

Status of NIH Today and Looking to the Future

Francis S. Collins, M.D., Ph.D.
Director, National Institutes of Health
Scientific Management Review Board
October 26, 2011



Extraordinary NIH Opportunities for FY 2013

- Investing in Basic Research
- Accelerating Discovery Through Technology
- Advancing Translational Sciences
- Encouraging New Investigators and New Ideas



“To help this country compete for new jobs and businesses, we also need to invest in basic research and technology, so the great ideas of the future will be born in our labs and in classrooms like these.”

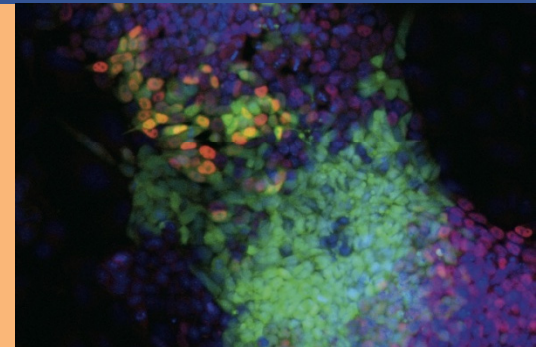
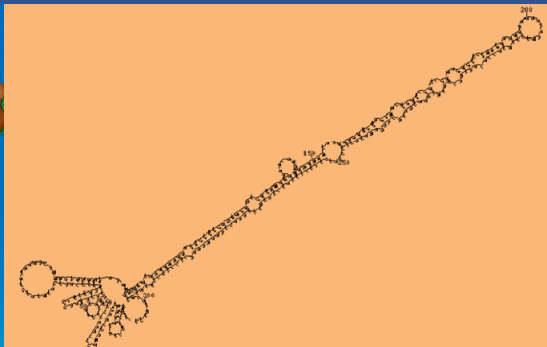
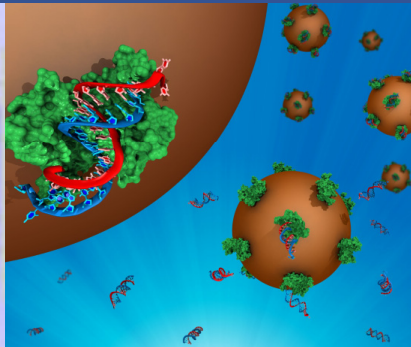
*President Obama
Signing of America Invent's Act
Thomas Jefferson High School
September 16, 2011*



MicroRNAs

An Exciting New Frontier

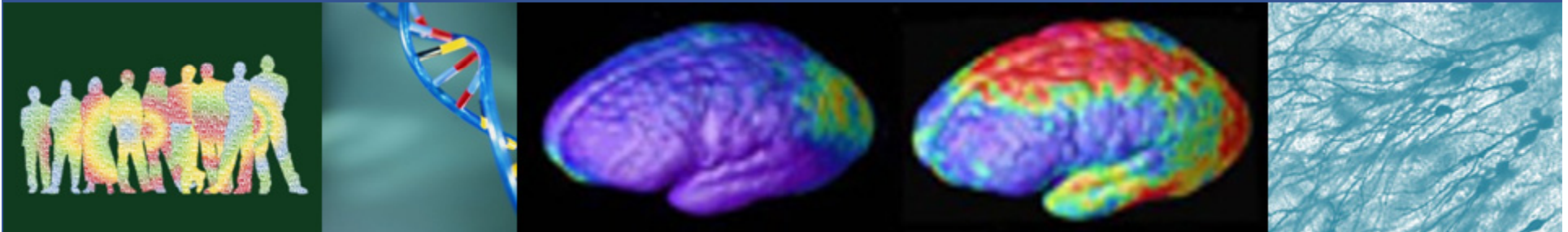
- What are microRNAs (miRNAs)?
 - Tiny snippets of RNA that control levels of protein production
- Hot areas of miRNA research
 - Design treatments for cancer, cardiovascular disease, immune disorders, Parkinson's disease, many other conditions
 - Explore how viruses, environmental factors affect human gene expression
 - Produce stem cells from adult skin cells



