Deputy Director's Update

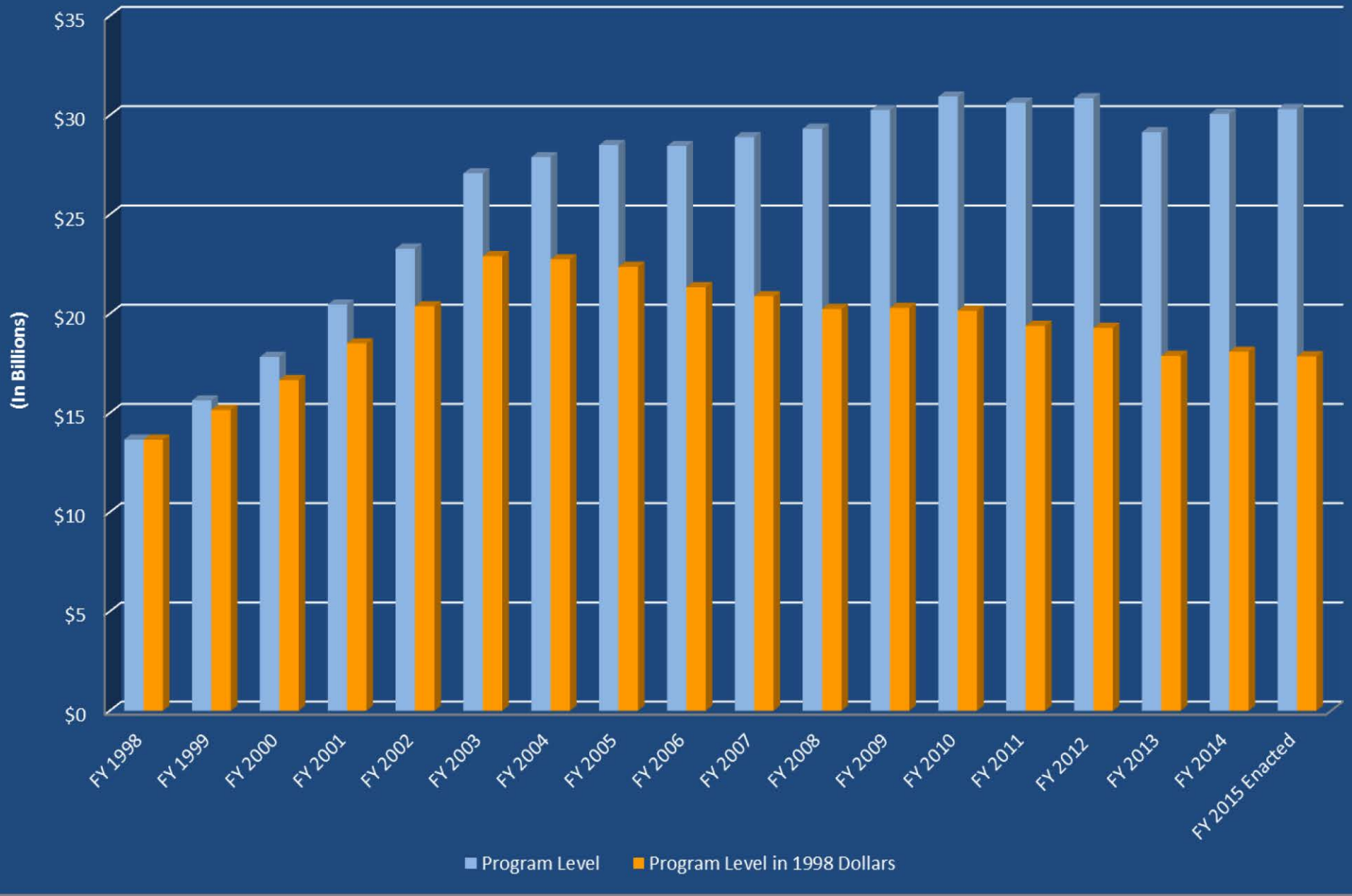
Lawrence A. Tabak, DDS, Ph.D.
Principal Deputy Director, National Institutes of Health

Council of Councils
January 30, 2015

Topics

- Support for Biomedical Research
- Biomedical Research Workforce
- Exceptional Opportunities
  - NIH BRAIN Initiative
  - Ebola Research
  - Precision Medicine

NIH Program Level in Nominal Dollars and Constant Dollars



JAMA The Journal of the American Medical Association

JAMA. 2015;313(2):174-189.

Special Communication | January 13, 2015

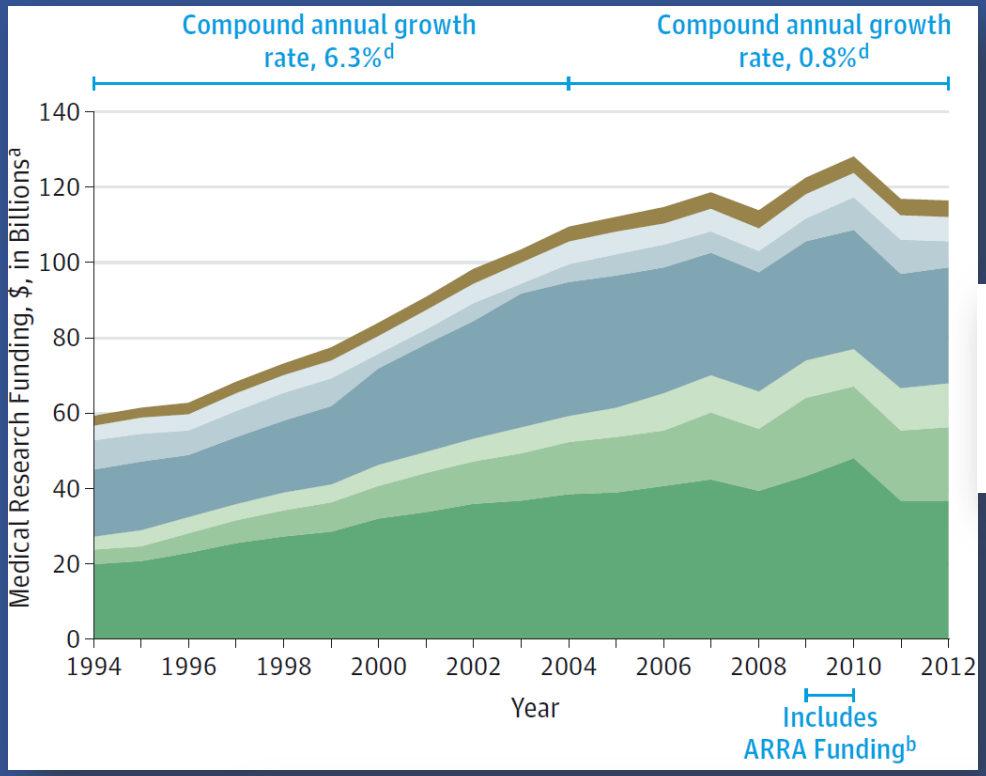
SCIENTIFIC DISCOVERY AND THE FUTURE OF MEDICINE

