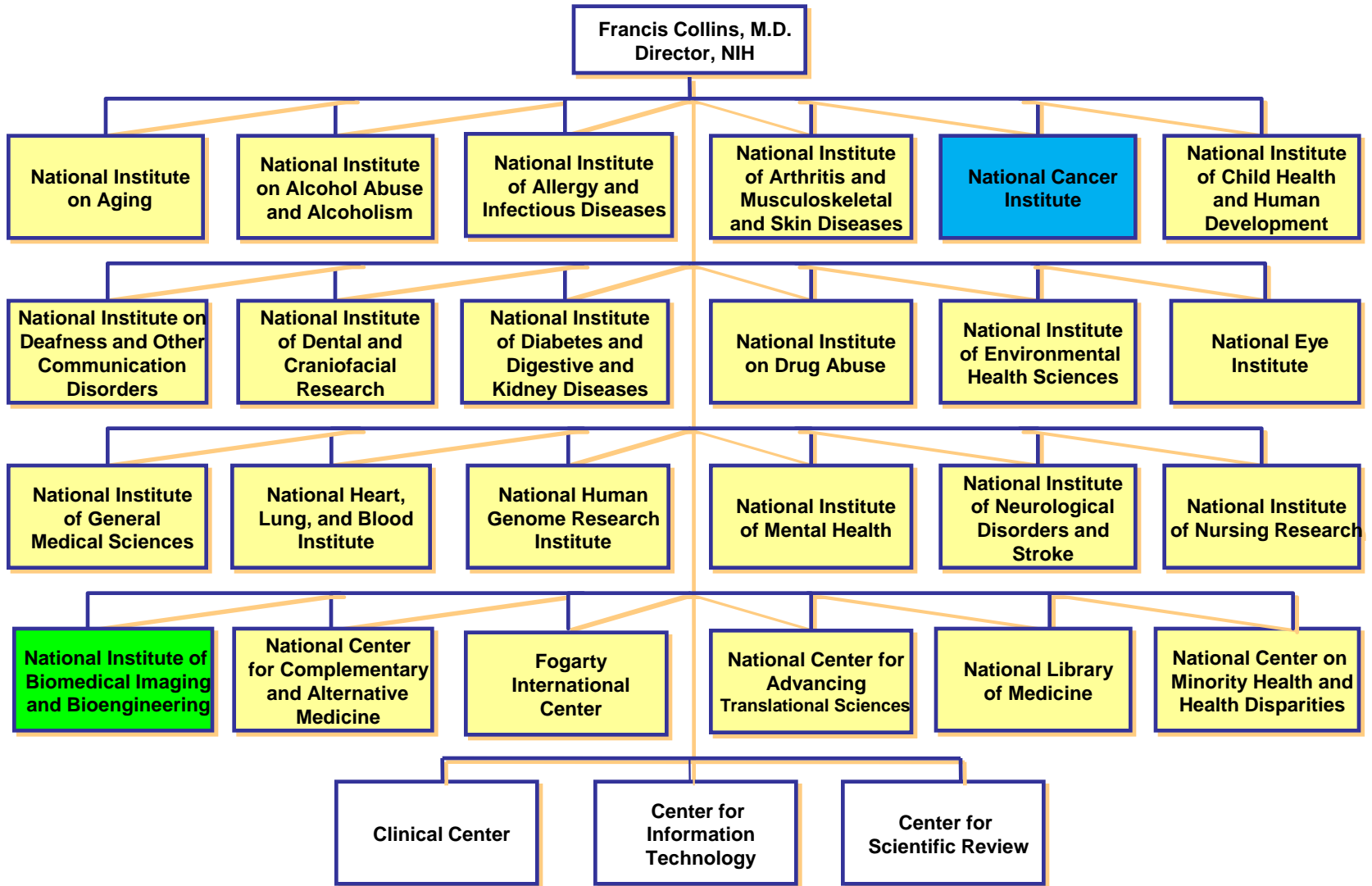


NIH Programs and Consortia in Multi-Scale Modeling

Jennifer A. Couch, NCI



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health



= Institutes and Centers that award grants



The NIH Mission

NIH is the steward of medical and behavioral research for the Nation.

Its mission is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability.

