



OFFICE OF BEHAVIORAL
AND SOCIAL SCIENCES RESEARCH
NATIONAL INSTITUTES OF HEALTH

Would You Trust Agent-Based Models With Your Health?

Patricia L. Mabry
Office of Behavioral and Social Sciences Research
National Institutes of Health

April 28, 2010





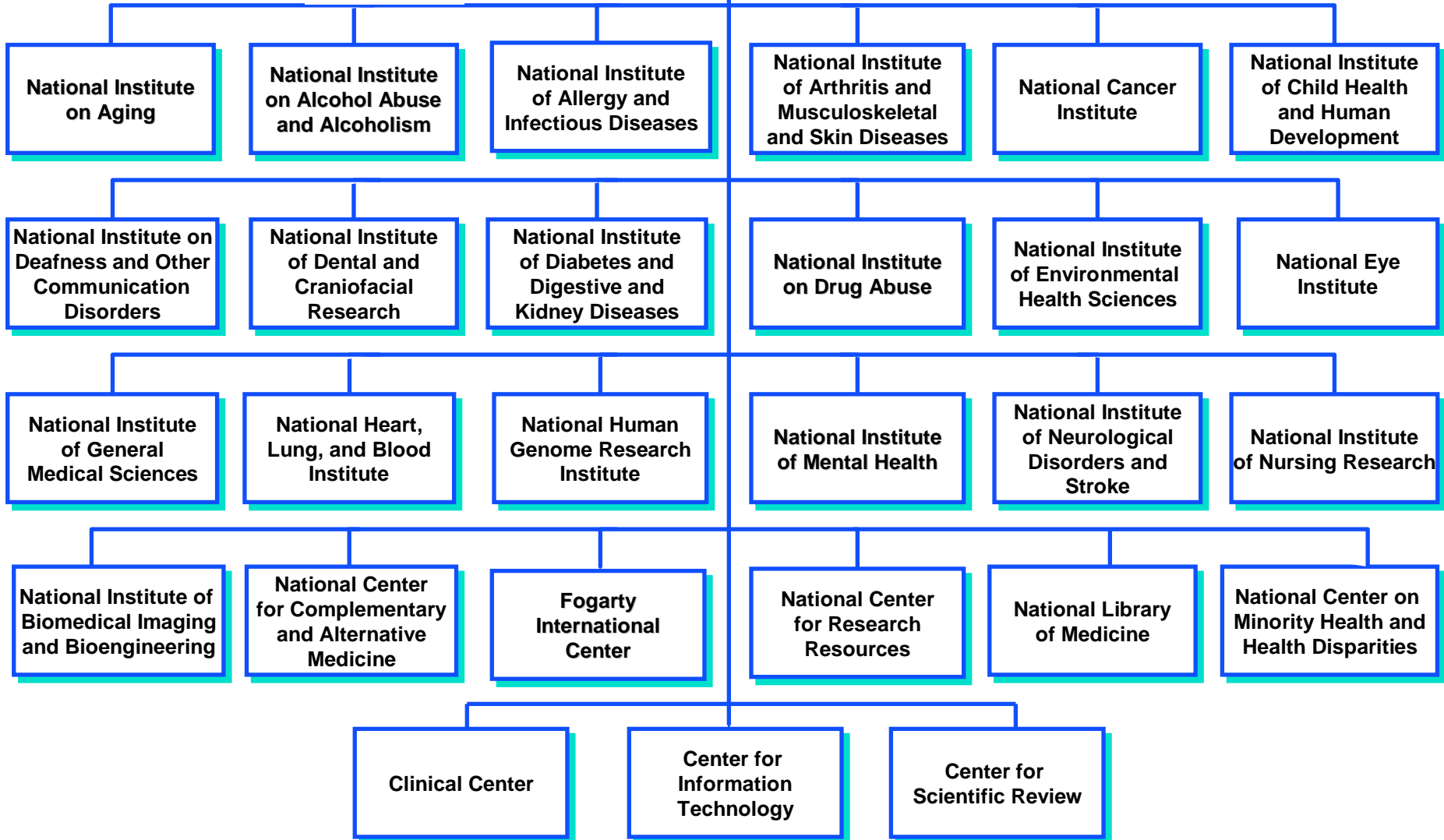
vacancy



National Institutes of Health 27 Institutes and Centers

Office of the Director

Francis Collins





- The **National Institutes of Health (NIH)** is an agency of the U.S. federal government within the Department of Health and Human Services. With a **\$30.5 billion budget**, it is the the steward of medical and behavioral research for the Nation. (<http://www.nih.gov/>)
- NIH is made up of **27 Institutes and Centers (ICs)** - each covering a specific domain of research, which is conducted both at NIH (*intramural*) and at grantee universities (*extramural*). See a directory of the ICs at <http://www.nih.gov/icd/index.html>
- The **Office of Behavioral and Social Sciences Research (OBSSR)** stimulates behavioral and social sciences research across the ICs. (<http://obssr.od.nih.gov/index.aspx>)





OBSSR Strategic Areas

1. Trans-/inter-disciplinary science
2. “Next generation”, basic science (OppNet)
3. Problem-based, outcomes oriented, strengthen the science of dissemination
4. Systems science for population impact