The Anatomy of Medical Research

US and International Comparisons

Hamilton Moses III, MD[1,2]; David H. M. Matheson, JD, MBA[3]; Sarah Cairns-Smith, PhD[3]; Benjamin P. George, MD, MPH[4]; Chase Palisch, MPhil[3,5]; E. Ray Dorsey, MD, MBA[4]

U.S. Funding for Medical Research by Source
1994-2012



Funding source

- Foundations, charities, and other private funds
- State and local government
- Other federal[b]
- National Institutes of Health[b]
- Medical device firms
- Biotechnology firms[c]
- Pharmaceutical firms

Data were calculated according to methods outlined in eTable 1 in the Supplement.
ARRA indicates American Recovery and Reinvestment Act.

[a] Data were adjusted to 2012 dollars using the Biomedical Research and Development Price Index.

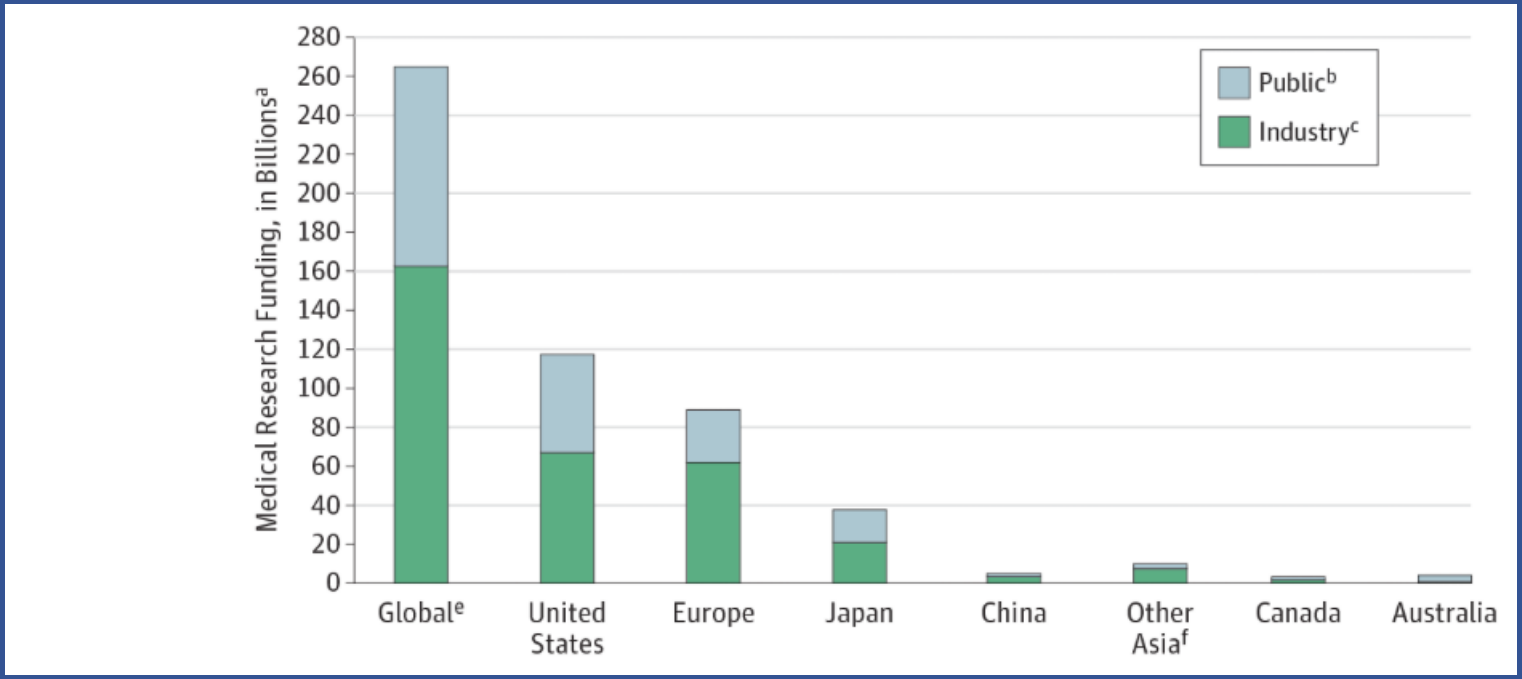
[b] The National Institutes of Health and other federal sources include stimulus provided by ARRA in 2009 and 2010.

[c] Data from 1994-2002 and 2011-2012 were estimated based on linear regression analysis of industry market share.

[d] Compound annual growth rate (CAGR) supposing that year A is x and year B is y, CAGR = $(y/x)^{\{1/(B-A)\}}-1$. The CAGR was calculated separately for 2 different periods with a single overlapping year: 1994-2004 and 2004-2012. The cut point was chosen at 2004 given the changes seen in funding from the National Institutes of Health in that year.

