Nanomedicine:
Enabling breakthrough diagnostics and therapeutics

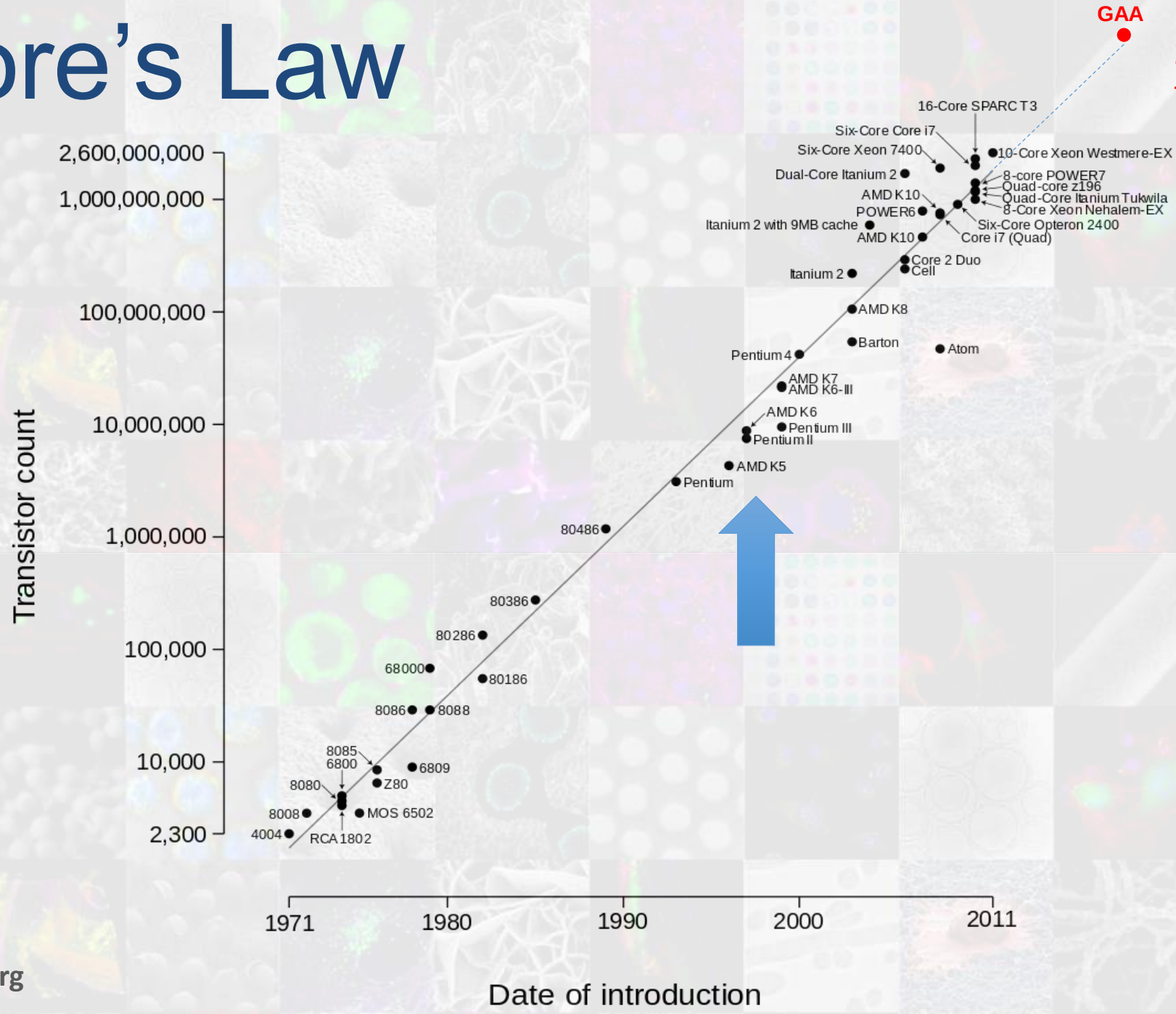
Tarek R. Fadel, PhD
MIT
June 2017

MARBLE CENTER FOR CANCER NANOMEDICINE
Small technologies, **BIG** impact

MIT

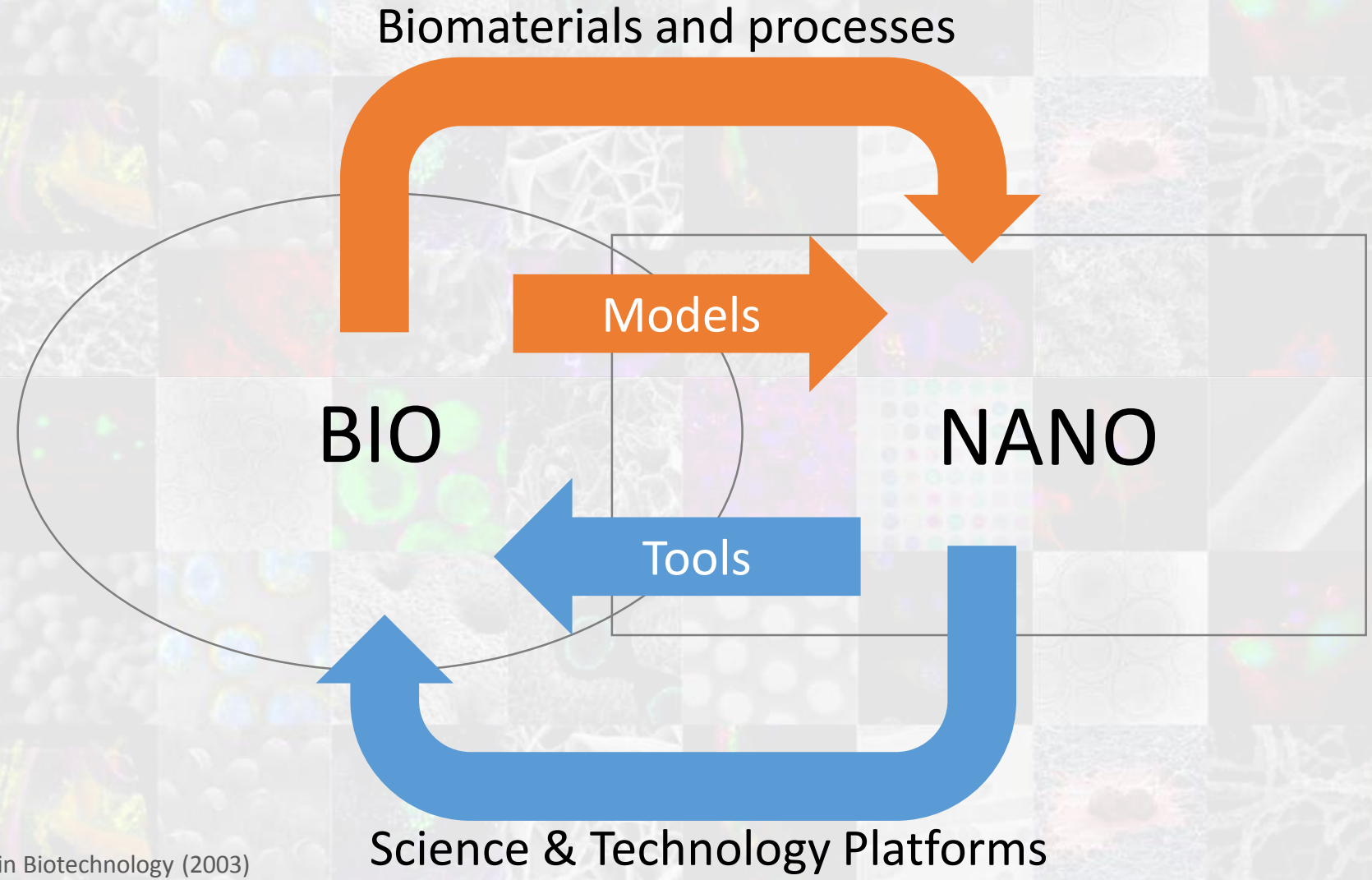
KOCH INSTITUTE for Integrative Cancer Research at MIT

Moore's Law



Wikipedia.org

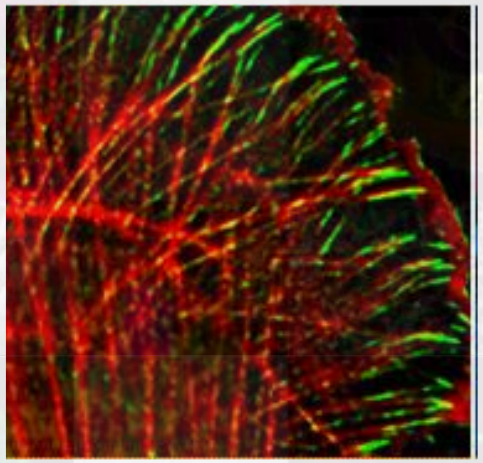
Nanotechnology: convergence of modern biology and engineering



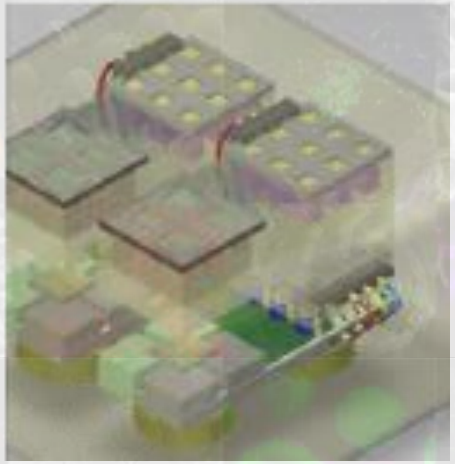
Roco, M. C., Current Opinion in Biotechnology (2003)


KOCH INSTITUTE
for Integrative Cancer Research at MIT
NCI·CC
A Cancer Center Designated by the National Cancer Institute
26 Faculty Laboratories
3 Clinical Investigator labs
Engineering
Biology
Integration & Collaboration
Discoveries & Solutions