The Complex Problem Space of Human Health

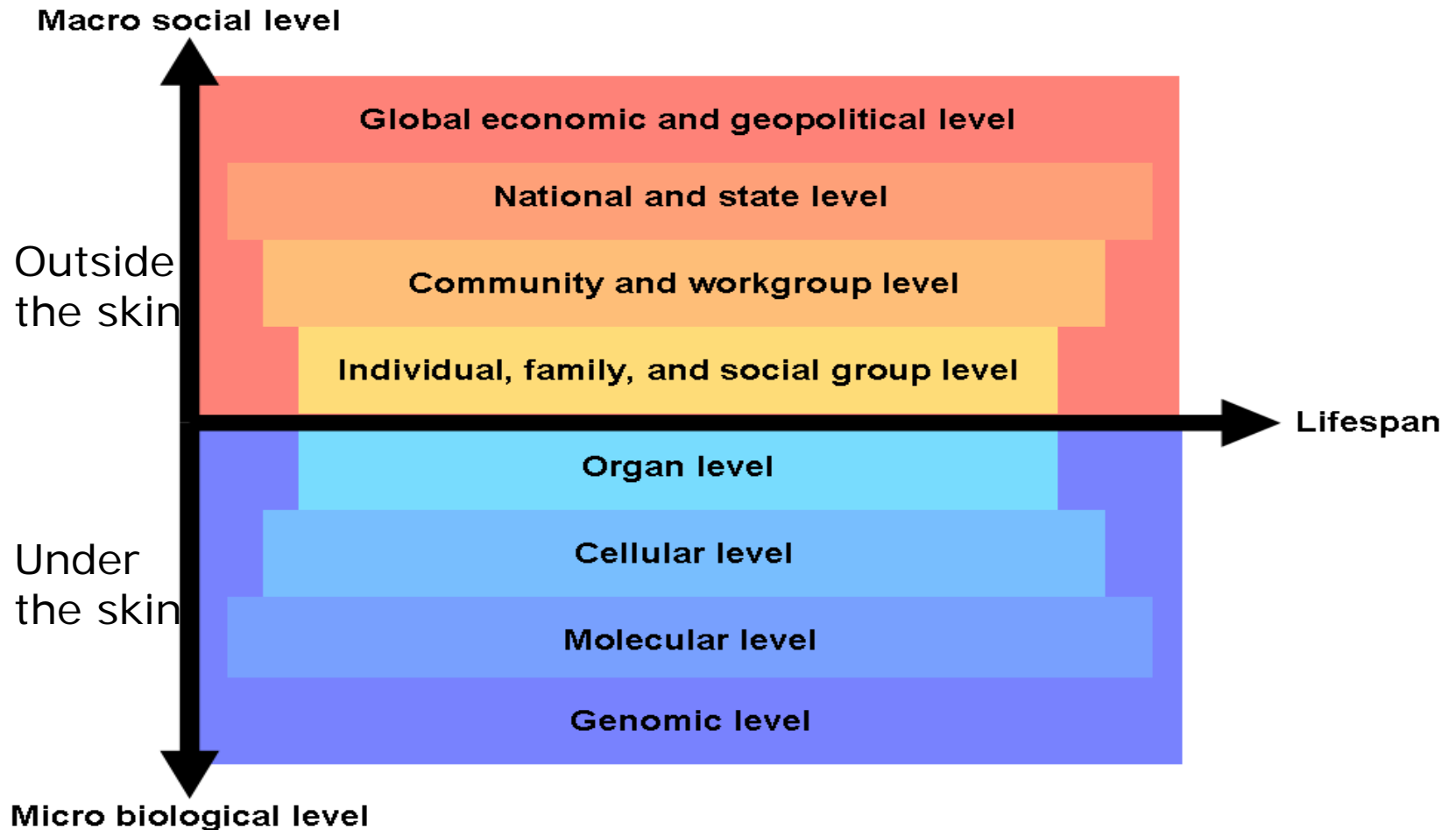


Figure 1. Health as a continuum between biological and social factors across the lifespan. (Adapted from Glass & McAtee, 2006).



Potential Areas of Modeling at NIH

- Pandemic flu, HIV/AIDS, Hepatitis B and other infectious disease
- Tobacco use/substance abuse/addiction
- Obesity
- Health disparities/inequalities/social determinants of health
- Chronic disease – cardiovascular, cancer, diabetes
- Health care delivery
- Stress, mental illness
- Gene x environment interaction
- Demography and population health
- Climate Change and Health
- Developmental issues over the lifespan
- Culture





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Would You Trust Models With Your Health?

YES!

Compared to what? ...

Mental models, naked brain, Gut instinct?

Other forms of modeling?





Would You Trust Models With Your Health?

NO!

Not excluding traditional reductionist methods

Not a replacement for judgment

Not a crystal ball



