

August 18, 2015
Outreach Partners Program 2015



NIMH Update

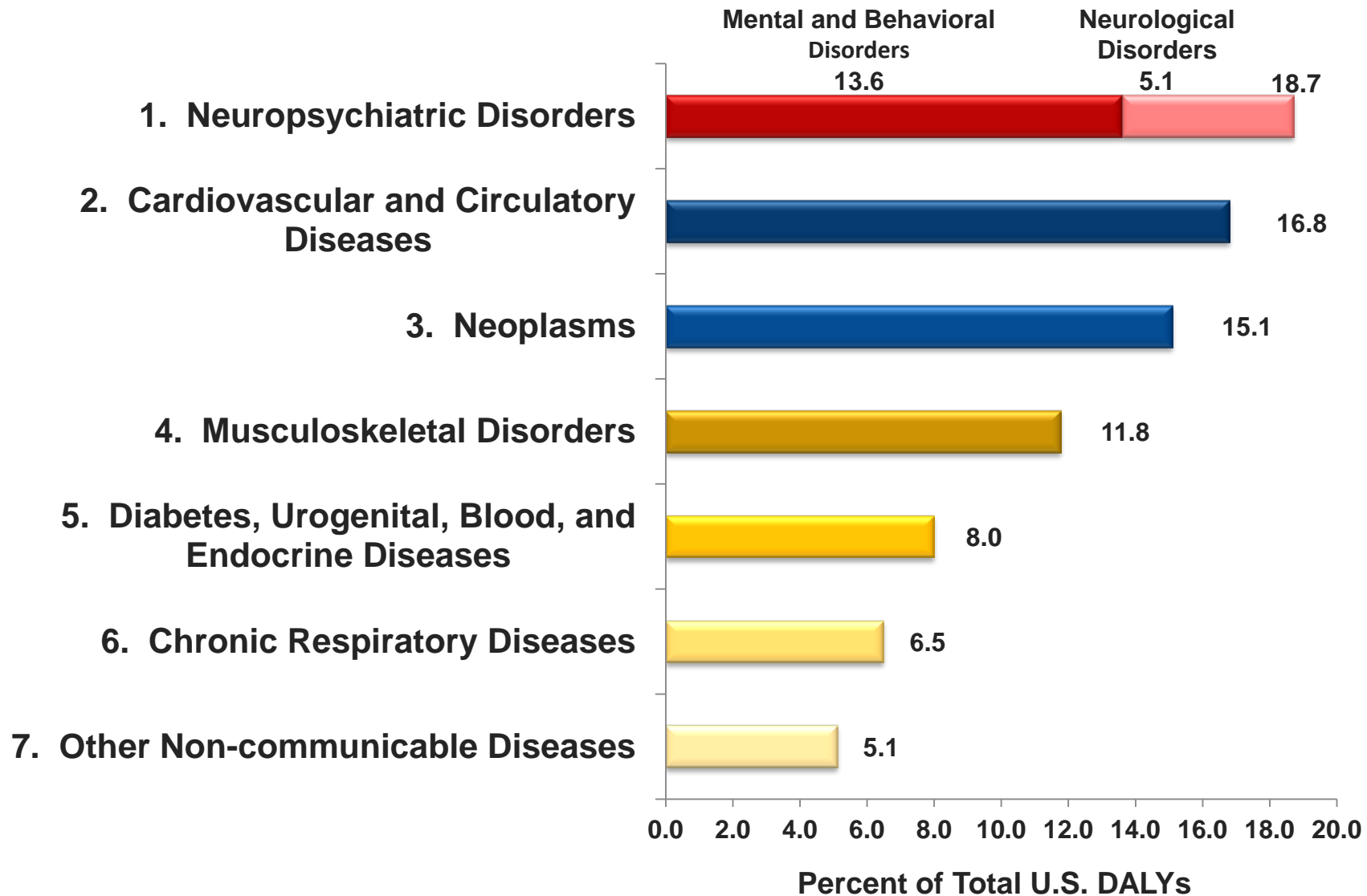
Thomas R. Insel, MD
Director, NIMH
Public Filer
Nothing to Disclose