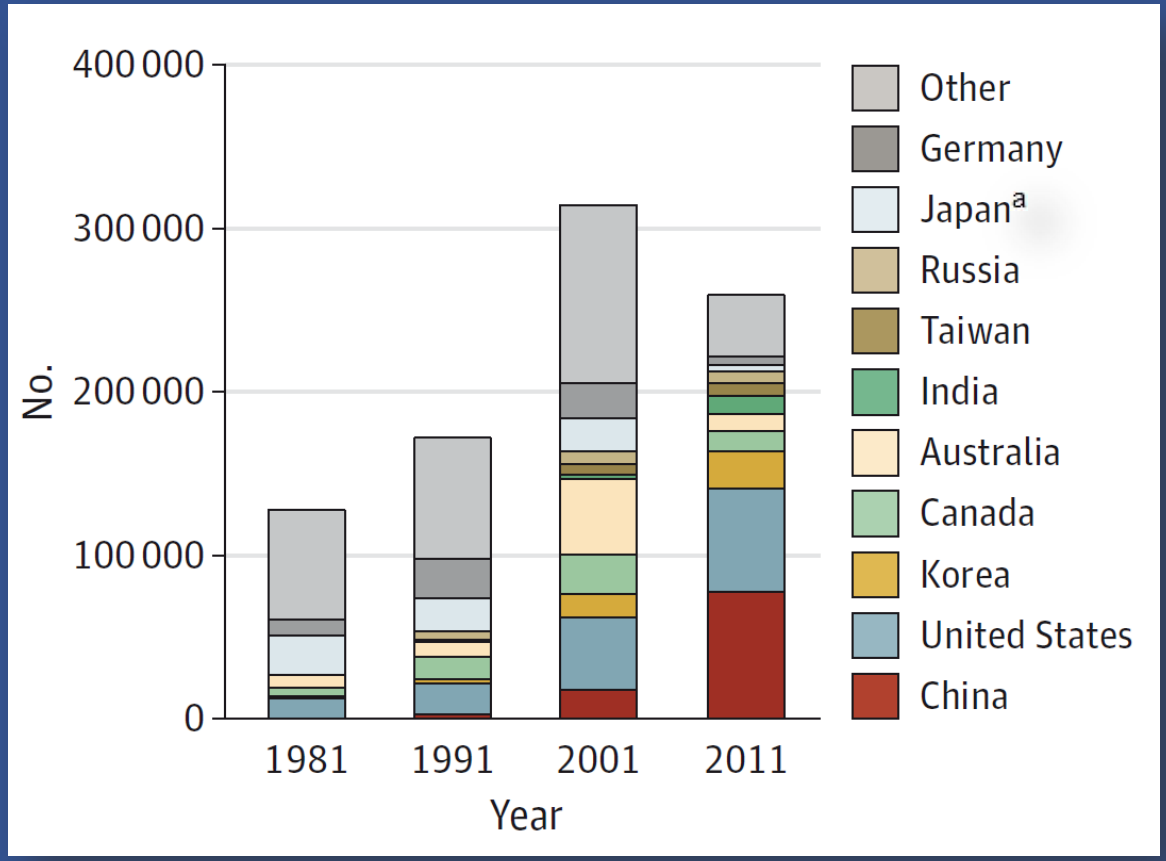
Source: *JAMA*. 2015; 313(2):1-16.

Global Medical Research Funding in Select Countries/Regions, 2011



Source: *JAMA*. 2015; 313(2):1-16.

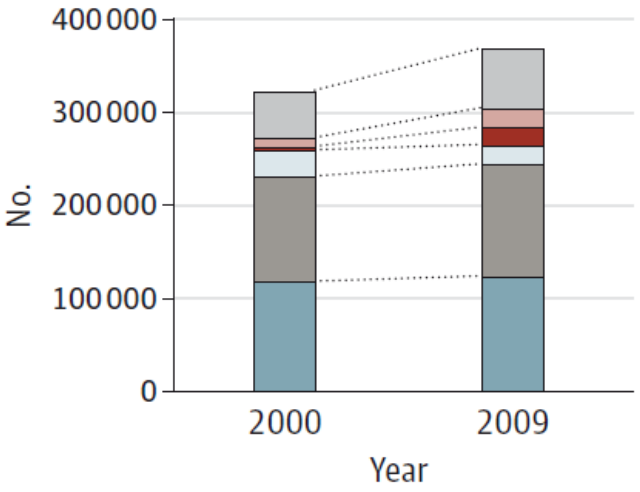
Global Life Science Patent Applications
Number of patent family applications
1981-2011



[a] Only patent grants, not all patent applications, are counted for Japan, which tends toward patent applications with narrower definitions and therefore much greater numbers relative to the number of patents ultimately granted.

Source: *JAMA*. 2015; 313(2):1-16.