Would You Trust Models With Your Health?

It depends on the question, and to what degree

Models are useful when...

The model is built to address the question

Questions are appropriately complex – beyond comprehension of naked brain

Impractical/impossible to do real world experiment

Want to try out a hypothesis

Not over-relying on the model

Better question: what are the steps to leverage modeling/simulation?





Modeling/simulation is hard, but...

Changing people is harder!

Thinking in Systems – Donella Meadows (2008)

Policy Resistance

- *What it is:* effects the system

Tragedy of the Commons

- *What it is:* Each a resource, resulting
- *What to do:* 1) Educate resources, 2) create

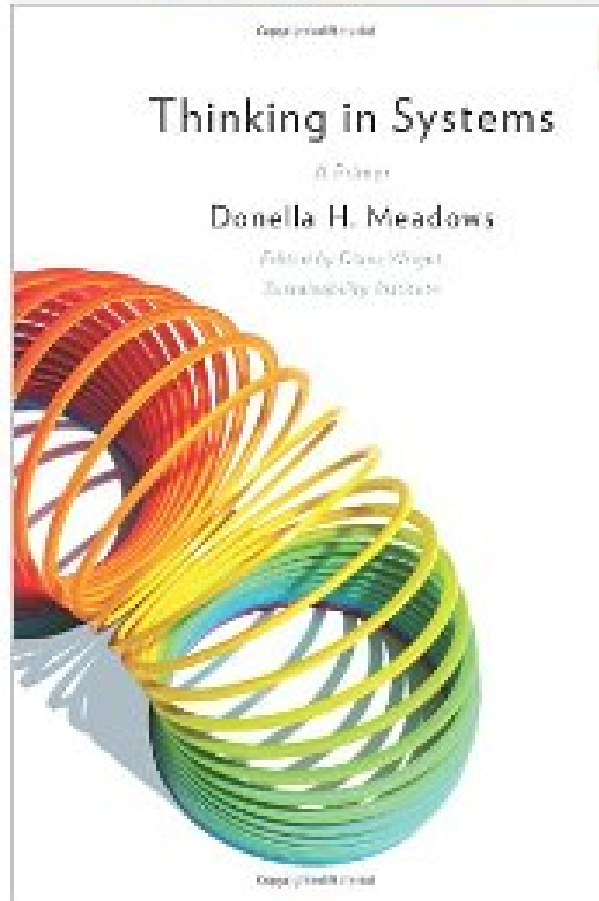
Success to the Successful

- *What it is:* The system
- *What to do:* Limit

Shifting Burden to the Proximate

- *What it is:* Solution
- *What to do:* Take

Click to **LOOK INSIDE!**



d by forces in

atural goals

depletes a shared

r on shared

'inequalities

g the problem
solution.