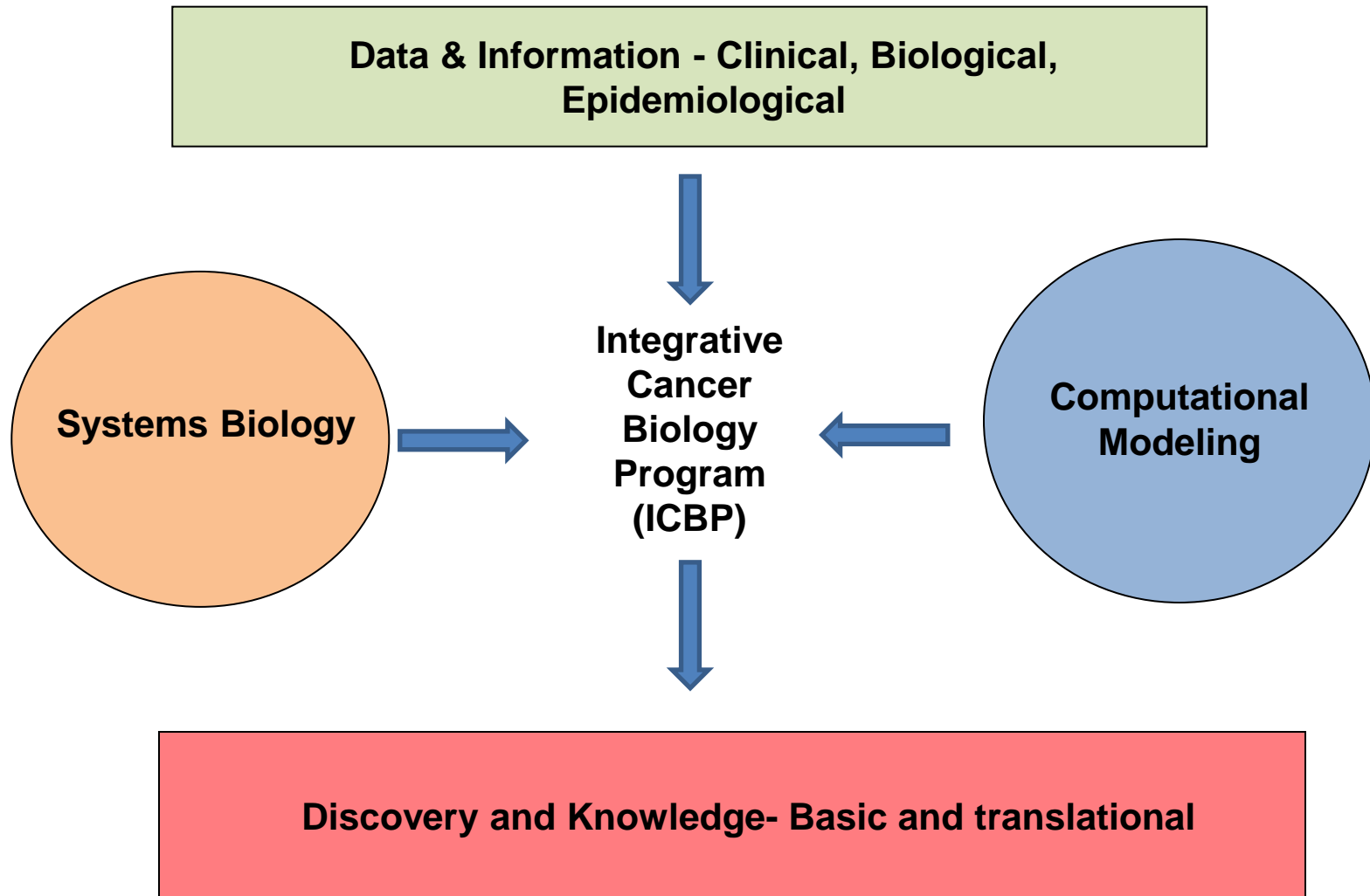


Broad support for model development

- Across the range of biomedical research areas
- Generally driven by a biological, clinical or epidemiological question
- Developing new methods or adapting approaches from other fields
- Collaborations between mathematicians, engineers with biologists, clinicians, epidemiologists...

An Example from NCI: Integrative Cancer Biology





Goals of the ICBP

- Apply systems approaches to the analysis of cancer as a complex disease through the development of interdisciplinary research teams
- Create predictive *in silico* models to aid with the understanding and management of the disease
- Integrate and explore the multi-dimensionality of large “omic” datasets as well as quantitative and descriptive data
- **Enrich the community** and the developing field through shared resources and a robust educational/outreach effort



ICBP2:Centers for Cancer Systems Biology

Cancer Stage

Initiation
Growth
Micro-environment
Progression
Metastasis
Treatment
Regression
Recurrence

Califano
Multiscale Analysis of Genomic and Cellular Networks (MAGNet), B cell lymphoma, glioma

Sander

3-D model cell-cell communication; microenvironment; variability of drug response
Melanoma, breast, panceas, glio, CLL

Quaranta

Cellular model of tumor heterogeneity; cell phenotype measurements; multiscale
Breast, Lung

Plevritis

Cell – cancer differentiation; single cell analysis; disease progression and resistance
Leukemia, Lymphoma

Lauffenburger

Quantative modeling of critical cancer process; growth, migration, DNA repair
Brain, lymphoma, Breast

Golub

Integrate multiple data types to identify essential gene-new drug targets
Lung Melanoma

Clarke

Hormone responsiveness; population exposure risk; GWAS; drug design
Breast

Friend

Cross disease analysis; Sage Bionetworks; network data integration
Glioma, Ovarian, colon, Liver, Meduloblastoma, Pancreas, Breast, ect

Hlatky

Tumor evolution; quanatative analysis; cellular population dynamic modeling
Prostate, Breast

Wong

Tumor Stem cell, imaging, ME interations; protein cDNA array
Breast

Gray

Cancer heterogeneity; molecular signaling and combinational therapy
Breast

Huang

Epigenetic and microRNA examination of hormonal –chemo resistance
Prostate, Ovarian Breast

Modeling Approach

Computer simulations
Statistical mining
Game theory
Bayesian networks
Boolean Models
Markov chains
Differential Equations

Population/ environment
Organism
Tissue/ organ
Micro-environment
Cell (components)
Interactions
Molecules

Physical Scale



ICBP: Beyond Individual Projects

- Junior Investigator Meetings
- Joint Projects
- Shared Resources
- Mathematicians Meeting
- Educators Meeting



Collaborative Research in Integrative Cancer Biology