MicroRNAs

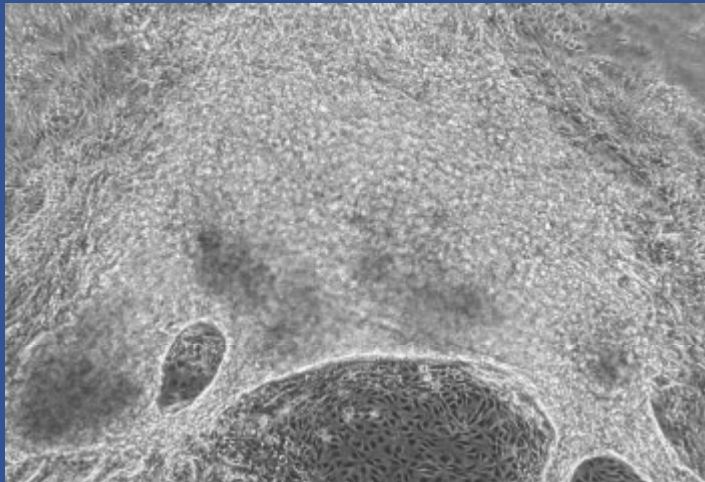
New Clues to Schizophrenia

- Schizophrenia
 - Affects 1% of U.S. population
 - Total economic burden > \$62 billion annually
 - Family history is a risk factor
 - Exact genetic, environmental factors unknown
- Genome-Wide Association Study
 - > 9,000 people with schizophrenia, > 12,000 unaffected
 - Discovered 5 genetic variants associated with schizophrenia
 - Includes microRNA 137, known to play role in brain development



Induced Pluripotent Stem Cells

Rapid Progress



Cell 131, 861–872, November 30, 2007 ©2007 Elsevier Inc.

Induction of Pluripotent Stem Cells from Adult Human Fibroblasts by Defined Factors

Kazutoshi Takahashi,¹ Koji Tanabe,¹ Mari Ohnuki,¹ Megumi Narita,^{1,2} Tomoko Ichisaka,^{1,2} Kiichiro Tomoda,³
and Shinya Yamanaka^{1,2,3,4,*}

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³Gladstone Institute of Cardiovascular Disease, San Francisco, CA 94158, USA

⁴Institute for Integrated Cell-Material Sciences, Kyoto University, Kyoto 606-8507, Japan

Science

AAAS

Science **318**, 1917 (2007)

Induced Pluripotent Stem Cell Lines Derived from Human Somatic Cells

Junying Yu,^{1,2,*} Maxim A. Vodyanik,² Kim Smuga-Otto,^{1,2} Jessica Antosiewicz-Bourget,^{1,2}
Jennifer L. Frane,¹ Shulan Tian,³ Jeff Nie,³ Gudrun A. Jonsdottir,³ Victor Ruotti,³
Ron Stewart,³ Igor I. Slukvin,^{2,4} James A. Thomson^{1,2,5,*}

Cell

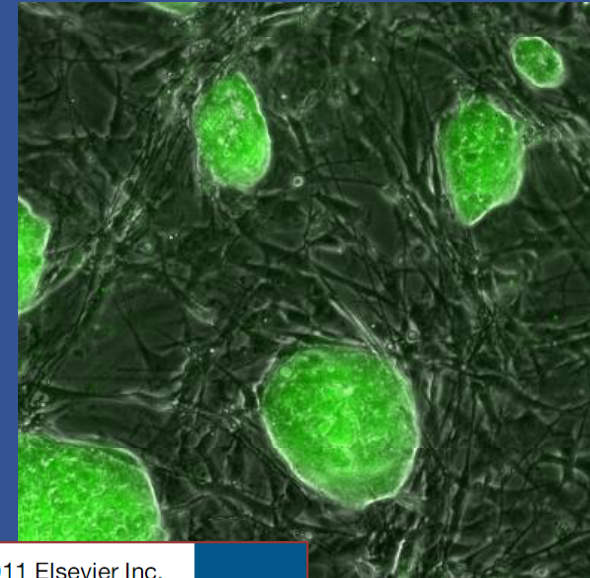
2007

Induced Pluripotent Stem Cells

Rapid Progress

New methods:

- Safer for possible clinical use
- Reduce reprogramming time
- Increase efficiency > 100-fold



Cell Stem Cell 8, 633–638, June 3, 2011 ©2011 Elsevier Inc.

Cell Stem Cell

Brief Report

Reprogramming of Mouse and Human Cells to Pluripotency Using Mature MicroRNAs

Norikatsu Miyoshi,¹ Hideshi Ishii,^{1,2,4,*} Hiroaki Nagano,¹ Naotsugu Haraguchi,¹ Dyah Laksmi Dewi,¹ Yoshihiro Kano,¹ Shinpei Nishikawa,¹ Masahiro Tanemura,¹ Koshi Mimori,² Fumiaki Tanaka,² Toshiyuki Saito,³ Junichi Nishimura,¹ Ichiro Takemasa,¹ Tsunekazu Mizushima,¹ Masataka Ikeda,¹ Hirofumi Yamamoto,¹ Mitsugu Sekimoto,¹ Yuichiro Doki,¹ and Masaki Mori^{1,2,4,*}

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Cell
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Cell Stem Cell 8, 376–388, April 8, 2011 ©2011 Elsevier Inc.