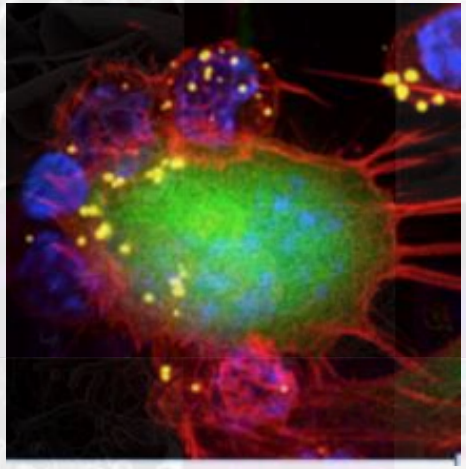
Koch Institute focus areas



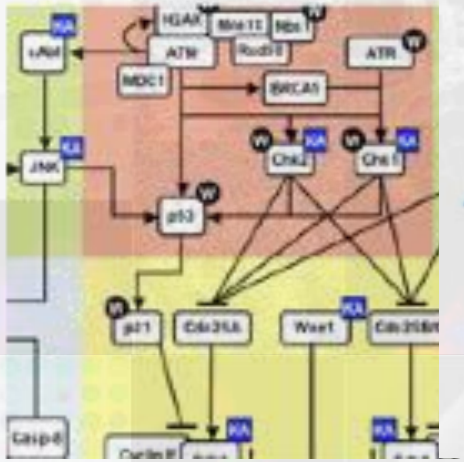
Metastasis



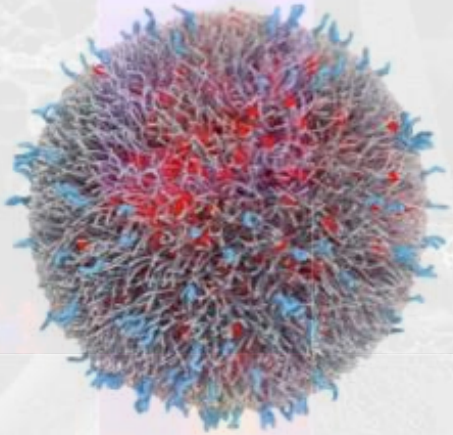
Devices



Immuno-Oncology



OMICS



Nanomedicine

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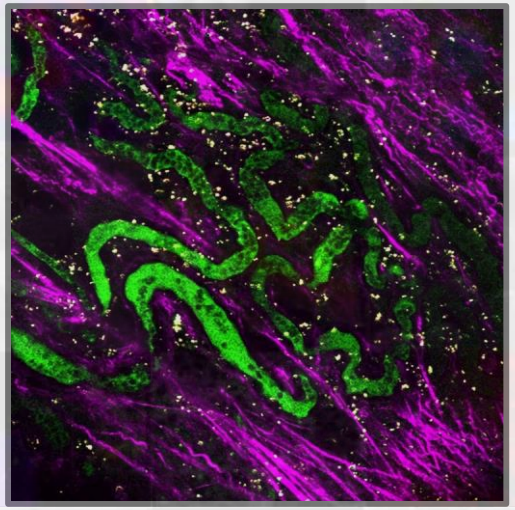
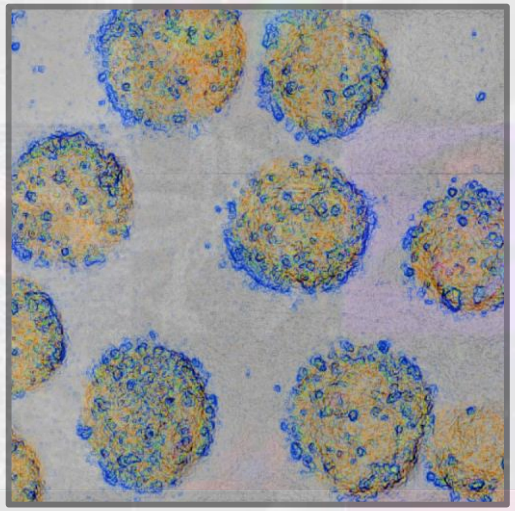
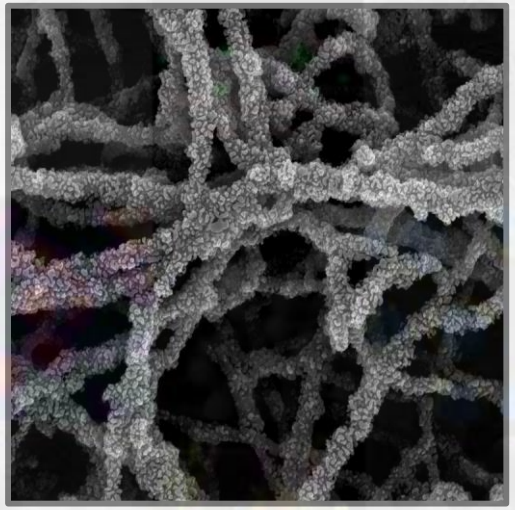