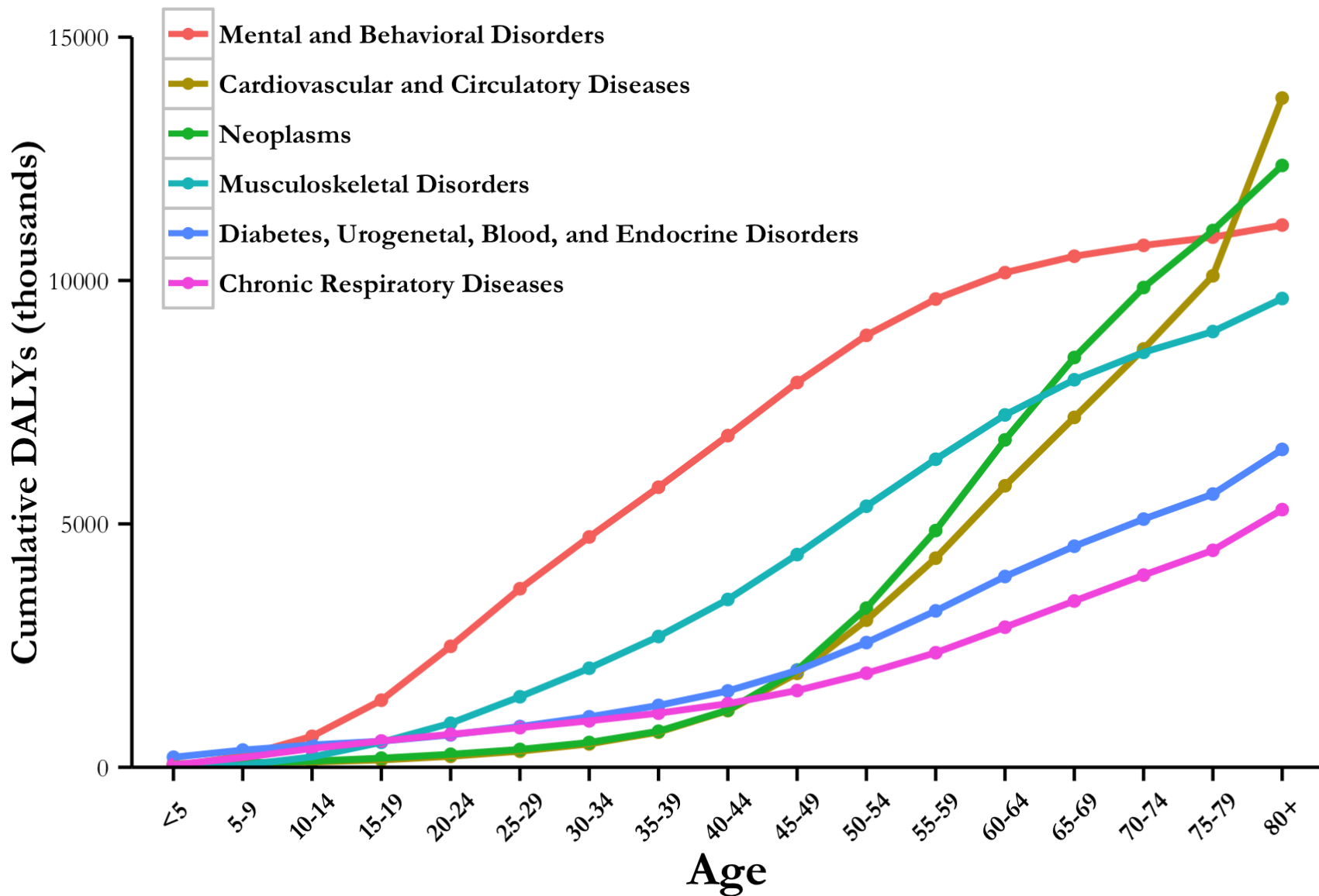
National Institute
of Mental Health

U.S. Burden of Diseases: 291 diseases and injuries

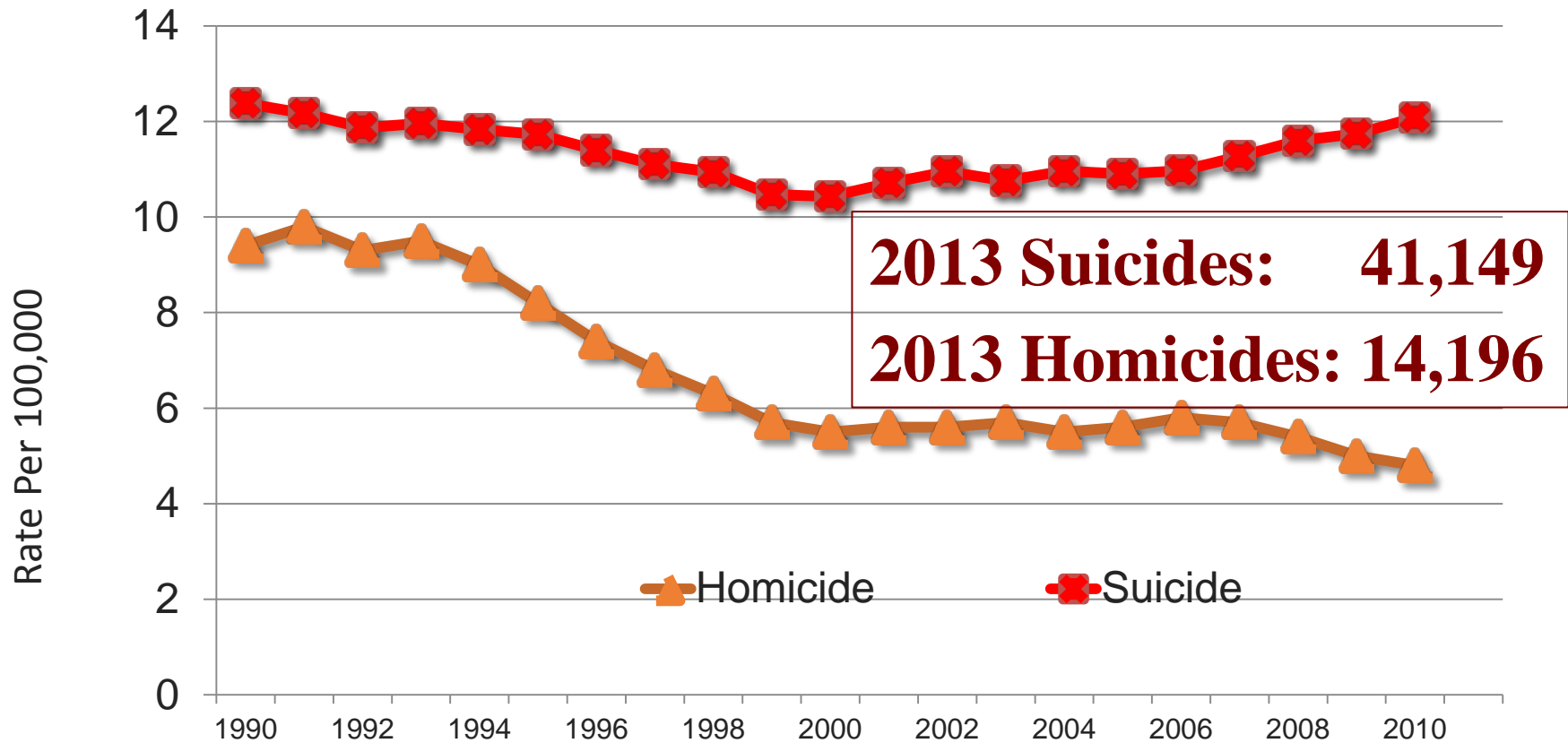
Leading Categories of DALYs 2010



The most disabling disorders before age 50



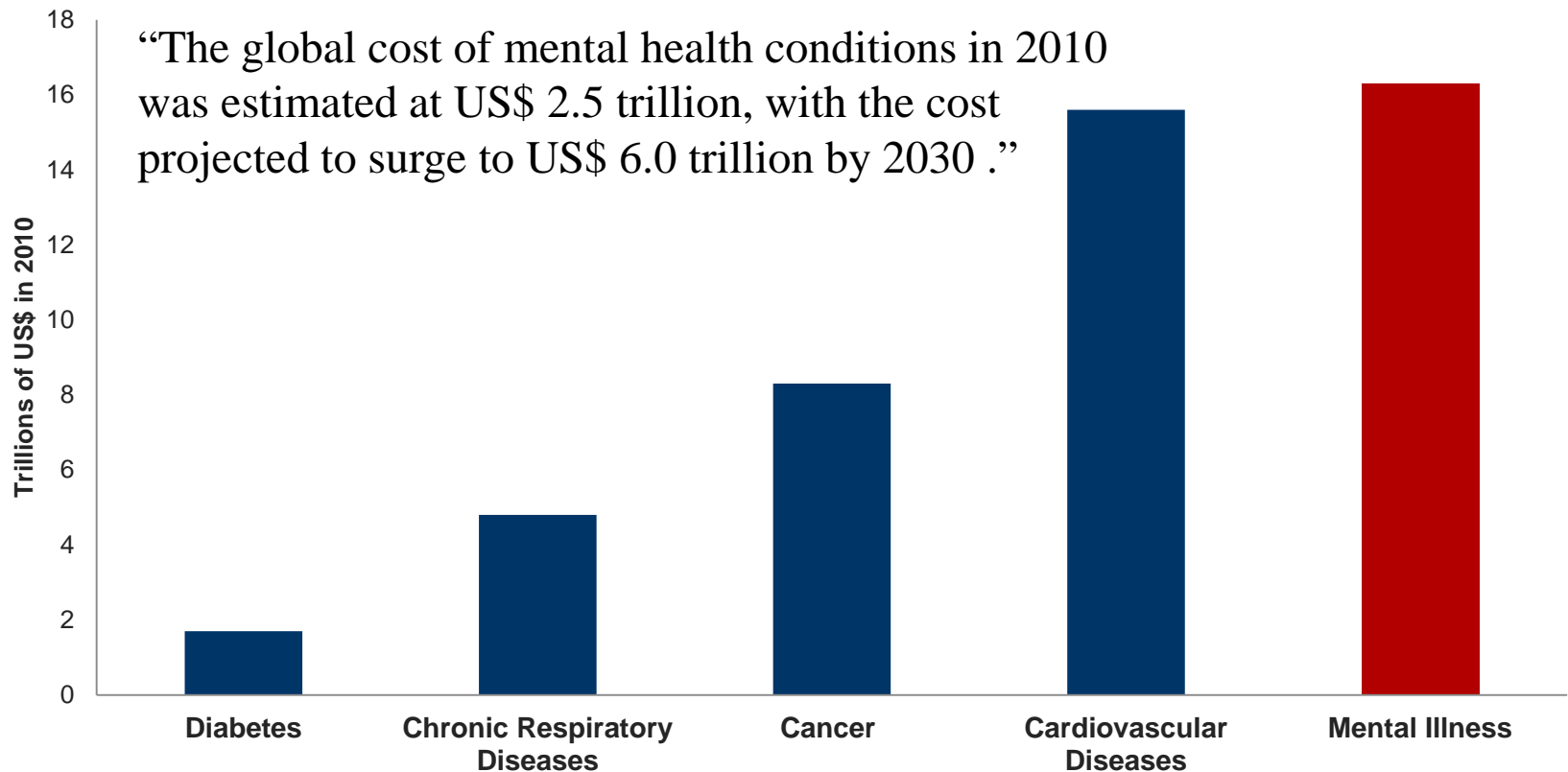
U.S. suicide rate unchanged in 2 decades



Homicides have dropped from 9.8/100,000 in 1992 to 4.8/100,000 in 2010 (<15,000/yr)

The Most Costly Conditions

Economic Burden of Noncommunicable Diseases 2011-2030



US Annual Costs > \$300B for SMI (Insel, AJP, 2008)