Cell Stem Cell
Article

Highly Efficient miRNA-Mediated Reprogramming of Mouse and Human Somatic Cells to Pluripotency

Frederick Anokye-Danso,¹ Chinmay M. Trivedi,² Denise Juhr,⁵ Mudit Gupta,² Zheng Cui,¹ Ying Tian,¹ Yuzhen Zhang,¹ Wenli Yang,^{1,4} Peter J. Gruber,^{3,4,5} Jonathan A. Epstein,^{1,2,3,4} and Edward E. Morrisey^{1,2,3,4,*}

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³Cardiovascular Institute

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University of Pennsylvania, Philadelphia, PA 19104, USA

⁵The Cardiac Center, Children's Hospital of Philadelphia, 34th Street and Civic Center Boulevard, Philadelphia, PA 19104, USA

2011

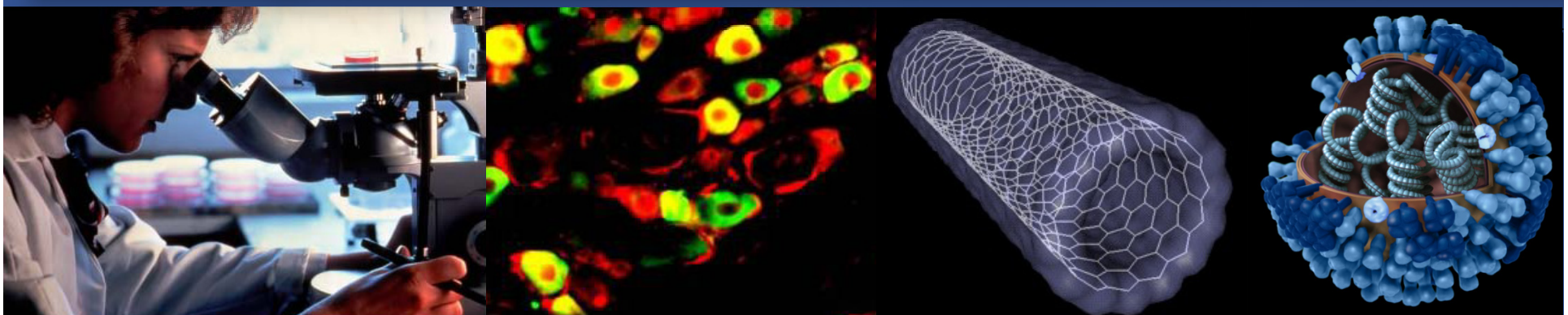
Investing in Basic Research



“... the hope of major advances lies in sustaining broad and free-ranging inquiry into all aspects of the phenomena of life, limited only by the criteria of excellence, the scientific importance, and the seriousness and competence of the investigator.”

