborative Projects
Working Groups
Annual Meetings
Site Visits
Outreach (Summer Program)

CSBC U01s: PAR-16-131 (next receipt date Nov 24, 2017)

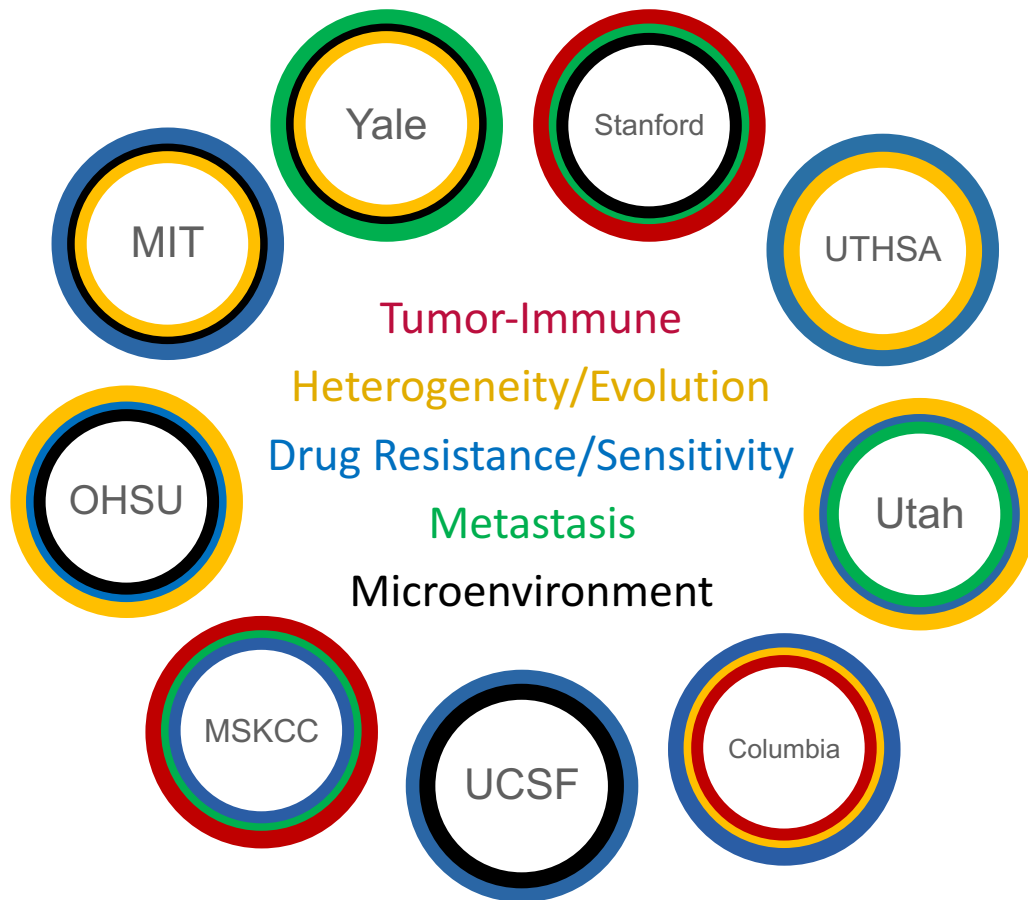
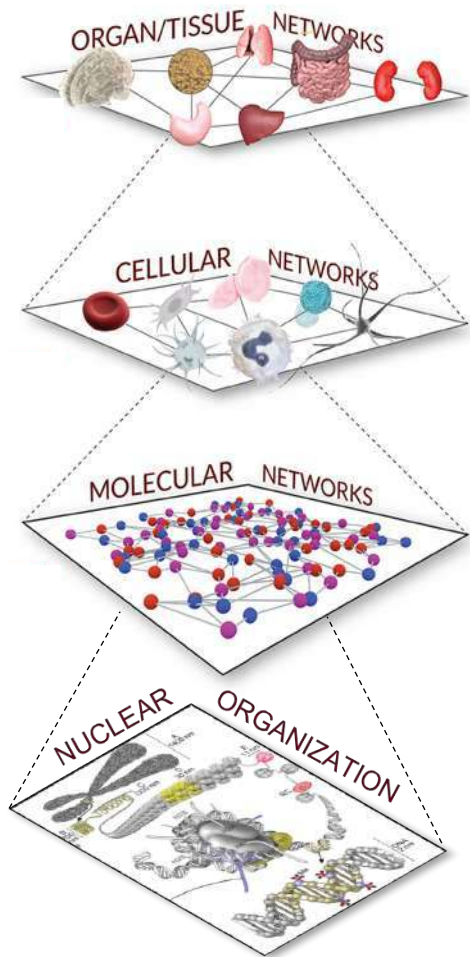
CSBC U54s: RFA-CA-15-014 (closed as of April 21, 2017)