How can we best take advantage of modeling? (Change people!)

- **Build good models**
 - Modeling standards
 - Think big – open source – take advantage of Crowdsourcing
 - Develop core engines that can be continually updated and shared Hall and Chow, Kaufman's STEM
 - Validation
- **Welcome and encourage all modeling methods - hybrids**
- **Transparency**



How can we best take advantage of modeling?

- **Gain acceptance among public health scientists as a legitimate form of inquiry**
 - **Education – what modeling is and isn't – another tool in the toolbox, not a crystal ball, assist with insight, aid decisions, not “baseless”, cannot make tough decisions easier**
 - **Publish in public health journals**
 - **AJPH – theme issue on Systems Thinking in Public Health (March 2006) Mathematical Modeling in Tobacco Control (July 2010)**
 - **American Journal of Preventive Medicine (March 2010)**
- **Foster cross fertilization – SBP10**





How can we best take advantage of modeling?

- Develop good decision making tools- accessible to policymakers
 - C-ROADS Stermann et al. www.Climateinteractive.org
 - Healthbound <http://www.cdc.gov/healthbound/>
- *Group model building – beyond policymakers – community members... along the lines of user centered design
- *Comparative modeling
- *Iterative and near real-time
- *Model driven data – new measures, methods of collection
- *Core engines –How should we evaluate our models
- *Develop methods of evaluating model utility – e.g., goodness of fit
See Rodgers, American Psychologist, January 2010
- ***Cross-fertilization** - Social Computing, Behavioral Modeling, and Prediction (**SBP10**) <http://sbp.asu.edu/sbp2010/sbp10.html> **R13**





Challenges - far beyond modeling

- **Working across disciplinary divides**
 - multiple levels of analysis
 - Cross discipline lack of communication, ability to think across disciplines, translation – speaking different languages
- **Seeking different goals**
 - U.S. Congress – what does compromise look like? How do we get something useful to come out?
 - Food and beverage industry vs. public health on obesity
 - Tobacco industry vs. tobacco control



www.nccor.org

What we are doing... Comparative modeling

National Collaborative on Childhood Obesity Research (NCCOR)

- Feb 2009
- Goal: accelerate progress on reversing the epidemic of overweight and obesity among U.S. youth.
- Partners:
 - Centers for Disease Control and Prevention (CDC)
 - National Institutes of Health (NIH)
 - Robert Wood Johnson Foundation (RWJF)
 - USDA (March 2010)

NCCOR will support the evaluation of new and existing prevention approaches, rapidly assess promising policy changes and speed the application of interventions that work.

ENVISION

- **COMNet**
- **COMPMod**



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What we are doing... education, training

Institute on Systems Science and Health

June 13-18, 2010

Columbia University



Columbia University
MAILMAN SCHOOL
OF PUBLIC HEALTH



Training needs:

Schools of Public Health (11 principles of systems thinking)

Feds: NIH and CDC program staff and review staff

BSSR investigators, Policymakers, K-12





Other activities

- **NIGMS Modeling Infectious Disease Agents Study (MIDAS)**
<http://www.nigms.nih.gov/Initiatives/MIDAS>
- **IMAG Interagency Modeling and Analysis Group NIH NSF NASA
DOE DOD USDA USDVA**
<http://www.nibib.nih.gov/Research/MultiScaleModeling/IMAG>
- **CISNET** <http://cisnet.cancer.gov/> **Model profiler**
- **SBP10 Social Computing Behavioral Modeling & Prediction**
- **Opp Net (\$20-30M/year)** <http://oppnet.nih.gov> **Basic Behavioral
and Social Sciences Research Opportunity Network**
- **PAR-10-038/039/040** **Dissemination and Implementation Research
in Health (R01, R21, R03) and annual conference**