Source: The Global Economic Burden of Noncommunicable Diseases. WEF, 2011

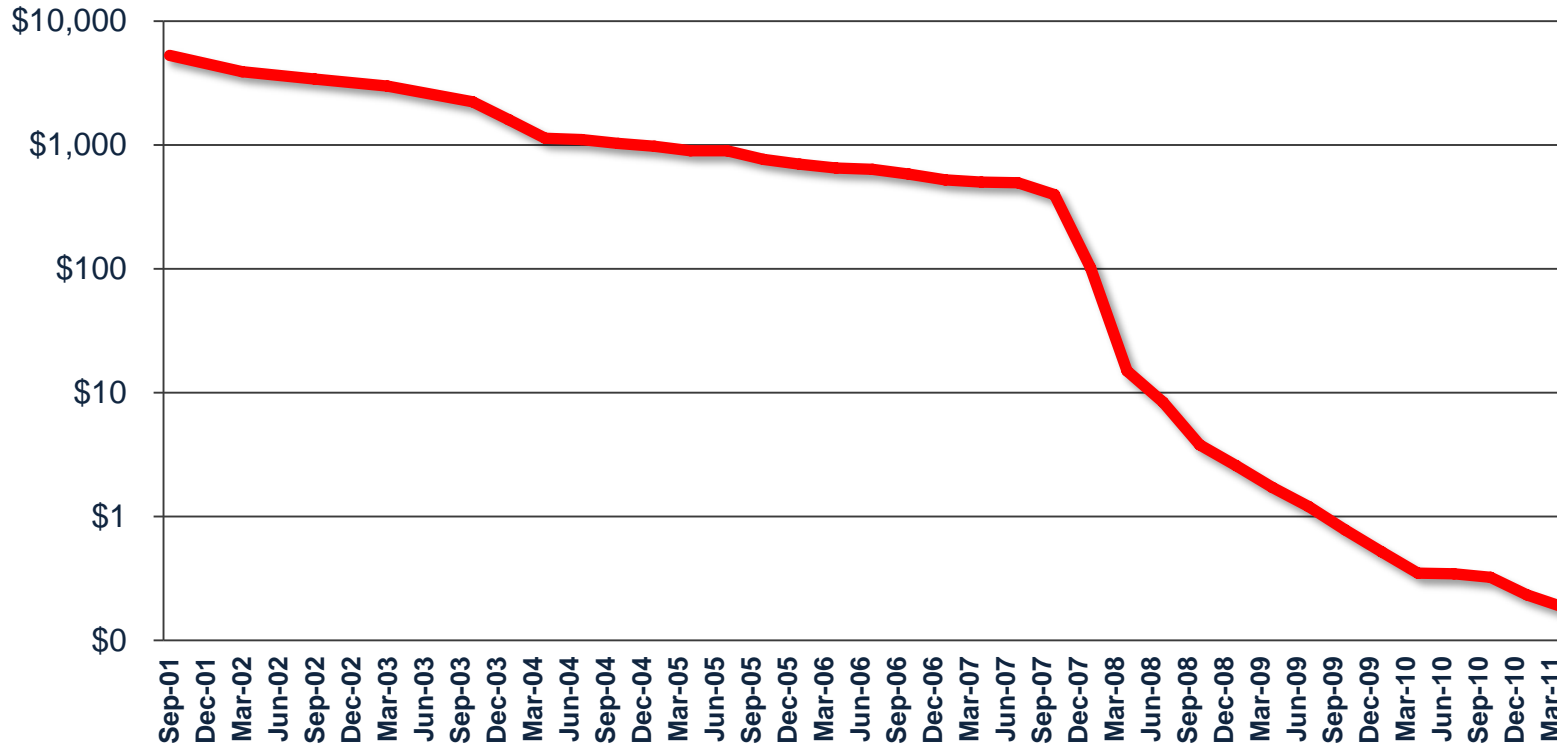
Exploiting Scientific Traction

	Ten Years Ago	Now – 2015 (most recent data)
Cost of sequencing a human genome	\$22,000,000	\$1000 - \$5000
Amount of Time to Sequence a Human Genome	2 years	<1 day
Number of smart phones in the United States	1 million (<2%)	160 million (58%)
EMR Adoption, (% providers)	20-30%	>90%
Computing Power	n	n x 16

Courtesy of Francis Collins 2015

The Genomic Revolution

Cost per Megabase of DNA Sequence

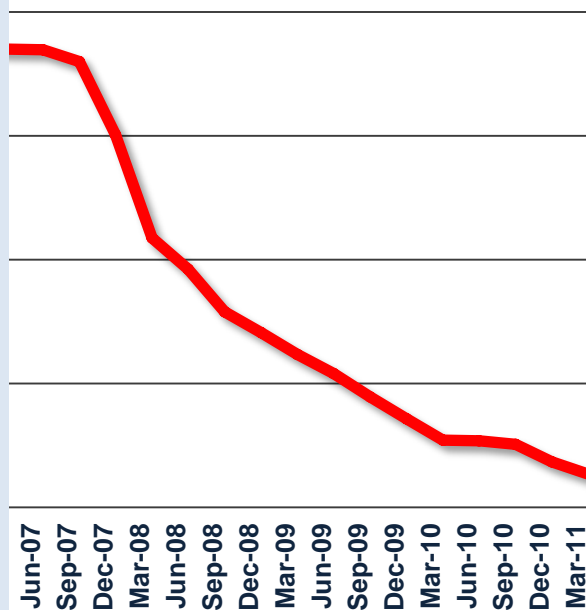
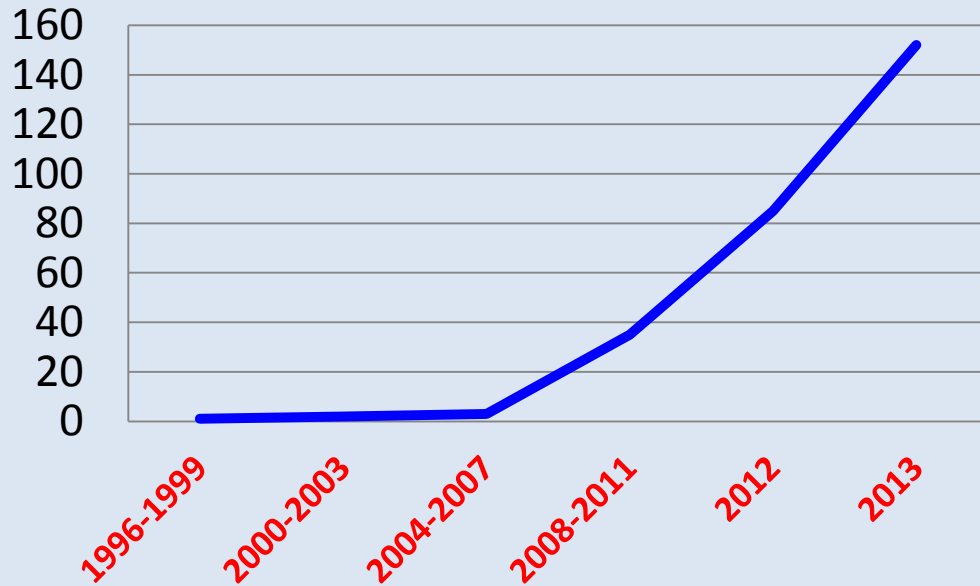