Number of Medical Research Articles
by Selected Countries/Regions
2000-2009

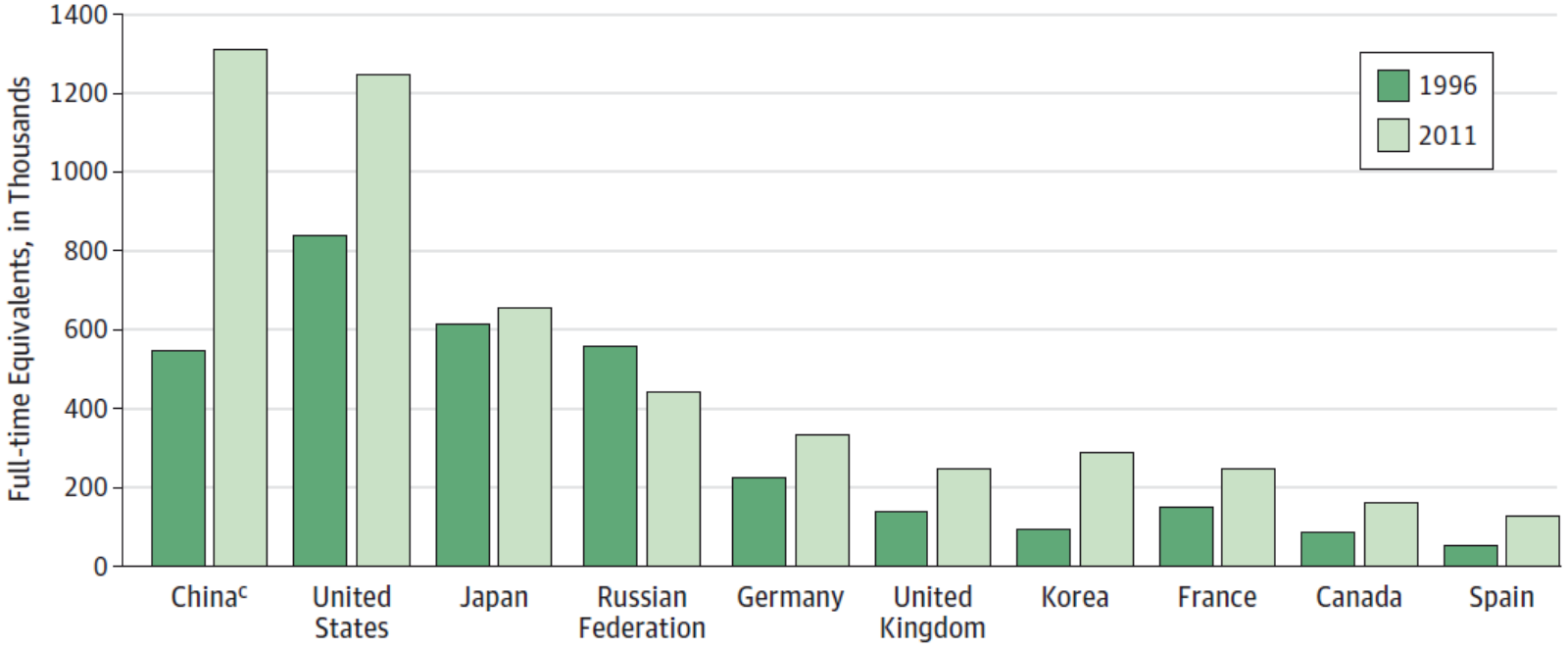


	No. of Medical Research Articles		Annual Growth Rate, %[a]
	2000	2009	2000-2009
Other[b]	49 946	63 483	2.7
Other Asia[c]	10 029	20 790	8.4
China	3937	18 399	18.7
Japan	26 755	21 477	-2.4
European Union[d]	114 970	120 421	0.5
United States	116 156	122 659	0.6
Overall	321 795	367 229	1.5

Source: *JAMA*. 2015; 313(2):1-16.

Top 10 Countries by Size of Science and Technology Workforce, 1996-2011

Workforce size



	China[c]	United States	Japan	Russian Federation	Germany	United Kingdom	Korea	France	Canada	Spain
Compound annual growth rate, % (1996-2011)[b]	6.0	2.7	0.4	-1.5	2.6	3.7	7.4	3.2	3.8	6.4

The sizes of national science and technology workforces were obtained from the Organisation for Economic Co-operation and Development.[16]

[a] Workforce size was measured in number of full-time equivalents and includes all science and technology sectors (eg, engineering, physical sciences) in addition to the medical and health sciences.

[b] Compound annual growth rate (CAGR) supposing that year A is x and year B is y, CAGR = $(y/x)^{\{1/(B-A)\}}-1$.

[c] Annual growth in China's science and technology workforce may be underestimated because of a change in reporting methods for China in 2009.

Source: *JAMA*. 2015; 313(2):1-16.

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Diversity is essential for the best science

- Excellence, Creativity & Innovation*
- Broadening scope of inquiry - solutions to complex problems of health and disease
- Narrowing the health gap
- Ensuring fairness
  - Changing demographics
  - Leveraging the US intellectual capital

* Scott E. Page - 2007: How the power of diversity creates better groups, firms & societies

What Harms are we Perpetuating by the Current Lack of Diversity in the US Scientific Workforce?

- Scientific innovation
- Global competitiveness
- Quality of training
- Quality of researchers (limited US source)
- Prioritization of research
- Research on health disparities
- Recruitment and retention of clinical subjects
- Public trust

Impact of Scientific Workforce Diversity on the Scientific Enterprise and the Public Good Literature Review/empirical evidence: Optimal Solutions Group, LLC; 2011

Decision to Make Diversity a Priority

POLICYFORUM

SOCIOLOGY

Weaving a Richer Tapestry in Biomedical Science

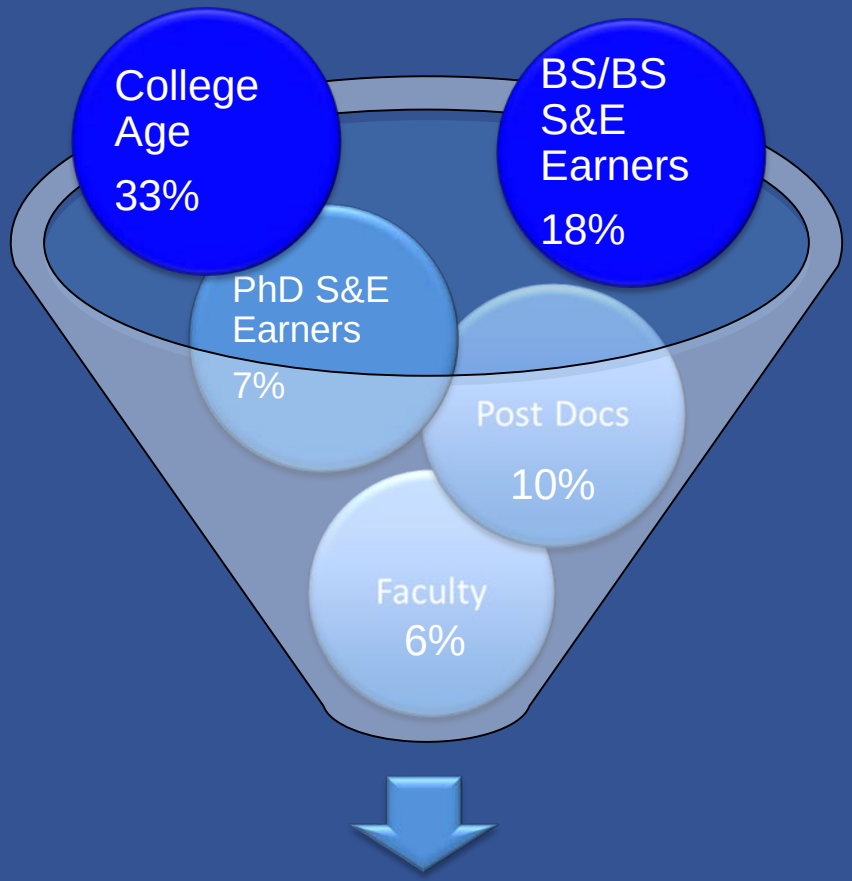
NIH leadership discusses the need for renewed efforts to increase diversity in the U.S. biomedical research workforce.