– *James A. Shannon, M.D.*
8th Director of NIH

135 NIH grantees/trainees have become Nobel Laureates



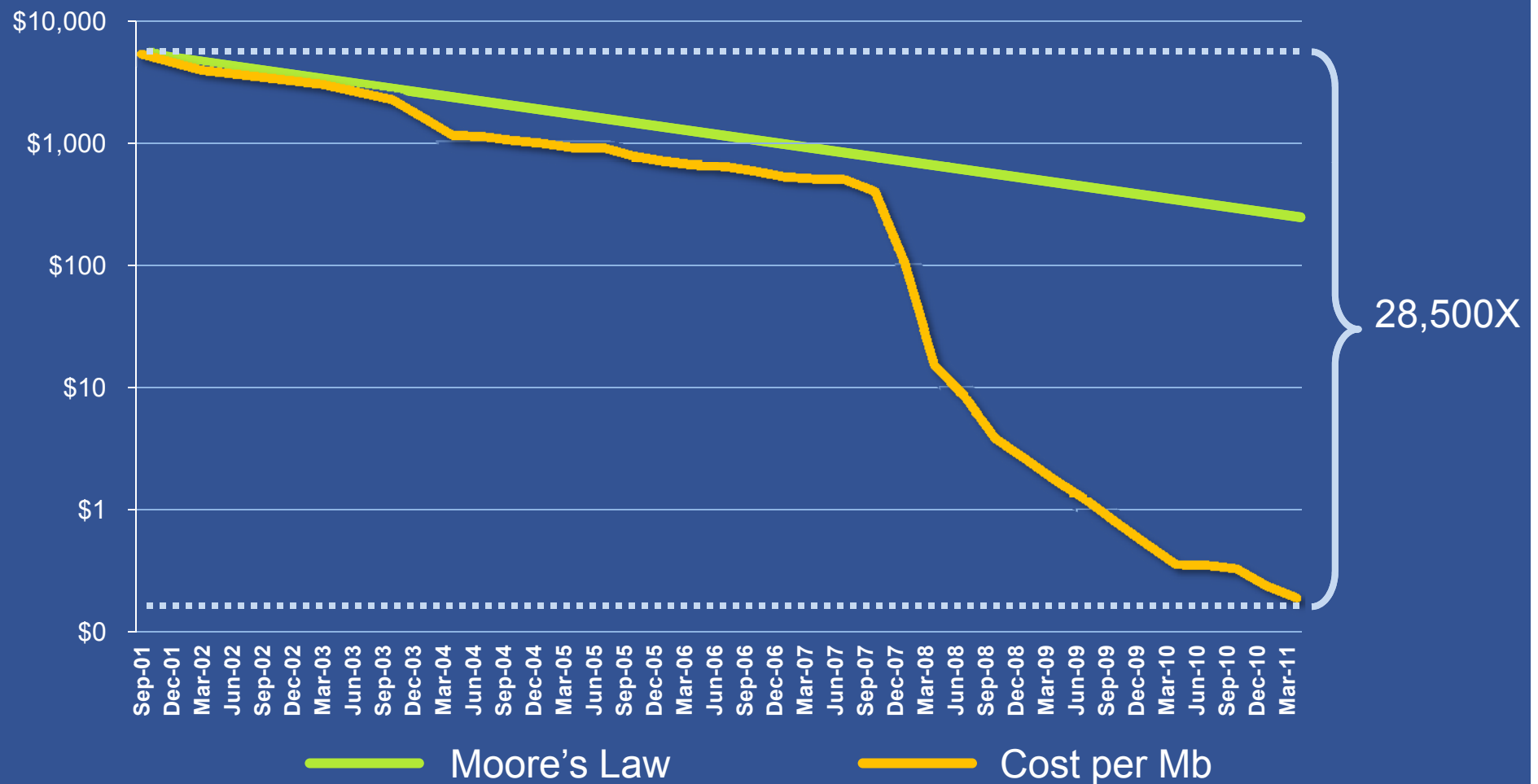
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Sequencing Costs Drop Faster than Moore's Law

Cost per Megabase of DNA Sequence



Applications of Genomic Analysis

Identification of a New Disease

- Kentucky family suffers from:
 - Progressive, debilitating joint pain
 - Calcium build-up in arteries of hands and feet; not heart
- Sisters, Louise and Paula, seek answers at NIH Undiagnosed Diseases Program
- Sequencing finds genetic mutation that causes new disease, Arterial Calcification Due to CD73-deficiency (ACDC)



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Creation of the National Center for Advancing Translational Sciences (NCATS)

POLICY

www.ScienceTranslationalMedicine.org 6 July 2011 Vol 3 Issue 90 90

Reengineering Translational Science: The Time Is Right

Francis S. Collins

Despite dramatic advances in the molecular pathogenesis of disease, translation of basic biomedical research into safe and effective clinical applications remains a slow, expensive, and failure-prone endeavor. To pursue opportunities for disruptive translational innovation, the U.S. National Institutes of Health (NIH) intends to establish a new entity, the National Center for Advancing Translational Sciences (NCATS). The mission of NCATS is to catalyze the generation of innovative methods and technologies that will enhance the development, testing, and implementation of diagnostics and therapeutics across a wide range of diseases and conditions. The new center's activities will complement, and not compete with, translational research being carried out at NIH and elsewhere in the public and private sectors.