Sangeeta N. Bhatia

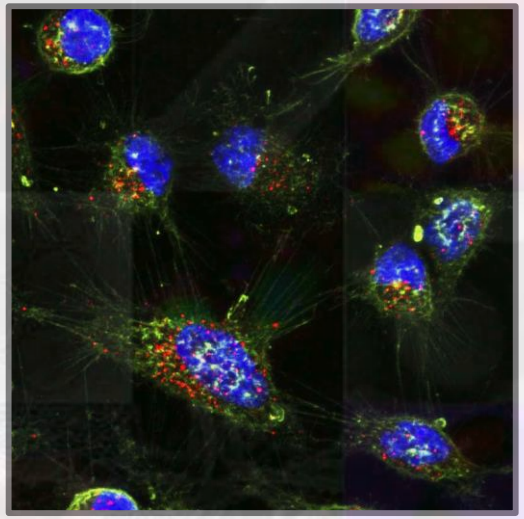
Daniel G. Anderson



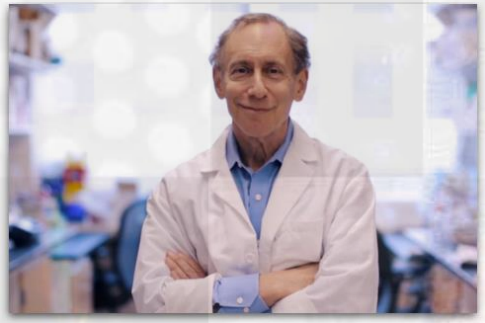


Angela M. Belcher

Paula T. Hammond



Darrell J. Irvine



Robert S. Langer

http://nanomedicine.mit.edu

Marble Center goals and general structure

BUILD a world-class community for cancer nanomedicine

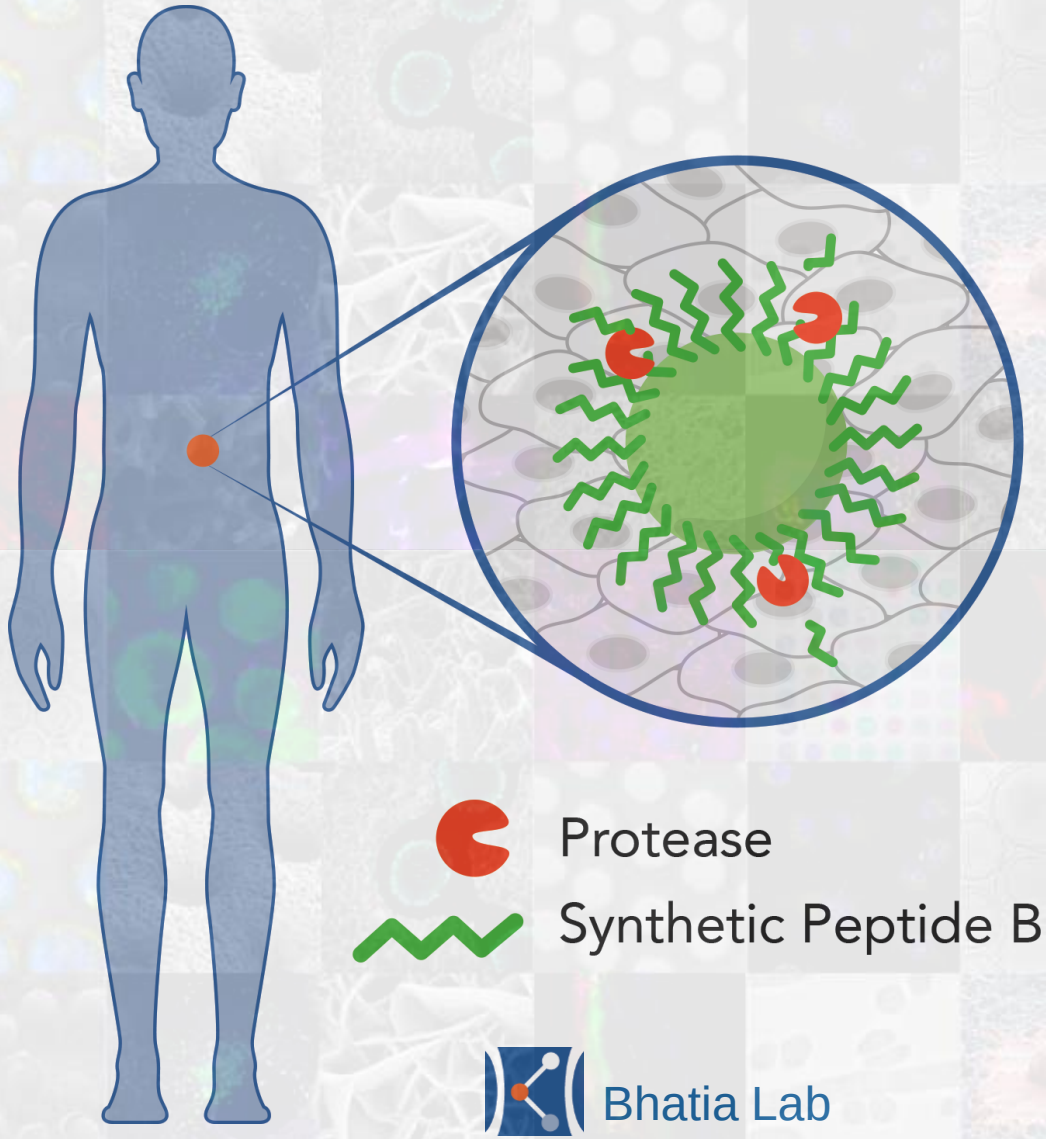
AMPLIFY the impact of our workforce

ADVANCE promising technologies

An ounce of prevention is worth a pound of cure.