Lawrence A. Tabak* and Francis S. Collins*

As much as the U.S. scientific community may wish to view itself as a single garment of many diverse and colorful threads, an unflinching consideration of actual data reminds us that our nation's biomedical research workforce remains nowhere near as rich as it could be. An analysis, performed by a team of researchers primarily supported by the National Institutes of Health (NIH) and published in this issue of *Science*, reveals that from 2000 to 2006, black (*1*) grant applicants were significantly less likely to receive NIH research funding than were white applicants. The gap in success rates amounted to 10 percentage points, even after controlling for education, country of origin, training, employer characteristics, previous research awards, and publication record (*2*). Their analysis also showed a gap of 4.2 percentage points for Asians; however, the differences between Asian and white

- A Working Group of the Advisory Committee to the Director was charged to review NIH's efforts in workforce diversity, and make substantive and actionable recommendations
- NIH Leadership concludes that this is an issue for all NIH Institutes, Centers, and Offices

The Nature of the Problem: The "Pipeline" Is Really a Funnel



NSF Women, Minorities and Persons with Disabilities in Science and Engineering 2013: Data Update

Implementation of a Major ACD WG Recommendation: NIH Transformative Diversity Initiative
Pipeline, Mentoring, Evaluation

Enhancing the Diversity of the NIH-Funded Workforce

- NIH Building Infrastructure Leading to Diversity (BUILD)
  - Grantees are universities with high proportion of URM
- National Research Mentoring Network (NRMN)
- Coordination and Evaluation Center (CEC)

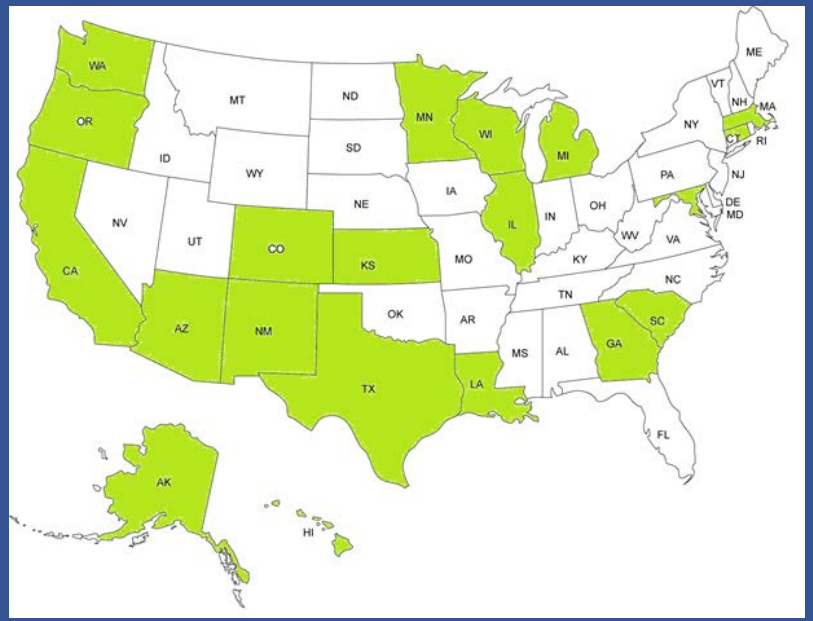
Awards made October 2014

BUILD: 10 sites

NRMN

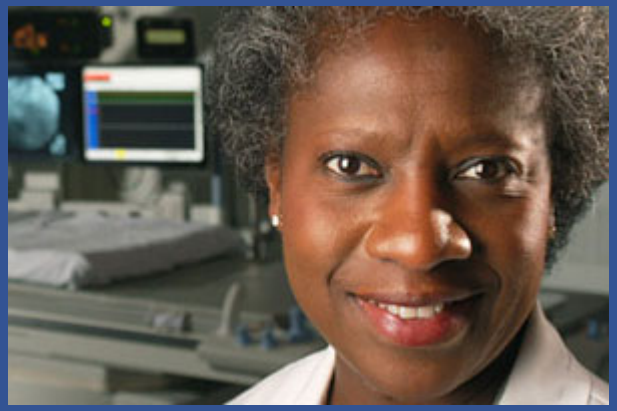
CEC

Total funding: $31M/5 yrs



ACD WG Recommendation:
Chief Officer for Scientific Workforce Diversity

- Needed to recruit an active biomedical researcher with commitment to diversity, and strong credibility in the academic community
- Charge is to coordinate diversity program across NIH
- NIH's Intramural research program can be a critical "laboratory" for experiments in recruiting/retention
- All programs must be subject to rigorous evaluation



Hannah Valantine, MD

Topics

- Support for Biomedical Research
- Biomedical Research Workforce
- Exceptional Opportunities

JAMA January 13, 2015 Volume 313, Number 2

VIEWPOINT

SCIENTIFIC DISCOVERY AND THE FUTURE OF MEDICINE

Exceptional Opportunities in Medical Science

A View From the National Institutes of Health

Francis S. Collins, MD, PhD
National Institutes of Health, Bethesda, Maryland.

As the world's largest source of biomedical research funding, the US National Institutes of Health (NIH) has been advancing understanding of health and disease for more than a century. Scientific and technological breakthroughs that have arisen from NIH-supported research account for many of the gains that the United States has seen in health and longevity.

look forward to a medical landscape in which the pairing of affordable, efficient DNA sequencing and electronic health records could be used to inform a lifetime of health care strategies. Combined with the use of mobile health technology to assist in real-time monitoring of factors such as diet, exercise, blood pressure, heart rate, and blood chemistries, this approach could

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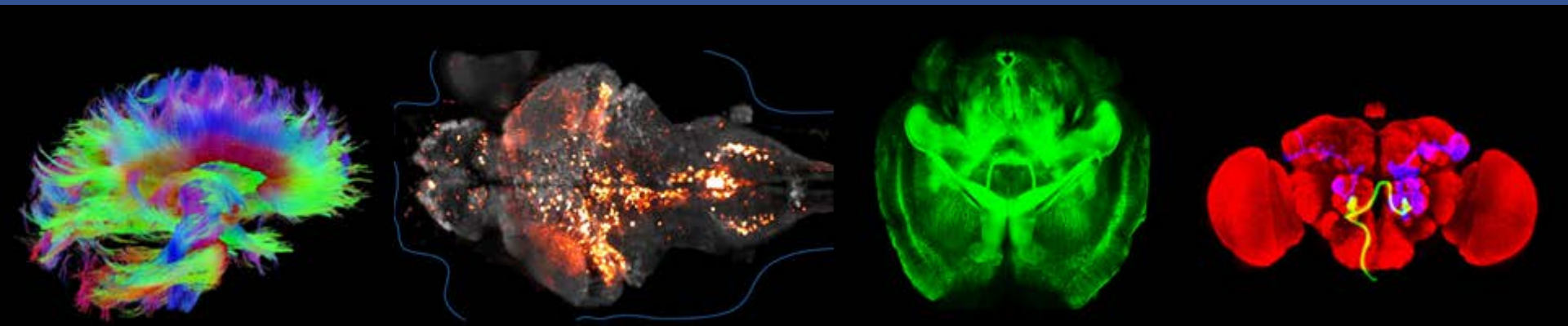
BRAIN Initiative: The Scientific Plan