The Genomic Revolution

Cost per Megabase of DNA Sequence

\$10,000

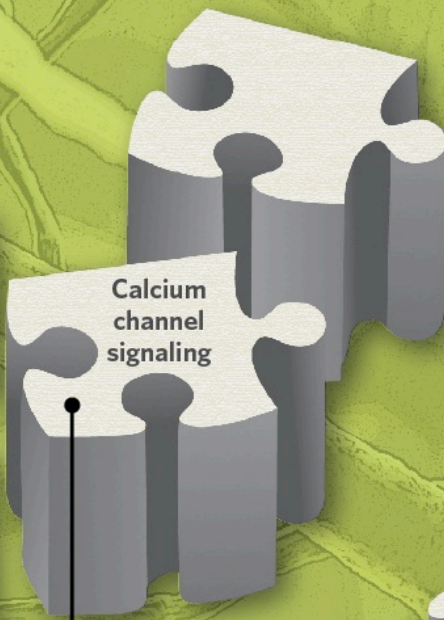
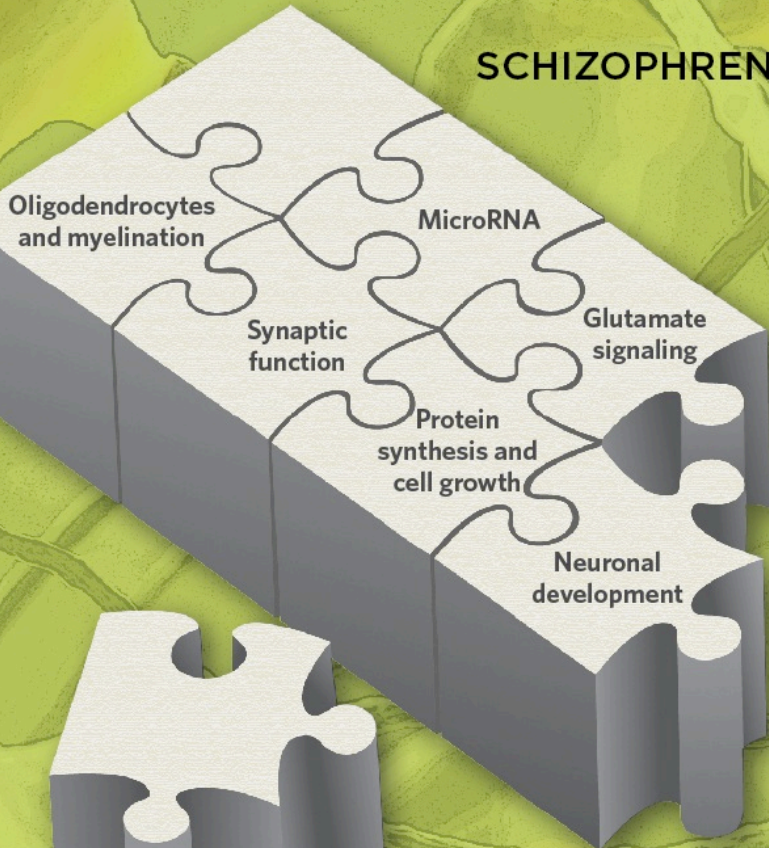
Confirmed Psychiatric Gene Findings



THE SUSPECTS

Based on new genetic findings, researchers have fingered the following cellular dysfunctions as playing a role in schizophrenia and/or bipolar disorder:

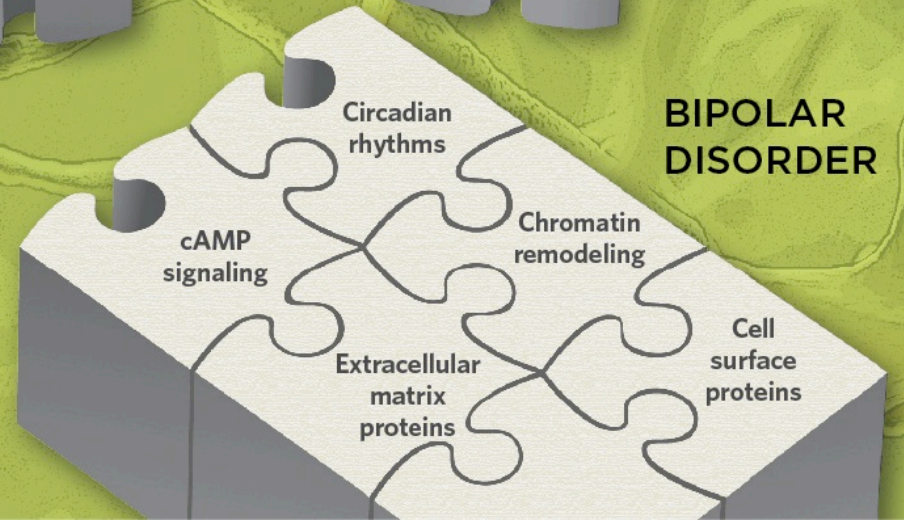
SCHIZOPHRENIA



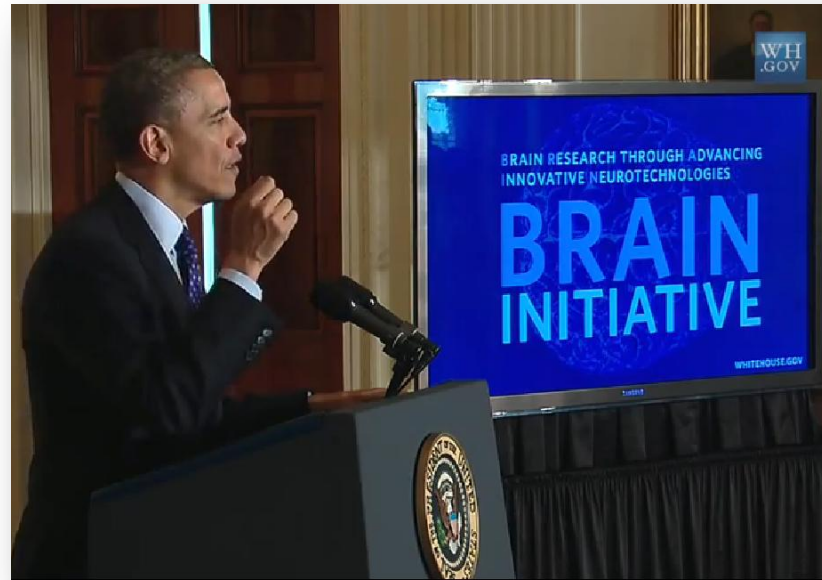
BOTH



BIPOLAR DISORDER



“The Next Great American Project”

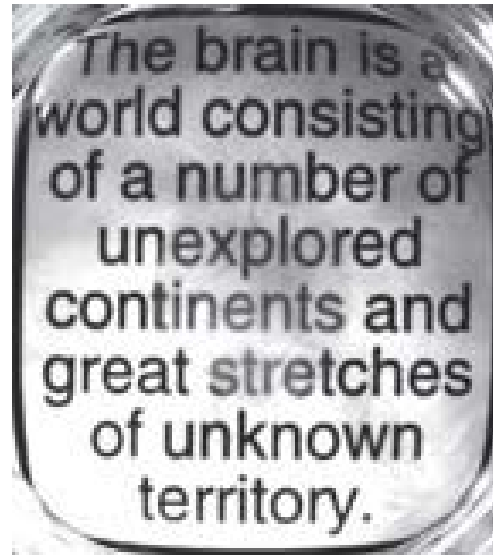
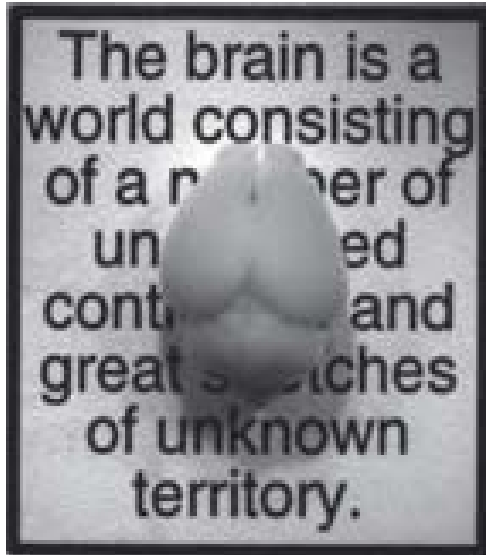


“So there is this enormous mystery waiting to be unlocked, and the BRAIN Initiative will change that by **giving scientists the tools they need to get a dynamic picture of the brain in action** and better understand how we think and how we learn and how we remember. And that knowledge could be – will be – transformative.”