CSBC U24: RFA-CA-15-015 (closed)

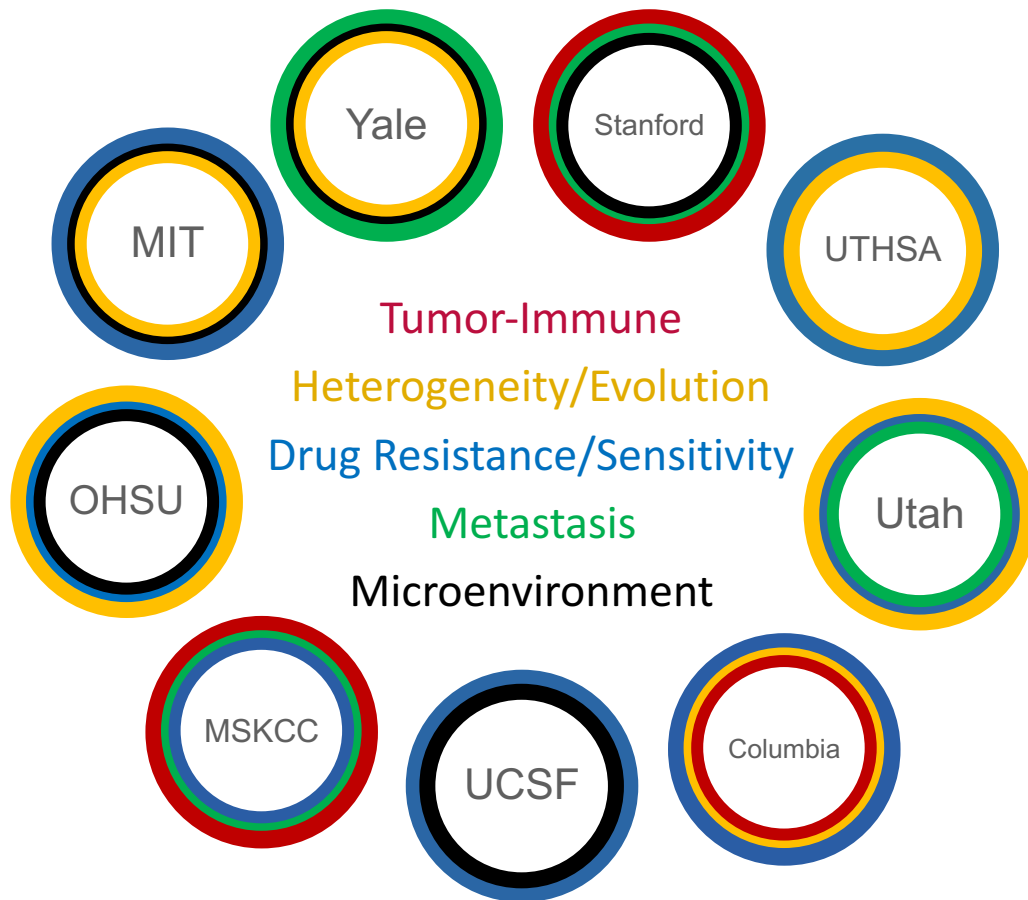
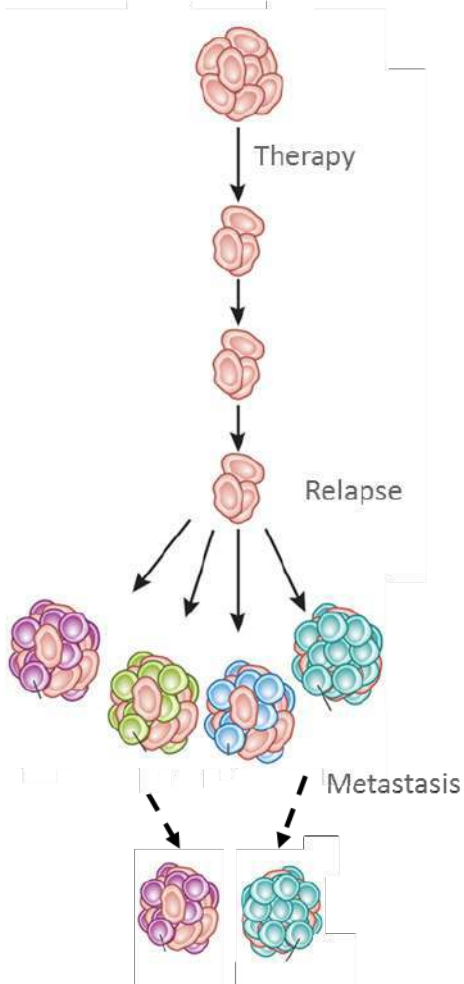
Summary of Research Themes and Systems Biology Approaches