FIRST FIVE YEARS

Emphasize technology development

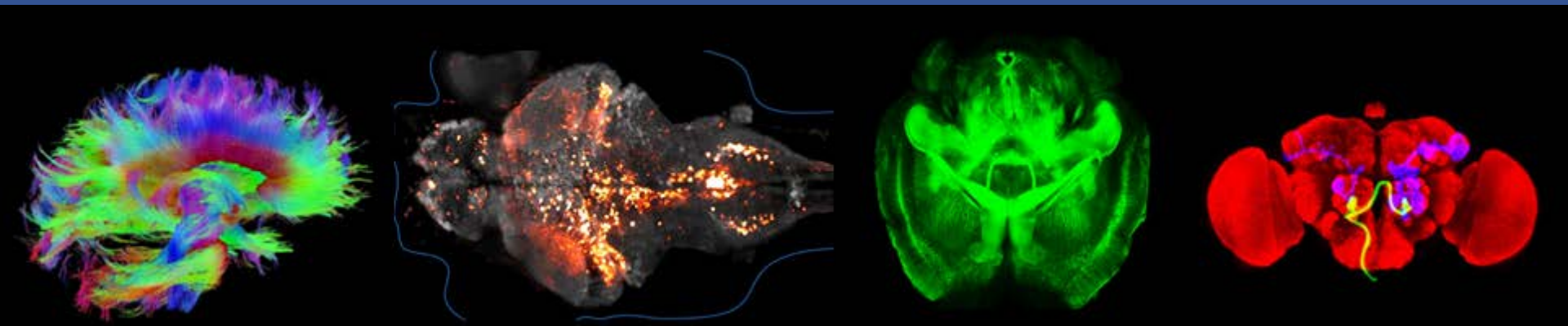
SECOND FIVE YEARS

Emphasize discovery driven science



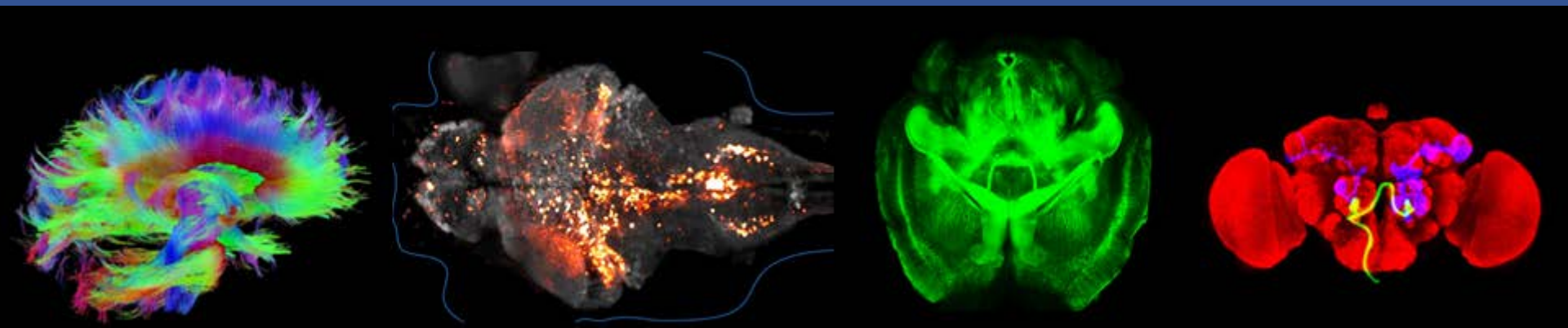
Example Deliverables: 5 Years

- Census of neuronal and glial cell types in animal models ("parts list") plus intellectual framework for cell classification
- Methods to map neural connections in human and animal brains with improved speed, cost, resolution, throughput
- Technologies for high density electrical and optical recording of neural activity in local and distributed circuits
- Technologies for perturbing electrical and biochemical activity in defined sets of neurons, at cellular resolution, in real time
- Integrated teams of clinicians, scientists, engineers, ethicists, regulatory specialists for advancing human subjects research



Example Deliverables: 10 Years

- Extension of cell type census to humans; tools to deliver genes, proteins, drugs to defined cell subpopulations
- Integrated systems for combining measurements of brain activity dynamics with perturbation, behavior, cell type information, connectivity maps, theory
- Greatly improved, minimally invasive technologies for monitoring and modulating human brain activity
- Systematic theories of how information is encoded in the chemical and electrical activity of the brain



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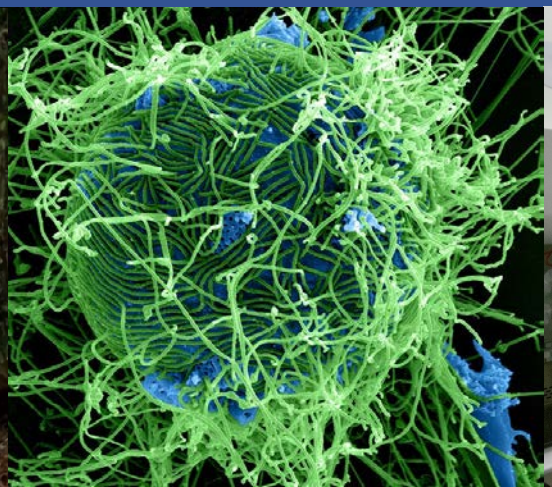
Ebola Virus Disease: NIH Research

- Longstanding commitment to research on viral hemorrhagic fevers, including Ebola
- Pathogenesis studies using molecular technologies, appropriate animal models
- Development of new antiviral strategies based on understanding of virus-host interactions