Selected funded systems science research at NIH

Joshua Epstein, Director's Pioneer Award, NIGMS, OBSSR, 2008. Project Title: *Behavioral Epidemiology: Applications of Agent-Based Modeling to Infectious Disease.*

David Lounsbury, R03, NIDA, 2008. Project Title: *Dynamics Modeling as a Tool for Disseminating the PHS Tobacco Treatment Guideline*

David T. Levy, U01, NCI, 2002-2010. CISNET. Project Title: *A Simulation of Tobacco Policy, Smoking and Lung Cancer.*

Linda Collins & Daniel Rivera, R21, 2007-2010. NIH Roadmap. *Dynamical System /Related Engineering Approach /Improving Behavioral Intervention*

Daniel Rivera, K25, NIDA, OBSSR. *Control Engineering Approaches to Adaptive Interventions in Drug Abuse Prevention.*

Joe Messina R21 NIH Roadmap. *Dynamic Ecological Simulation Model Of Tsetse Transmitted Trypanosomosis In Kenya*





Selected funded systems science research at NIH

Joe Eisenberg, Jim Trostle, R01 NIAID/NSF.

Project 1 Title: *Environmental change and diarrheal disease.*

Project 2 Title: *Ecology of Infectious Disease.*

Yasmin Said, F32, NIAAA. *A Social Network Model of Ecological Alcohol Systems*

RFA-HD-08-023 (R01), *Innovative Computational and Statistical Methodologies for the Design and Analysis of Multilevel Studies on Childhood Obesity (R01).* Michael Rendall, RAND; David Shoham & Amy Luke, Loyola Chicago.

Laurette Dube/Ross Hammond U01 *Multi-level Modular Agent-based Modeling For The Study Of Childhood Obesity*

Margaret Brandeau- NIDA HIV/AIDS network

Areas ripe:

- Climate Change
- Global Health
- CBPR and modeling
- Comparative Effectiveness





Open Funding Opportunity Announcements at NIH in Systems Science

- **PAR-08-224** *Using Systems Science Methodologies to Protect and Improve Population Health (R21).*
- **PAR-10-145/146** *Social Network Analysis and Health (R01, R21)*
- **PAR-08-212, -213, -214** *Methodology and Measurement in the Behavioral and Social Sciences (R01, R21, R03).*
- **PAR-10-136** *Behavioral and Social Science Research on Understanding and Reducing Health Disparities (R01, R21)*
- **PAR-08-023** *Predictive Multiscale Models of the Physiome in Health and Disease (R01).*
- **PA-07-427 (R01) ; PA-07-428 (R21) ; PA-07-429 (R03)** *Research on Alcohol-Related Public Policies such as Those Detailed in the Alcohol Policy Information System*
- **PA-10-106** *Scientific Meetings for Creating Interdisciplinary Teams (R13)*





Final Thoughts

Join the BSSR-Systems Science Listserv

- To join, contact the listowner, Patty Mabry at mabryp@od.nih.gov

Ask me for my “Resource Page” for applying for NIH grant funding

mabryp@od.nih.gov



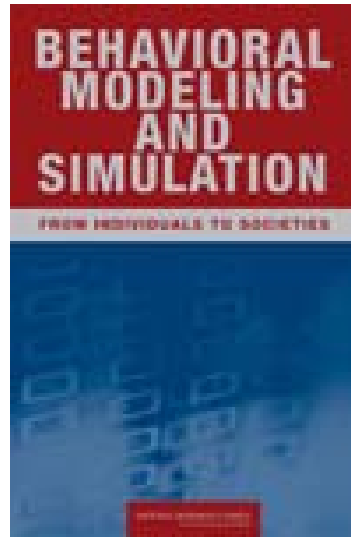
From Qualitative to Quantitative

From Large to Small scales (and back)

About 150 years



What we might do in the future....



Behavioral Modeling and Simulation From Individuals to Societies (2008)

National Research Council

Greg L. Zacharias, Jean MacMillan, and Susan B. Van Hemel, Editors

National Research Council, Committee on Organizational Modeling from
Individuals to Societies,



What assets do we have at the ready?

- IBM –
- NIH/CDC
- RWJF
- Public-Private Partnerships?
- NCCOR