Summary of Research Themes and Systems Biology Approaches



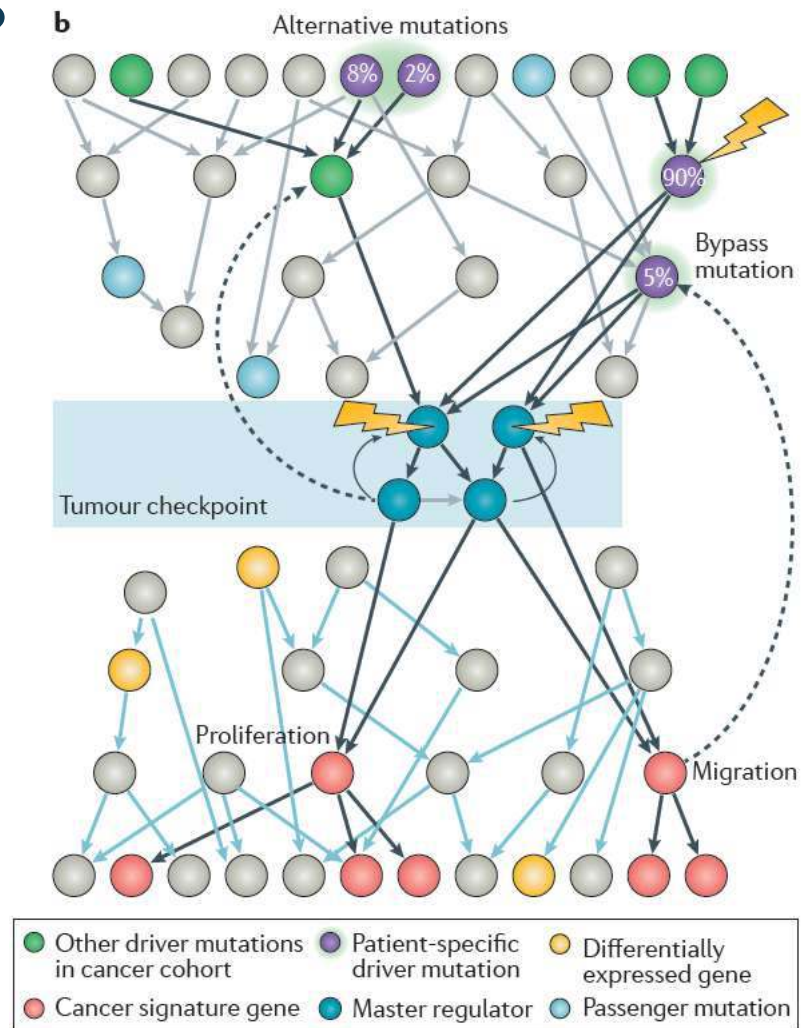
Summary of Research Themes and Systems Biology Approaches