- Benjamin Franklin

Amplify disease detection with nanotechnology



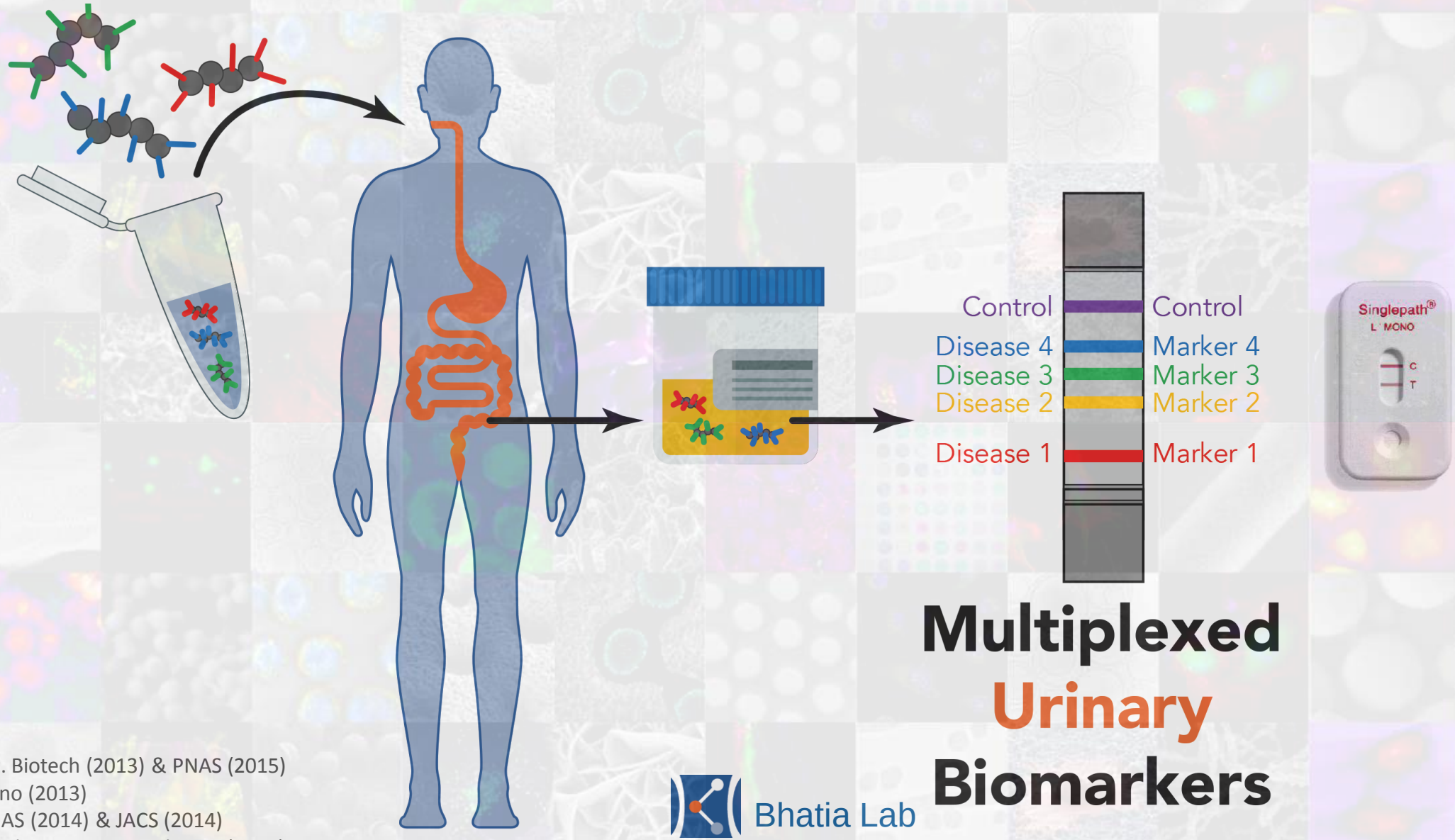
Protease

Synthetic Peptide Biomarker

Kwong et al. Nat. Biotech (2013) & PNAS (2015)
Lin et al. ACS Nano (2013)
Warren et al. PNAS (2014) & JACS (2014)
Kwon/Dudani et al. Nature Biomed. Eng. (2017)