*~President Obama, April 2, 2013*¹⁰

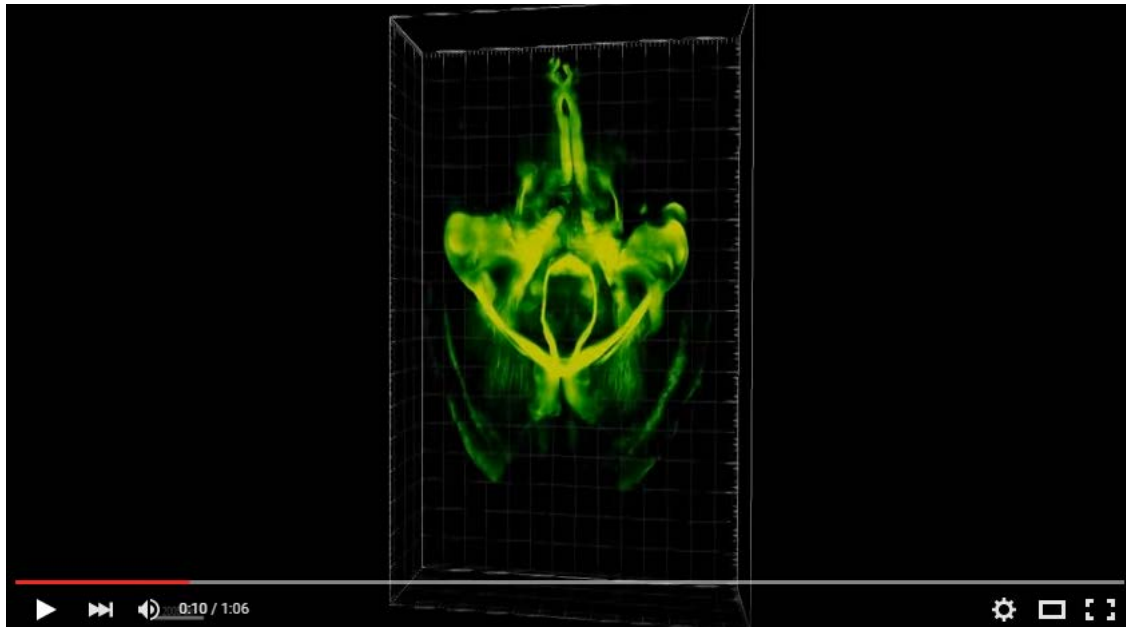
CLARITY: *Neuroanatomy for the 21st Century*

Deisseroth et al, Stanford



CLARITY: *Neuroanatomy for the 21st Century*

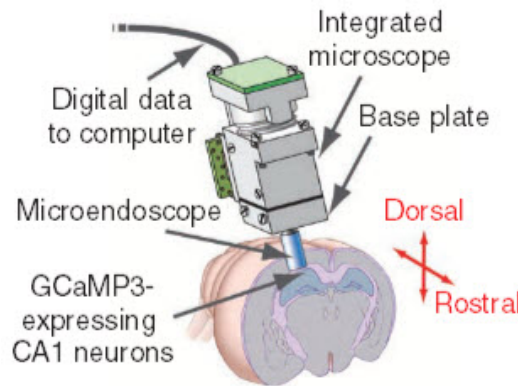
Deisseroth et al, Stanford



Video: <https://www.youtube.com/watch?v=stPThgZ2Y5o>

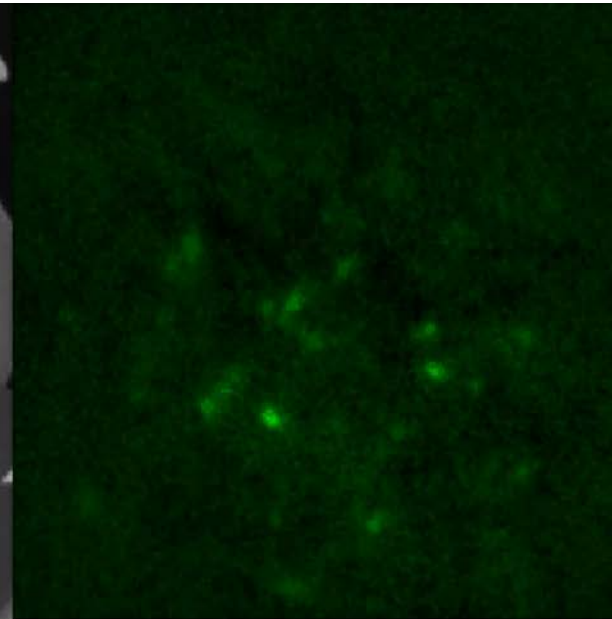
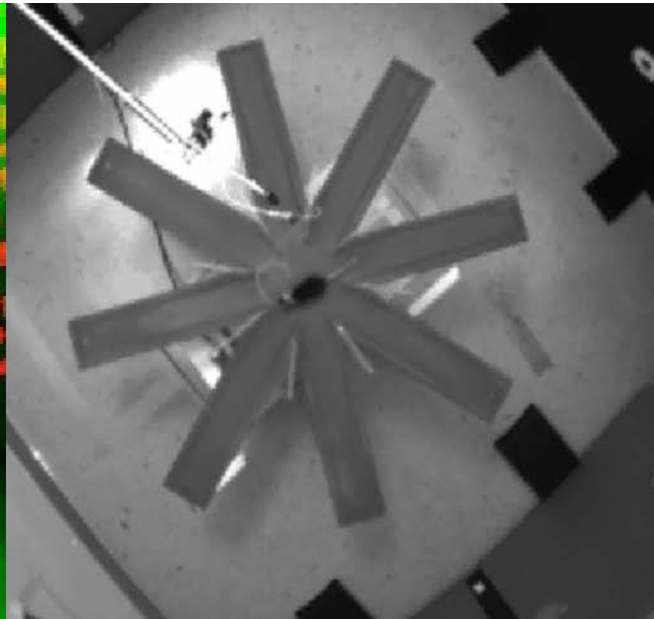
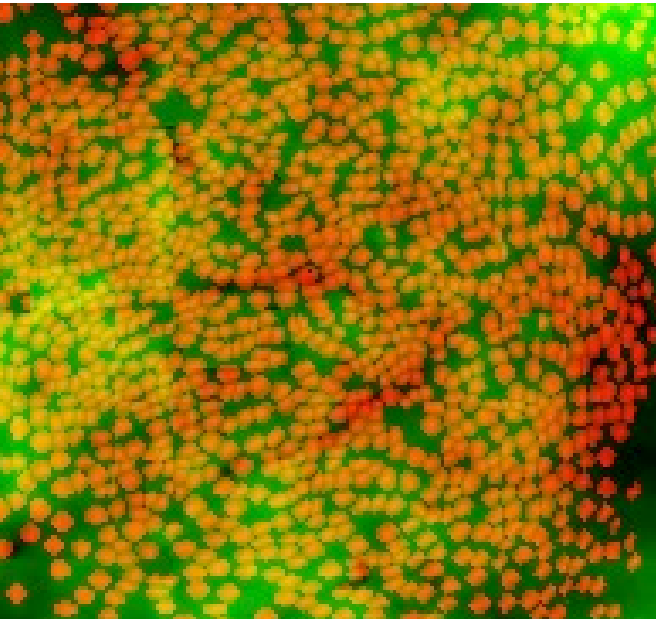
Mapping circuit function: *Visually*

Mark Schnitzer, Stanford



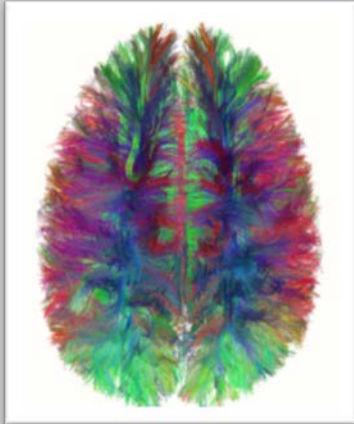
Pulsed laser microendoscope records ~ 1200 hippocampal neurons, freely behaving mouse