A recurrent regulatory architecture?

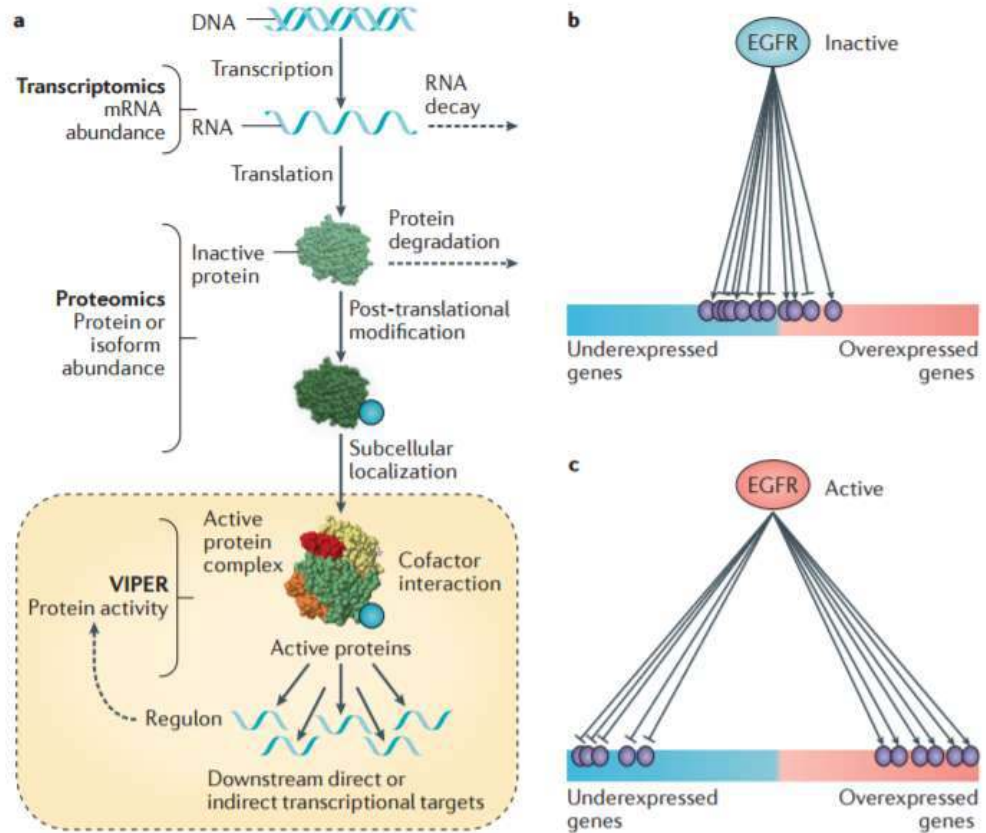
- Why are transcriptional profiles similar despite a huge variety of somatic mutations?
- Small groups of proteins (master regulators) that form highly interconnected modules (tumor checkpoints) control cell state
- Could failing to account for these modules explain unpredictable MOA or drug failure?