Bhatia Lab

Early detection and diagnosis

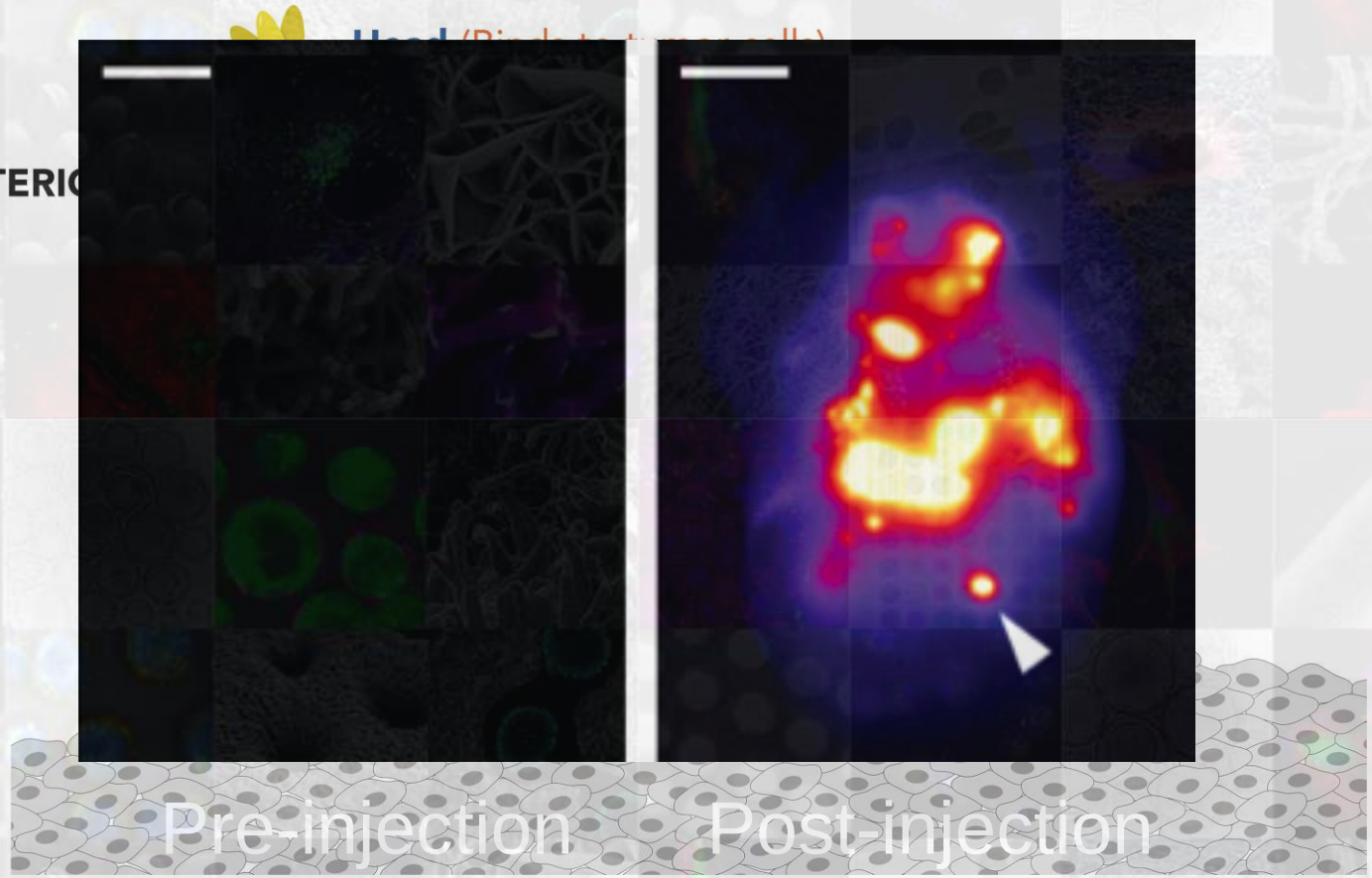


Multiplexed Urinary Biomarkers

Bhatia Lab

Kwong et al. Nat. Biotech (2013) & PNAS (2015)
Lin et al. ACS Nano (2013)
Warren et al. PNAS (2014) & JACS (2014)
Kwon/Dudani et al. Nature Biomed. Eng. (2017)

Virus repurposed for non-invasive imaging of cancer and surgical guidance



Courchesne, N. D. et al. Adv. Mater. (2014)
Ghosh, D. et al. PNAS (2014)
Dang, X. et al. PNAS (2014)

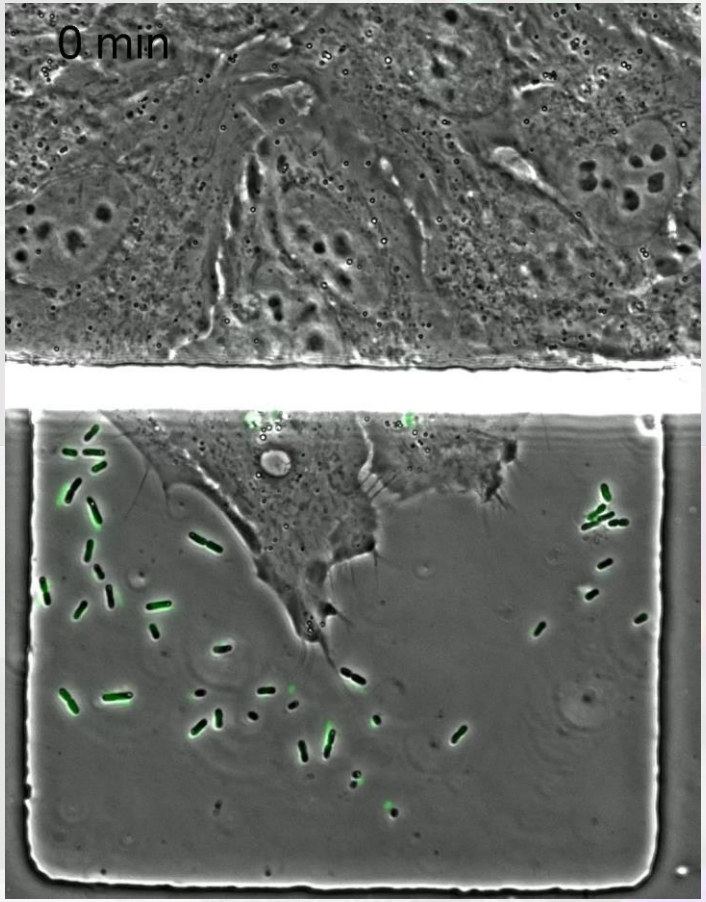
Belcher Lab

Harmless bacteria engineered to deliver toxic payloads to tumors

Cancer-fighting bacteria

Engineers program E. coli to destroy tumor cells.

Din, M. O. et al. Nature (2016)