Neuron firing pattern correlated with mouse spatial position in ~ 1 body length

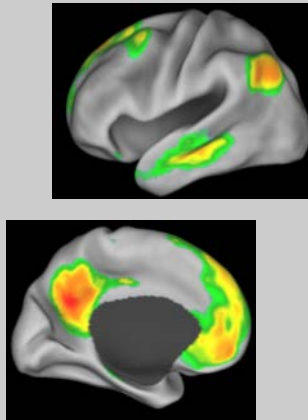


The Neuroscience Revolution

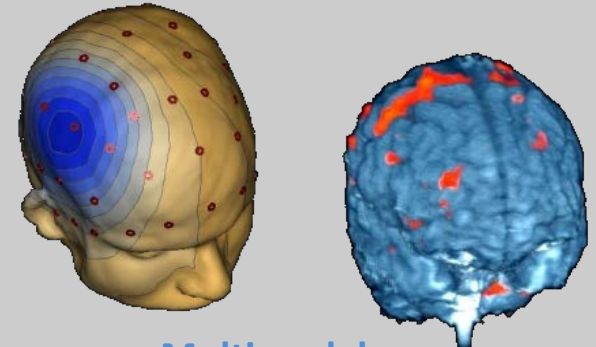
**Structural
Connectivity**



**Functional
Connectivity**

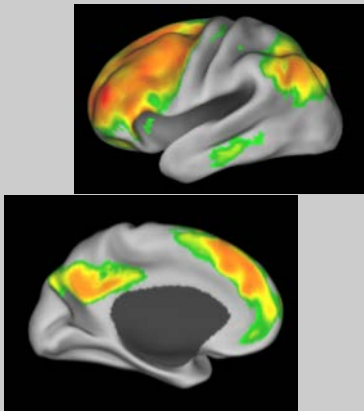


**Temporal
Connectivity**

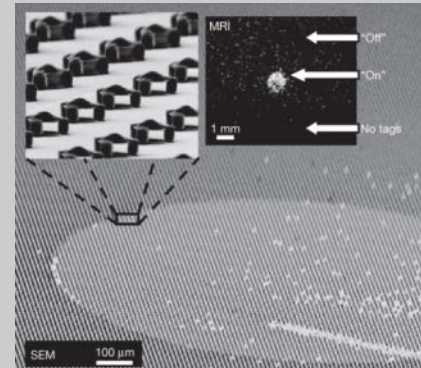
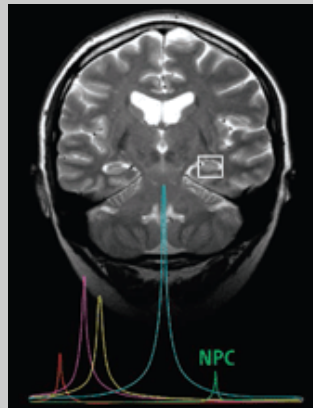


**Multimodal
Integration**

Molecular Imaging

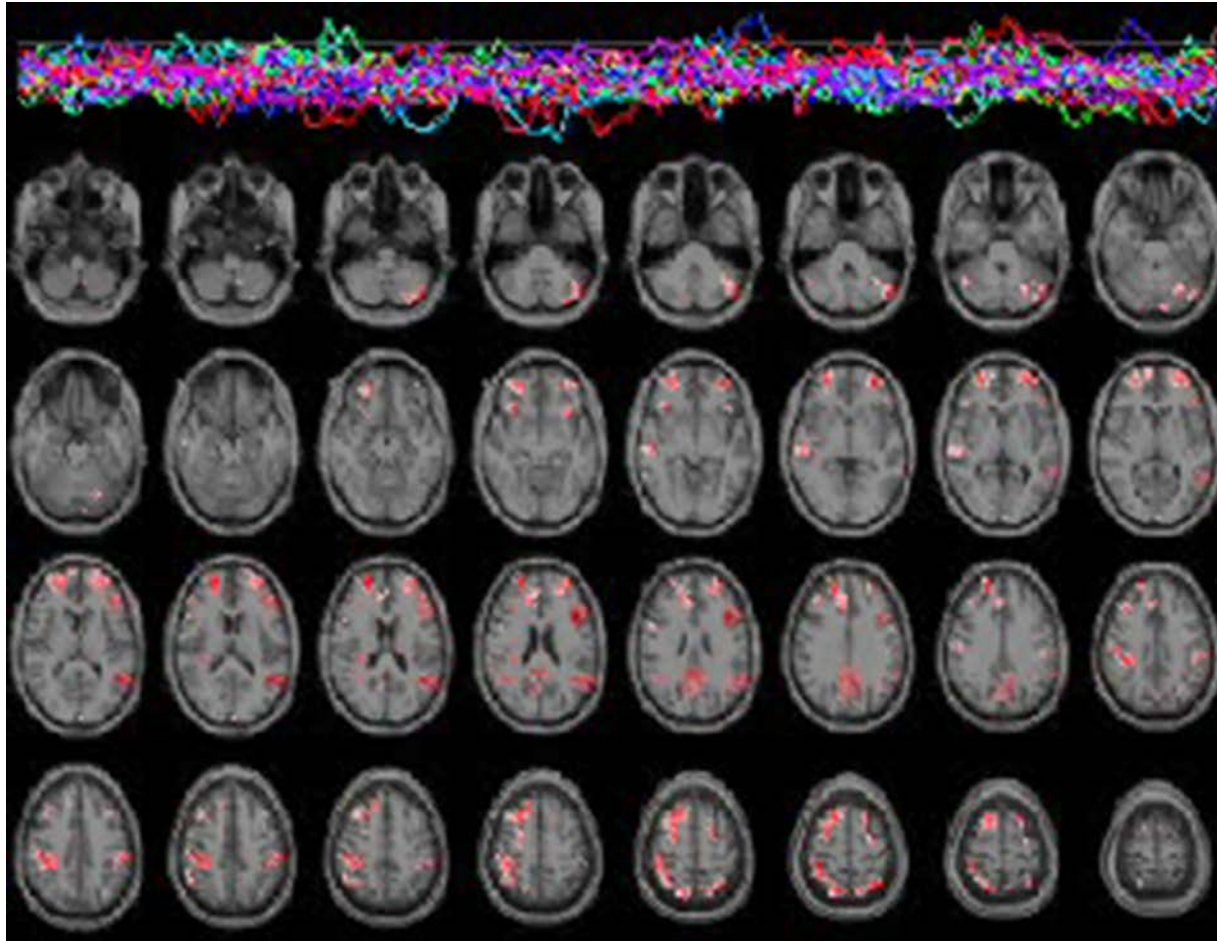


New Molecular Imaging



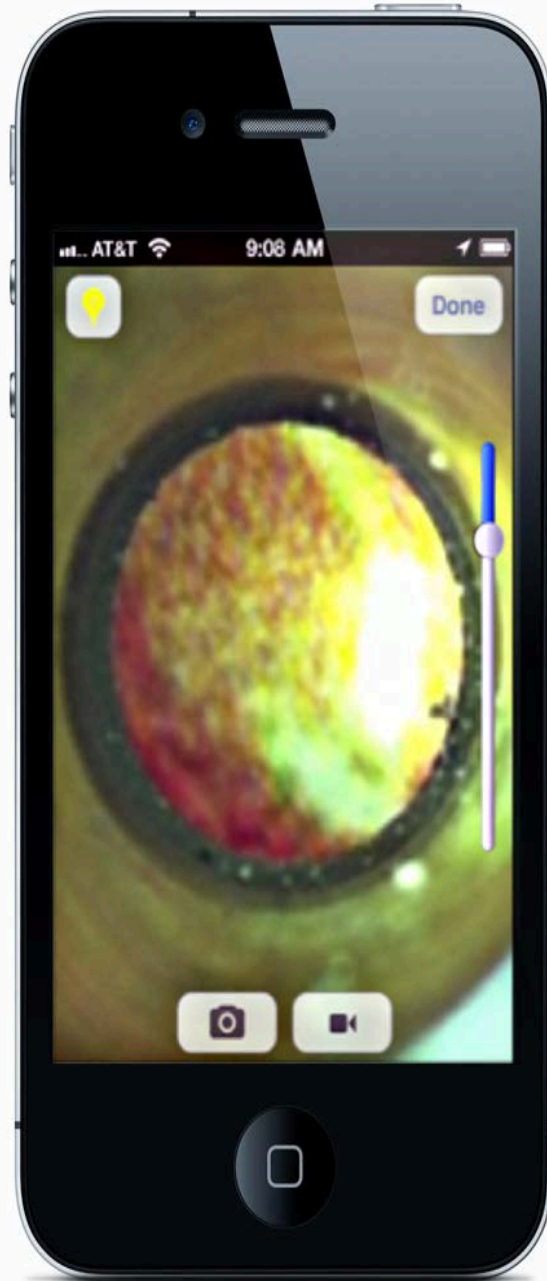
**Wash U
U Minn
MGH**

New Tools: **Function**



21 transient co-activation networks (U-Minn/Was U)





METAMED
PERSONALIZED MEDICAL RESEARCH



FLATIRON

wellframe

ZocDoc
Get well sooner.

proteus
DIGITAL HEALTH

ClearDATA
HEALTHCARE • COMPLIANT • CLOUD



ThriveOn

PROPELLER  HEALTH

CellScope
mobile microscopy

 **practice fusion**TM
Free, web-based Electronic Health Records

Ginger.io


MISFIT



 **HUMEDICA**



Withings

AMBIENT
CLINICAL ANALYTICS

 **chrono**

 **AliveCor**

Smartphone “Biomarkers”

Smartphone *metadata*

- Contact list (social integration)
- Calls, emails (social contact)
- Conversational prosody on calls (depression)

Actigraphy

GPS monitoring



Smartphone facilities

- Photographs (food)



- Video (facial coding of emotion)





mPower



Welcome to mPower

A Parkinson Disease Research Study

Swipe to preview



Join Study

Already Participating?