Ebola Virus: Genomic Sequencing

NIH National Institutes of Health
Turning Discovery Into Health

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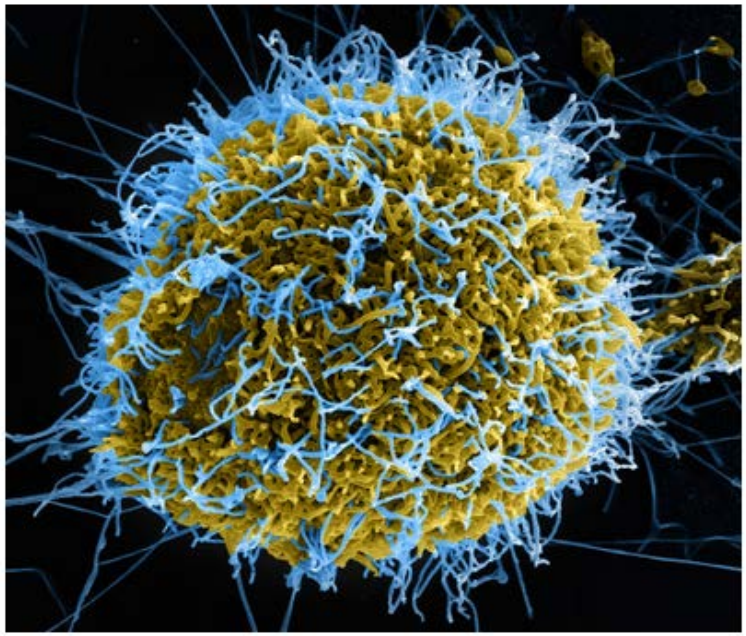
NIH DIRECTOR'S BLOG

Using Genomics to Follow the Path of Ebola

Posted on September 2, 2014 by Dr. Francis Collins



Caption: Colorized scanning electron micrograph of filamentous Ebola virus particles (blue) budding from a chronically infected VERO E6 cell (yellow-green).

Credit: National Institute of Allergy and Infectious Diseases, NIH

Long before the current outbreak of Ebola Virus Disease (EVD) began in West Africa, NIH-funded scientists had begun collaborating with labs in Sierra Leone and Nigeria to analyze the genomes and develop diagnostic tests for the virus that caused Lassa fever, a deadly hemorrhagic disease

Science

VIRAL EVOLUTION

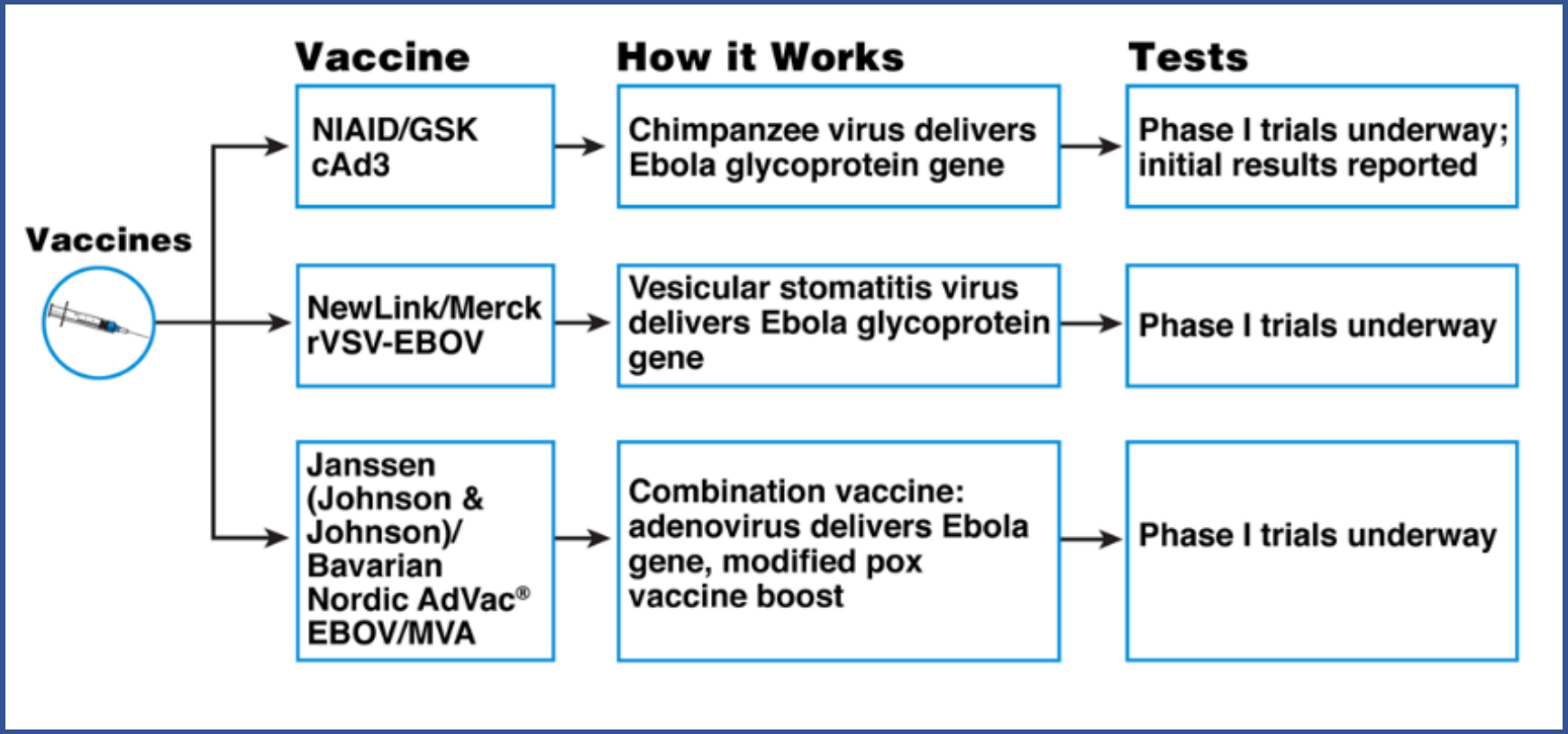
12 SEPTEMBER 2014 • VOL 345 ISSUE 6202

Genomic surveillance elucidates Ebola virus origin and transmission during the 2014 outbreak