Bhatia Lab

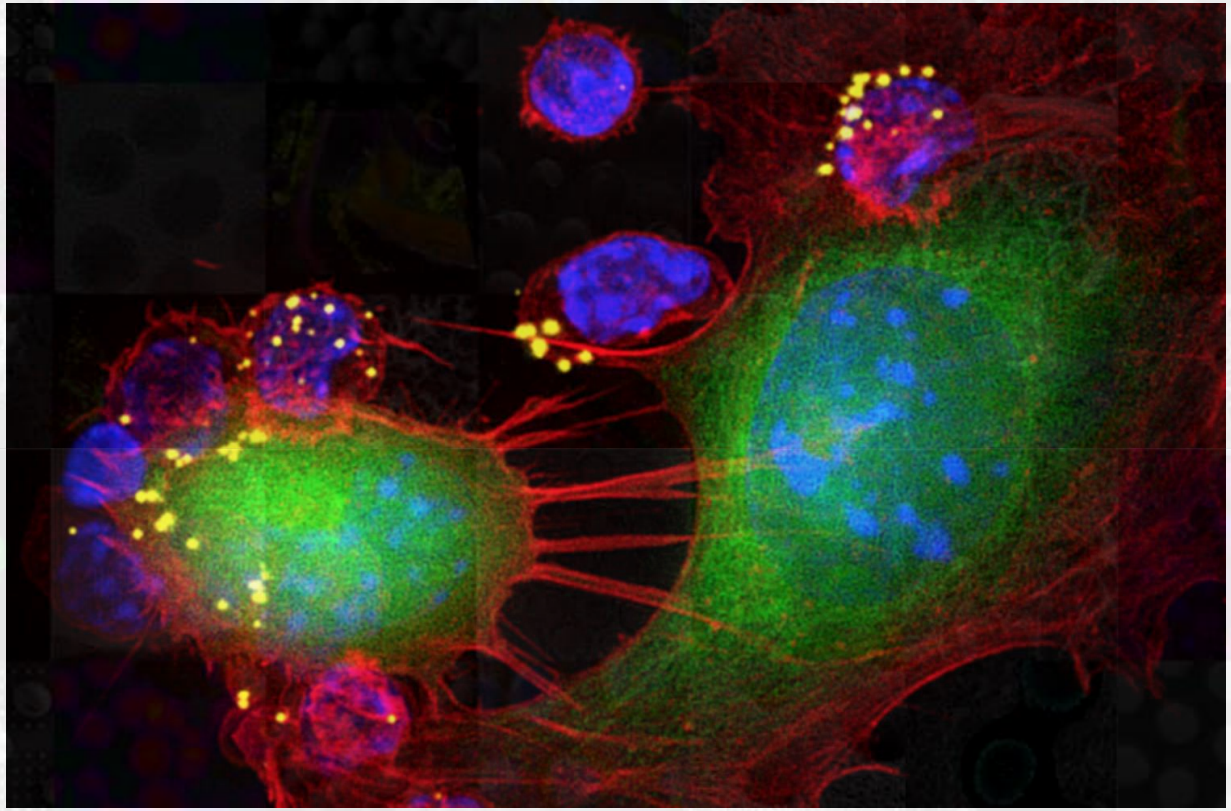
‘OMICs’ and systems biology for personalized medicine

Morton, S. W. et al. Science Signaling (2014)

Hammond & Yaffe Labs

Immuno-oncology applications

Nanoparticle backpacks for T-cells



Stephan, M. Nature Med. (2010)
Huang, B. et al. Science Transl. Med. (2015)

Nanoparticle vaccines: synthetic, customized, on-demand replicon mRNA

Chahal, S. J. & Khan, O. F. et al. PNAS (2016)

Irvine Lab Anderson Lab

Future areas

- Advanced technologies for the detection and characterization of tumors
- Breaking the delivery barrier at the tissue/cell level
- Precision imaging technologies

Thoughts on the ‘impact’ of nanomedicine

- Nanomedicine: evolution vs. revolution?
- How long does it take for an emerging field to yield clinically approved interventions?

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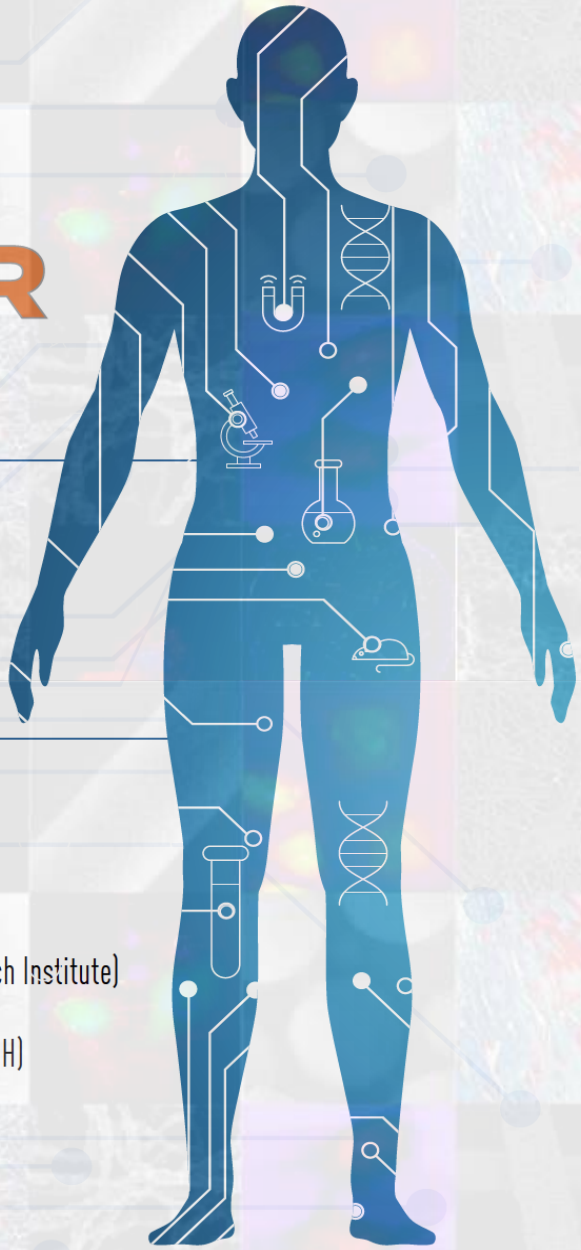
16TH ANNUAL CANCER RESEARCH SYMPOSIUM