Califano & Alvarez, Nature Reviews Cancer, 2017

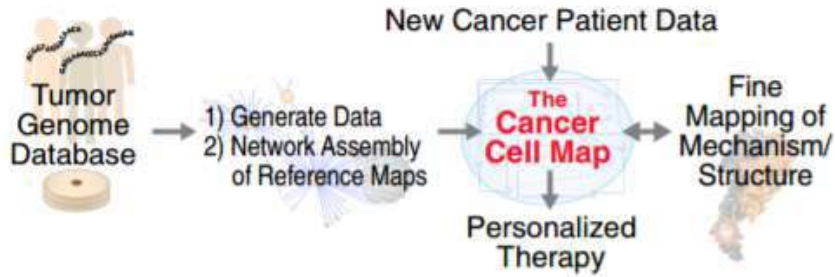


We know that the transcriptome isn't everything....

- But what if it's all you've got?
- [VIPER](#) and related algorithms predict protein activity through inferring protein-protein interaction and activation/suppression of downstream targets



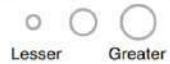
Hierarchical pathway models allow multi-scale predictions



Krogan et al., Molecular Cell 58, May 21, 2015

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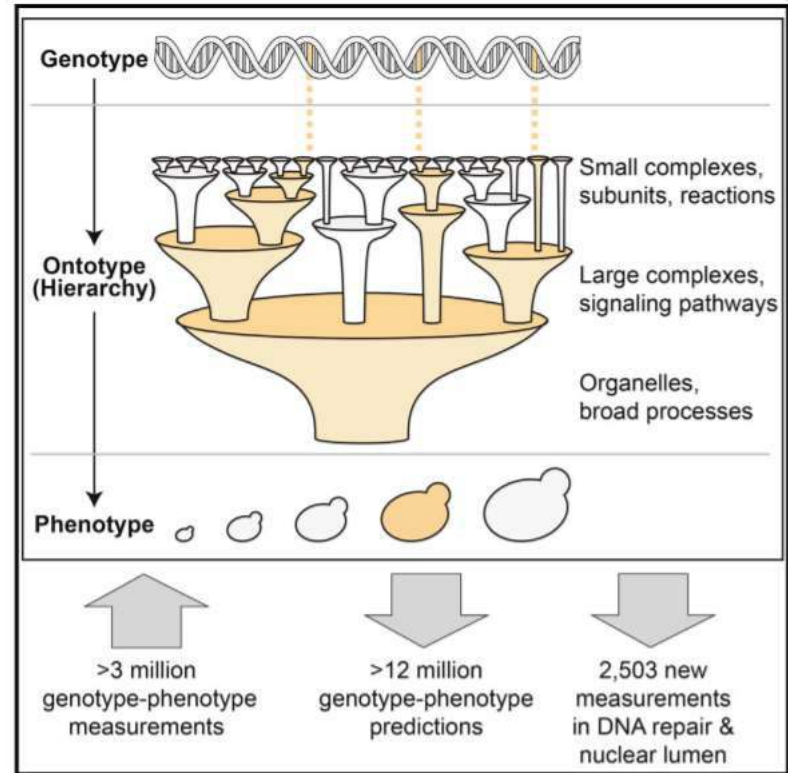
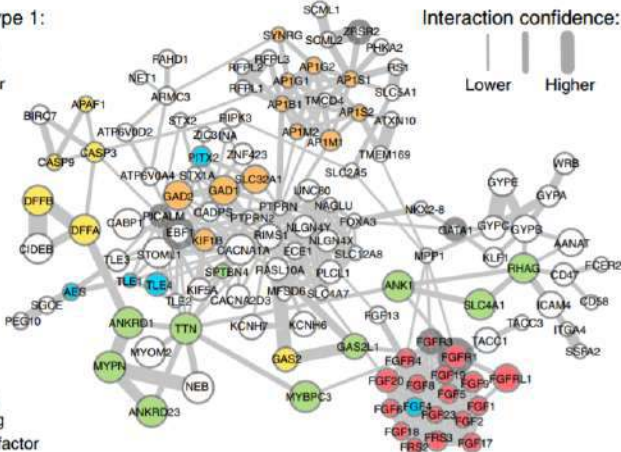
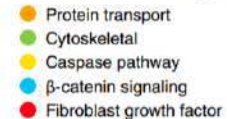
Importance to subtype 1:



Cancer status:

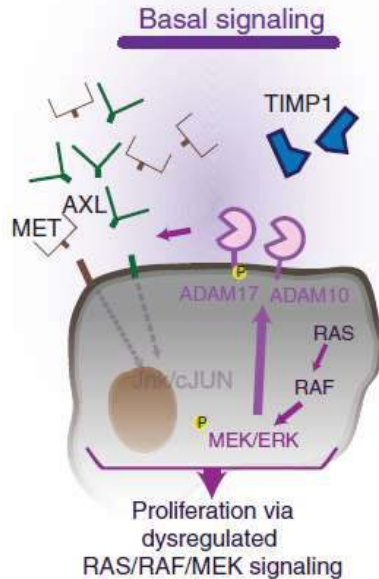


Functions:



Yu et al., Cell Systems, 2016, 77–88

Using systems approaches to understand why drugs fail



Secure | https://www.synapse.org/#!Synapse:syn7080714

Apps Home - Division of C CSBC PS-ON Data Co Home - PubMed - NC NIH Guide Publishing Integrated Time and NIH Login User Name Workbench Other bookmarks

CSBC PS-ON Data Coordinating Center

Search Shannon Hughes (shannon.hughes) Help

Synapse ID: syn7080714 Storage Location: Synapse Storage


Share Annotations Tools

Wiki Files Tables Discussion Docker **beta**

CSBC PS-ON Data Coordinating Center

- Navigating the data portal
- Getting Access
- Individual Data Portals
- Events
- Working Groups
- Job Opportunities
- Patient Advocacy

Edit Order



Cancer Systems Biology Consortium (CSBC) and Physical Sciences in Oncology Network (PS-ON)

Getting Access CSBC Data Portal PSON Data Portal Events Working Groups

The NIH National Cancer Institute-sponsored [Cancer Systems Biology Consortium \(CSBC\)](#) and [Physical Sciences in Oncology Network \(PS-ON\)](#) aim to tackle the most perplexing issues in cancer to increase our understanding of tumor biology, treatment options, and patient outcome. Cancer systems biology is an effort to use computational analysis and mathematical modeling to describe and understand cancer mechanisms in a deeply multivariate way, and to predict the consequences of interventions on disease. Physical oncology applies physical science-based theories and experimental techniques to complement and advance our current understanding of cancer biology and oncology, particularly in the areas of

https://www.synapse.org/#!Synapse:syn7080714

DREAM Challenges now facilitate “private” data sharing

Synapse ID: syn4224222

Storage Location: Synapse Storage

Annotations

- Wiki
- Files
- Discussion
- Docker beta

- The Digital Mammography DREAM Challenge
 - 1 - Challenge News and Updates
 - 2 - Challenge Overview
 - 3 - How to Participate
 - 4 - Leaderboards
 - 5 - Top Performing Teams
 - 6 - Challenge Photos
 - 7 - FAQ



The Digital Mammography DREAM Challenge

Build a model to help reduce the recall rate for breast cancer screening

Learn more & register to participate here: www.synapse.org/Digital_Mammography_DREAM_Challenge

Powered by:           

- About the Challenge
- How to Participate
- Leaderboards
- News and Updates

Registration Open:
Competitive Period Launch: Nov 18, 2016
Competitive Period Close: May 16, 2017
Community Period Close: TBD

Justin Guinney (justin.guinney@sagebase.org)

Association of Early Career Cancer Systems Biologists (AECCSB)



Systems Approaches to Cancer Biology
Co-sponsored by the AECCSB & NCI: April 3-6 2016

www.SACBmeeting.org

NEXT MEETING: NOVEMBER 7-10, 2018



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Contact: Aaron Meyer
(aameyer@mit.edu)
Or Stephen Piccolo
(stephen.piccolo.byu@gmail.com)

Thank you!

*Please contact me with any questions:
shannon.hughes@nih.gov*