Stephen K. Gire,[1,2*] Augustine Goba,[3*†] Kristian G. Andersen,[1,2*†] Rachel S. G. Sealfon,[2,4*] Daniel J. Park,[2*] Lansana Kanneh,[3] Simbirie Jalloh,[3] Mambu Momoh,[3,5] Mohamed Fullah,[3,5‡] Gytis Dudas,[6] Shirlee Wohl,[1,2,7] Lina M. Moses,[8] Nathan L. Yozwiak,[1,2] Sarah Winnicki,[1,2] Christian B. Matranga,[2] Christine M. Malboeuf,[2] James Qu,[2] Adrianne D. Gladden,[2] Stephen F. Schaffner,[1,2] Xiao Yang,[2] Pan-Pan Jiang,[1,2] Mahan Nekoui,[1,2] Andres Colubri,[1] Moinya Ruth Coomber,[3] Mbalu Fonnie,[3‡] Alex Moigboi,[3‡] Michael Gbakie,[3] Fatima K. Kamara,[3] Veronica Tucker,[3] Edwin Konuwa,[3] Sidiki Saffa,[3‡] Josephine Sellu,[3] Abdul Azziz Jalloh,[3] Alice Kovoma,[3‡] James Koninga,[3] Ibrahim Mustapha,[3] Kandeh Kargbo,[3] Momoh Foday,[3] Mohamed Yillah,[3] Franklyn Kanneh,[3] Willie Robert,[3] James L. B. Massally,[3] Sinéad B. Chapman,[2] James Bochicchio,[2] Cheryl Murphy,[2] Chad Nusbaum,[2] Sarah Young,[2] Bruce W. Birren,[2] Donald S. Grant,[3] John S. Scheiffelin,[8] Eric S. Lander,[2,7,9] Christian Happi,[10] Sahr M. Gevao,[11] Andreas Gnirke,[2§] Andrew Rambaut,[6,12,13§] Robert F. Garry,[8§] S. Humarr Khan,[3‡§] Pardis C. Sabeti[1,2†§]

Leading Ebola Vaccine Candidates

each of which has received NIH support



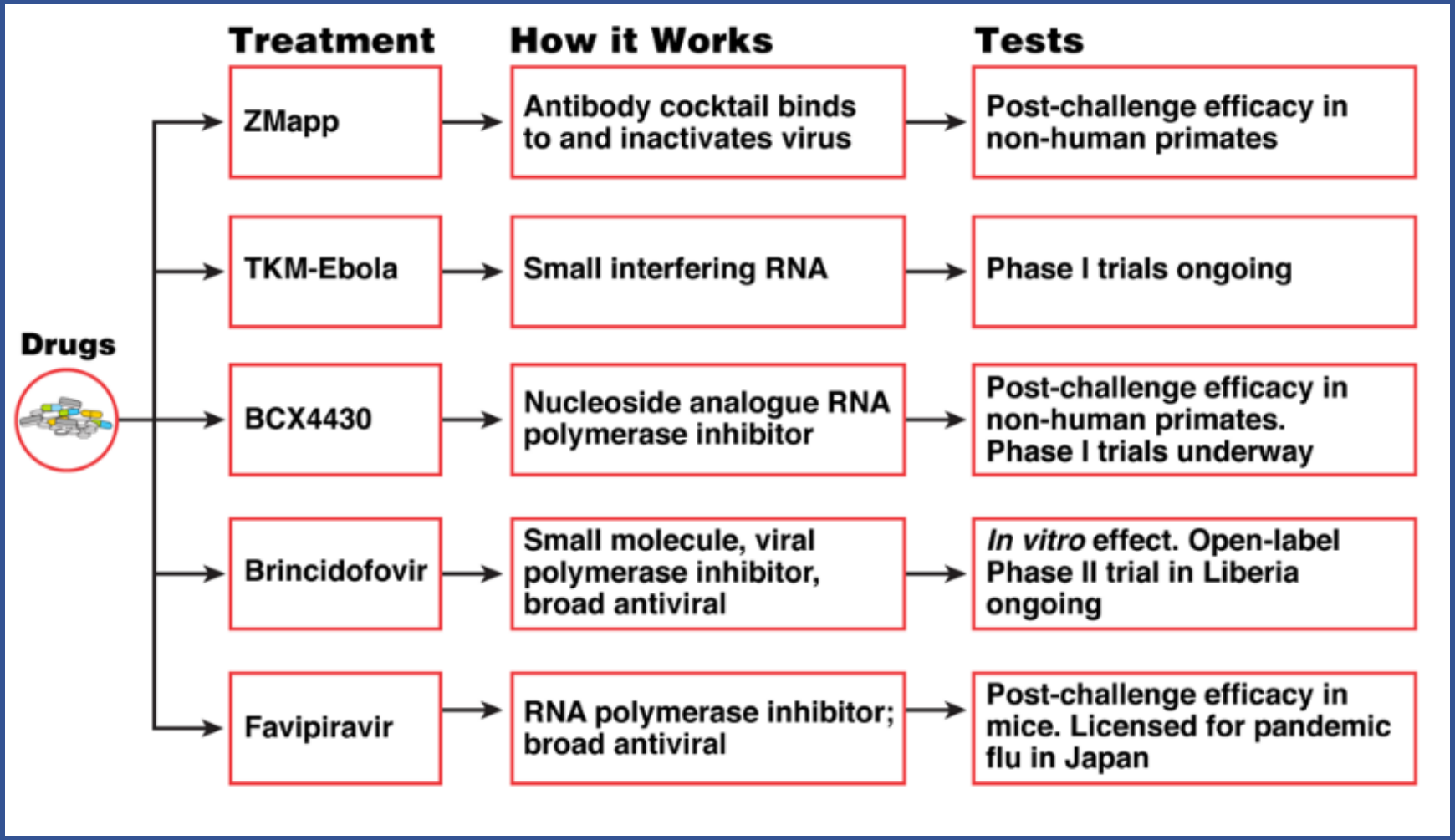
Three Efficacy Trials of Ebola Vaccines Are Currently Planned

Ring Vaccine Trial (Govt of Guinea/Guinea Collaboration lead), N=4,500

Stepped-Wedge Trial (Govt of Sierra Leone/CDC lead), N=6,000

Randomized Controlled Trial (Govt of Liberia/NIAID lead), N=27,000

Promising Ebola Therapeutics



Ebola Virus Disease:
U.S. Government-Supported Research

- Federal agencies collaborating to support development of Ebola vaccines and treatments
  - Department of Health and Human Services:
    - National Institutes of Health
    - Centers for Disease Control and Prevention
    - Food and Drug Administration
    - Biomedical Advanced Research & Development Authority
    - ASPR
  - Department of Defense:
    - Walter Reed Army Institute of Research
    - Defense Threat Reduction Agency
    - U.S. Army Medical Research Institute of Infectious Diseases
- All working with USAID and White House Ebola Response Coordinator, Ron Klain

NIH CDC FDA BARDA WRAIR Walter Reed Army Institute of Research Soldier Health • World Health USAMRIID United States Army Medical Research Institute of Infectious Diseases

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“Tonight, I’m launching a new Precision Medicine Initiative to bring us closer to curing diseases like cancer and diabetes – and to give all of us access to the personalized information we need to keep ourselves and our families healthier.”

President Barack Obama

State of the Union Address, January 20, 2015




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