CONVERGENCE OF SCIENCE AND ENGINEERING IN CANCER



FRIDAY, JUNE 16, 2017 • 9:00 AM - 5:00 PM • KRESGE AUDITORIUM, MIT

James Collins MIT	Gad Getz Broad Institute	Paula Hammond Koch Institute	Eric Lander Broad Institute	Robert Langer Koch Institute
Daniel Larson National Cancer Institute	Franziska Michor Dana-Farber Cancer Institute	Chad A. Mirkin Northwestern University	Aviv Regev Broad Institute	Xiaowei Zhuang Harvard University

FEATURED EXPERT PANEL: CONVERGENCE IN HEALTH

Cori Bargmann (President of Science, Chan Zuckerberg Initiative; Torsten N. Wiesel Professor, The Rockefeller University)

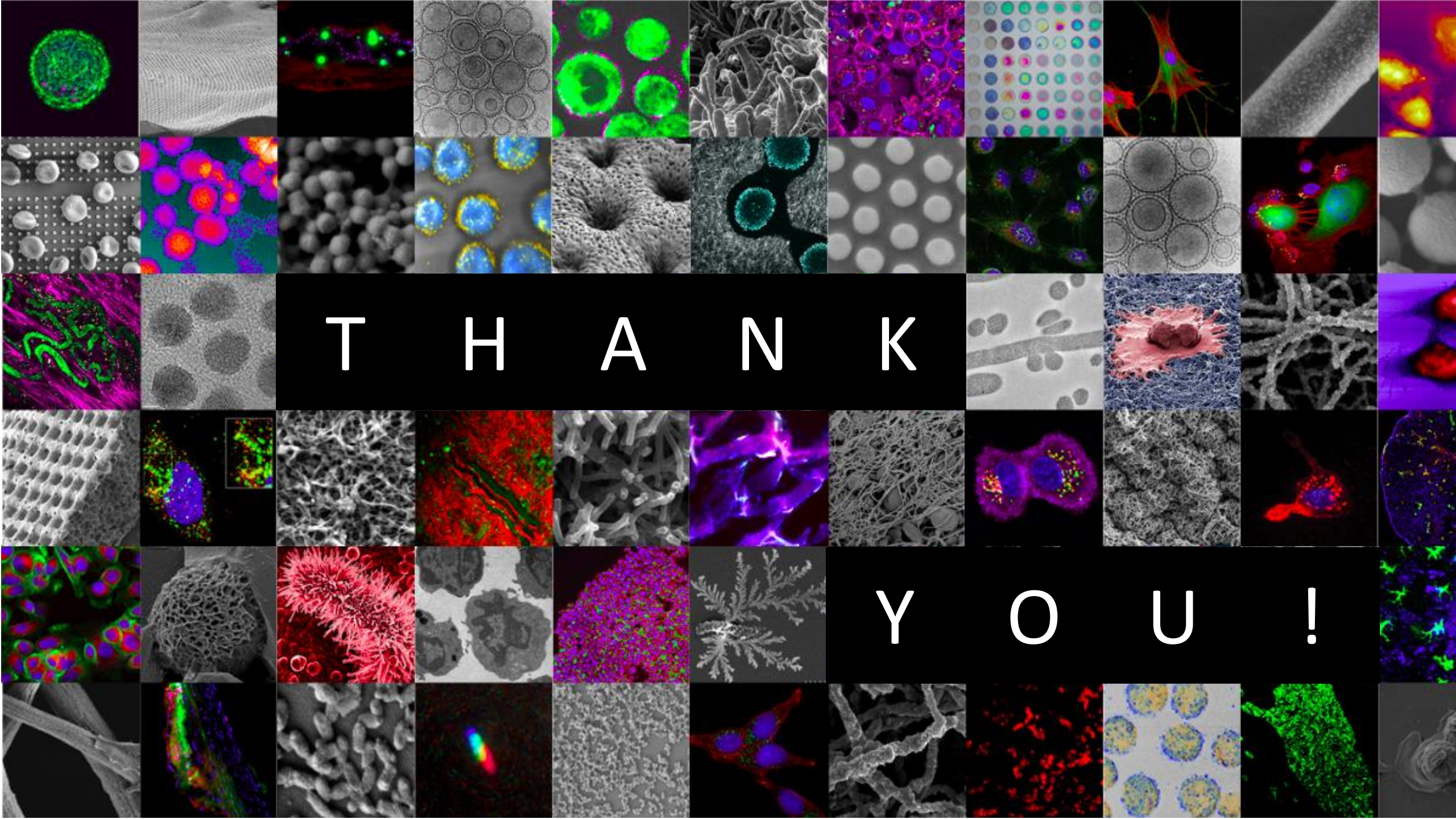
Marc N. Casper (President and CEO, Thermo Fisher Scientific) • Victor Dzau (President, National Academy of Medicine) • Tyler Jacks (Director, Koch Institute)

Nancy Simonian (CEO, Syros Pharmaceuticals) • Elias Zerhouni (President for Global Research and Development, Sanofi; Former Director, NIH)

WITH Moderator Susan Hockfield (President Emerita, MIT; Koch Institute)

REGISTER: ki.mit.edu/news/symposium

@kochinstitute #kisymposium


T H A N K
Y O U !