Learn



mPower



About this Study



How this Study Works



Who Can Participate



Who is Running this Study



Life with Parkinson's Disease



Symptoms



Activities



Dashboard



Learn



Profile

NIMH Strategic Plan for Research



NATIONAL INSTITUTE
OF MENTAL HEALTH

Strategic Plan
for Research



NIH National Institute
of Mental Health

Cross-cutting Research Themes

- Transforming Diagnostics
- Accelerating Therapeutics
- Role of the environment
- Digital Enterprise
- Preemptive Medicine
- Global Mental Health
- Mental Health Disparities
- Partnerships
- Investing in the Future

Strategic Objectives

- Mechanisms of behavior
- Trajectories
- Prevention and Cure
- Public Health Impact



NIH National Institute
of Mental Health

Bending the curve with clinical neuroscience

Transforming diagnostics

**From behavioral disorders to brain disorders:
Diagnosis rooted in biology and behavior**

Transforming therapeutics

**From chemical imbalance to circuit dysfunction
Treatments for circuit tuning**

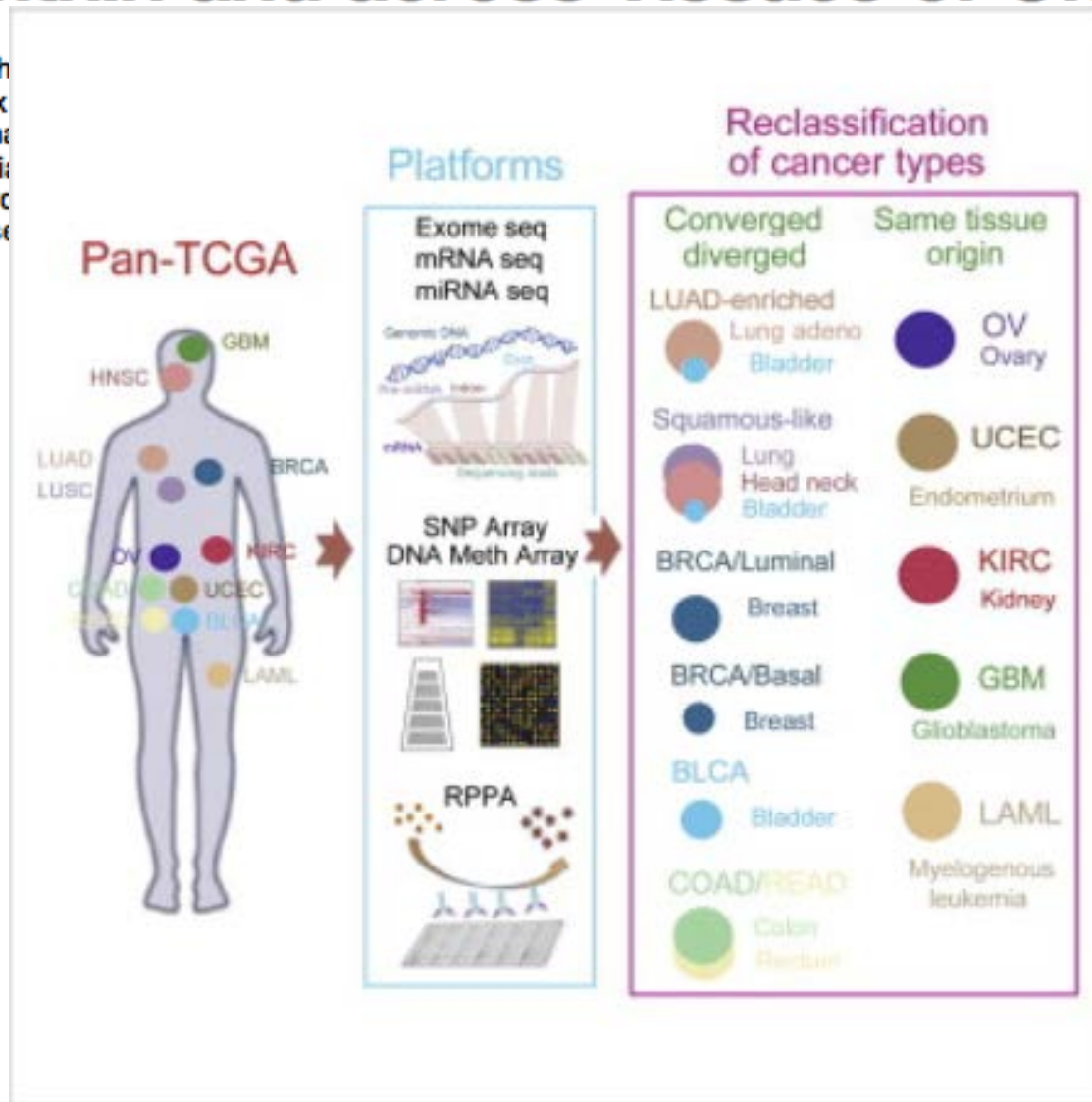
Transforming culture

**From “my data” to data mining
Standardization, integration, sharing**

Multiplatform Analysis of 12 Cancer Types Reveals Molecular Classification within and across Tissues of Origin

Kath
Max
Reh
Nuri
Gorc
Rese

²⁰ David Tamborero,⁵ Sam Ng,⁶ shan Zhang,⁹ Cyriac Kandoth,⁸ Laura J. van't Veer,³ Robertson,¹³ Lauren A. Byers,¹⁰ son,¹⁵ The Cancer Genome Atlas quart^{6,*}



12 cancer types
6 platforms
11 forms of cancer
(only 5 reflect tissue of origin, all predict clinical outcome)

Diagnosis 2015

Symptoms only
Defined by consensus
Reliable but not valid



Heterogeneous

Major Depressive Disorder: 256 combinations

Symptoms are late manifestations
of brain disorders

Treatments focused on
symptoms not cures

Transforming Diagnosis: RDoC

Brain disorders? Precisely

Science

Precision medicine comes to psychiatry

May 1, 2015

Deconstructed, parsed, and diagnosed.

A hypothetical example illustrates how precision medicine might deconstruct traditional symptom-based categories. Patients with a range of mood disorders are studied across several analytical platforms to parse current heterogeneous syndromes into homogeneous clusters.

Symptom-based categories

Major depressive disorder



Mild depression (dysthymia)



Bipolar depression



Integrated data

Genetic risk
polygenic risk score

Brain activity
insula cortex

Physiology
inflammatory markers

Behavioral process
affective bias

Life experience
social, cultural, and
environmental factors

Data-driven categories

Cluster 1



Cluster 2



Cluster 3



Cluster 4



Prospective
replication and
stratified clinical
trials

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Treatments for circuit tuning**

Treatments 2015

- Fragmented (medications vs psychosocial)
- Mostly focused on symptom control
- Access limited, adherence poor, onset late



Medications –
Little innovation

Psychotherapy –
dose and duration
not known

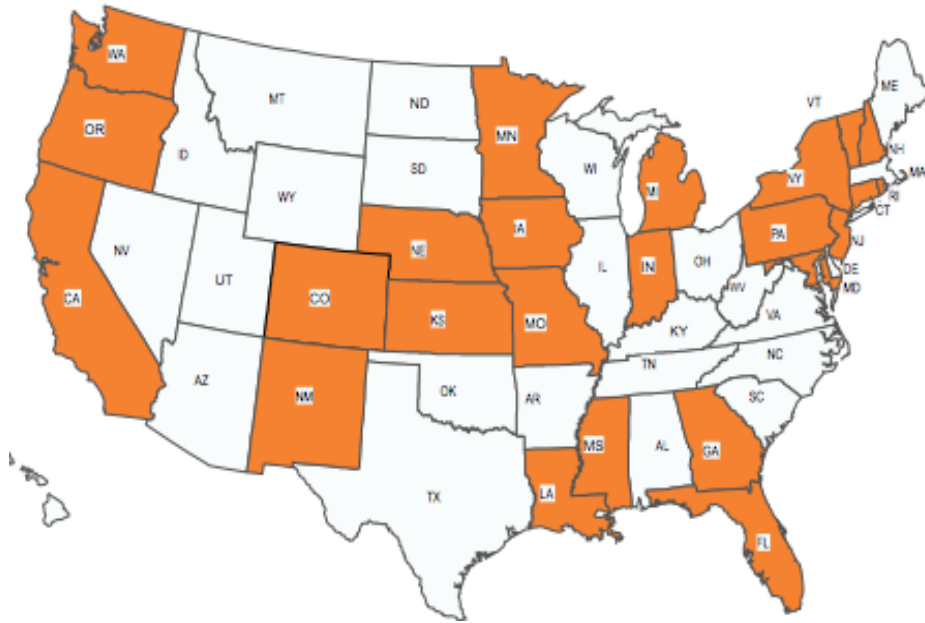
Treatments depend
on the provider not
the patient

Transforming Therapeutics

- Therapeutics = tuning circuits
- Early intervention is critical
- From magic bullets to “network solutions”

RAISE: Recovery After Initial Schizophrenia Episode

- 2 Studies
- 134 Providers
- 22 States
- 469 Participants
- 36 Sites
- Policy relevant!

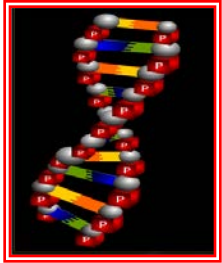


Orange color states = RAISE sites

RAISE Toolbox:

- Coordinated Specialty Care
- Person-centered treatment
- CBT-informed individual resilience training
- Family psycho-education
- Supported education / Supported employment
- Low dose antipsychotic medication
- Liaison with primary medical care providers

From Magic Bullets to Networked Treatments



Protective LOF mutations, Pathway targets, epigenetics



Cell replacement Rx, Plasticity agents



Circuit based Rx, rTMS, DBS

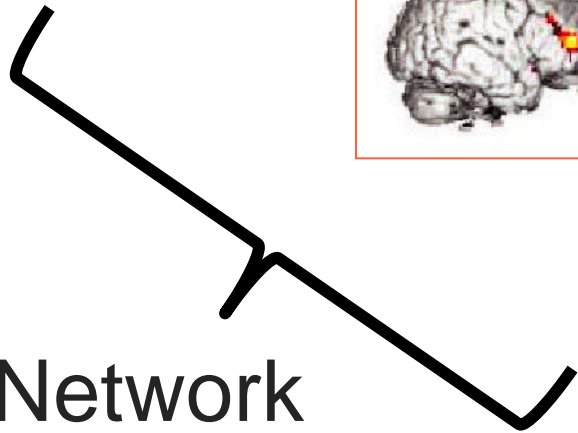


Cognitive training



mHealth,
Social
networks

Network
Solutions



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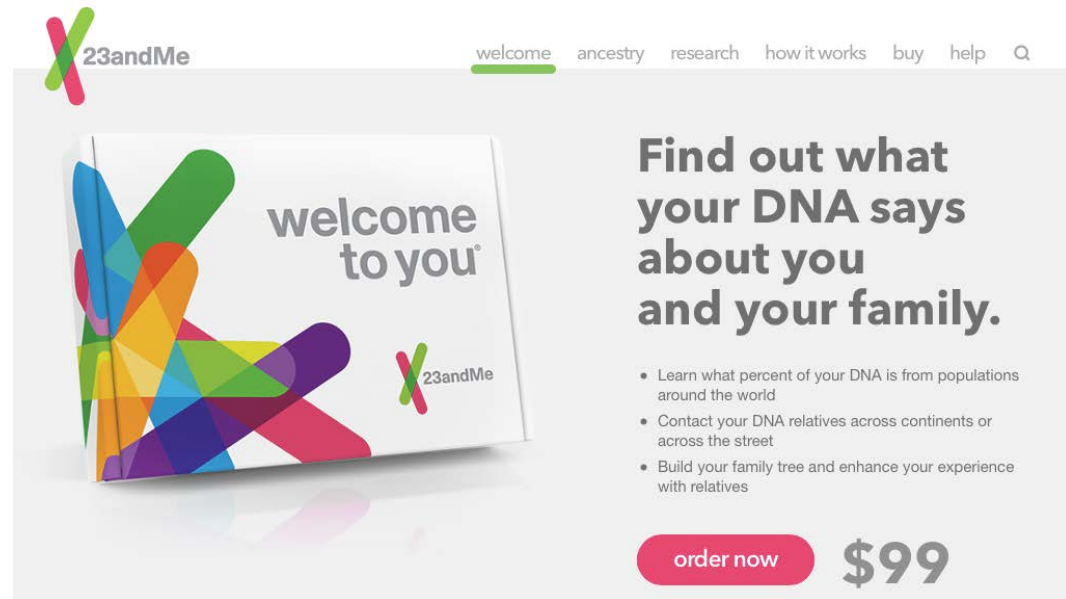
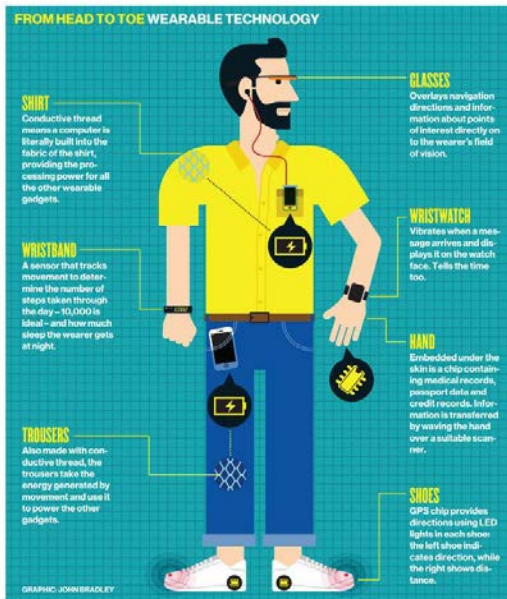
**From chemical imbalance to circuit dysfunction
Treatments for circuit tuning**

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Transforming How Science is Done

Empowering patients and families through:
Technology (wearables, devices, etc.)
Registries (Patients Like Me, 23andMe, etc)
Information (Web resources)

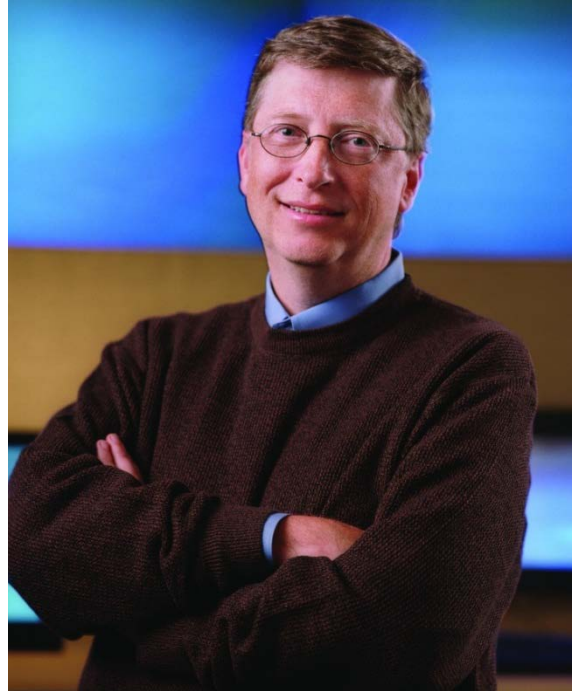


Summary

- Mental disorders cause greatest morbidity, mortality, and costs of all medical problems for people < age 50
- We have unprecedented traction from genomics, imaging, information technologies
- Converting this traction into better outcomes will require new approaches to diagnosis, therapeutics, and research



Finally



“We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten.”

--Bill Gates Jr.

Thank you !



National Institute
of Mental Health

Paving the Way for Prevention, Recovery, and Cure

www.nimh.nih.gov

Research = Hope