Science
Translational
Medicine

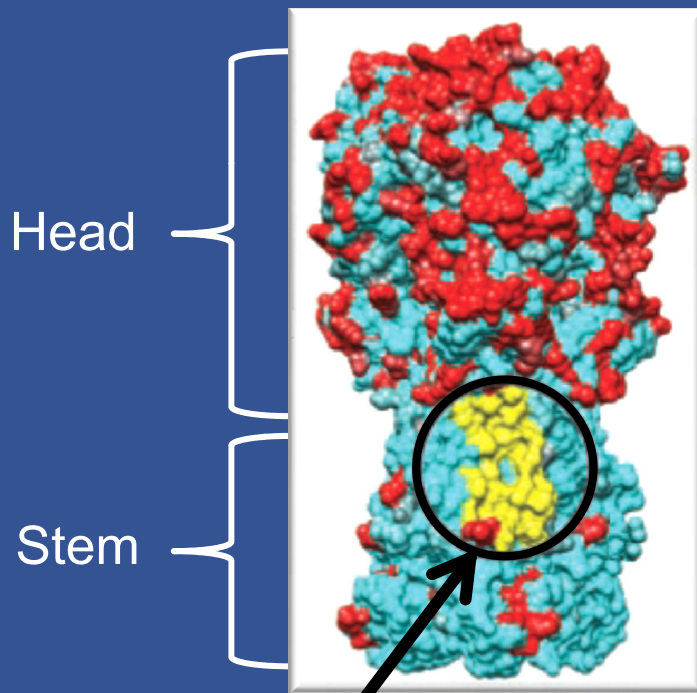


Online issue 6 July 2011

Advancing Translational Sciences

The Need for a Universal Flu Vaccine

Influenza Virus



Target for
universal
flu vaccine

- Up to 50,000 U.S. deaths associated with flu annually
- \$87 billion in economic costs
- Protection currently involves getting a flu shot every year
- Vaccine manufacture takes 6 months; requires predicting this year's flu strain before production

Universal Flu Vaccine: **Development Timeline**

- 2007 → Basic and preclinical studies
- 2011 → Phase 1 human clinical trials
- 2013 → Phase 2 human clinical trials
- 2014 → Complementary human studies in partnership with private sector
- 2015 → Licensure studies and application for licensure

Advancing Translational Sciences

Mark O. Hatfield Clinical Research Center



Lasker~Bloomberg Public Service Award

For serving since its inception as a model research hospital — providing innovative therapy and high-quality patient care, treating rare and severe diseases, and producing outstanding physician-scientists whose collective work has set a standard of excellence in biomedical research.



Extraordinary Opportunities for FY 2013

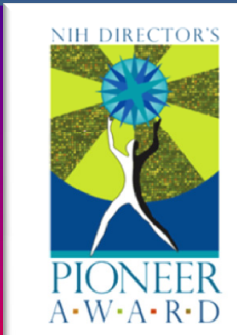
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Opportunities for Tomorrow

NIH Investing in New, Transformative Ideas

- NIH-Lasker Clinical Research Scholars
- Transformative R01
- NIH Director's Pioneer Award
- New Innovator Award
- NIH Director's Early Independence Awards



Building the Research Workforce

Need for Greater Diversity: NIH's Action Plan

Enhancing Recruitment

- Evaluate current training programs
- Phase out unsuccessful programs, expand successful ones

Enhancing Career Advancement

- Increase number of early career reviewers, including those from underrepresented populations
- Examine grant review process for bias, develop interventions
- Improve support for grant applicants
- Gather expert advice on additional action steps



ACD Working Group on Diversity in the Biomedical Research Workforce

- Charged by Advisory Committee to the Director (ACD) to focus on 5 key transition points in the pipeline:
 1. Entry into graduate degree programs
 2. Transition from graduate degree to post-doctoral fellowship
 3. Appointment from post-doctoral position to first independent scientific position
 4. Award of first independent research grant from NIH or equivalent in industry
 5. Award of tenure in an academic position or equivalent in an industrial setting
- Produce interim recommendations by December 2011 and final recommendations by June 2012

ACD Working Group on Diversity in the Biomedical Research Workforce

- **Reed Tuckson, M.D.**, co-chair
UnitedHealth Group
- **John Ruffin, Ph.D.**, co-chair
NIH
- **Lawrence Tabak, D.D.S., Ph.D.**
NIH
- **Ann Bonham, Ph.D.**
AAMC
- **Jordan Cohen, M.D.**
AAMC
- **José Florez, M.D., Ph.D.**
Harvard Medical School
- **Gary Gibbons, M.D.**
Morehouse School of Medicine
- **Renee Jenkins, M.D.**
Howard University
- **Tuajuanda Jordan, Ph.D.**
Lewis and Clark College
- **Wayne Riley, M.D., M.P.H., M.B.A.**
Meharry Medical College
- **Samuel Silverstein, M.D.**
Columbia University Medical Center
- **Dana Yasu Takagi, Ph.D.**
University of California, Santa Cruz
- **Maria Teresa Velez, Ph.D.**
University of Arizona
- **M. Roy Wilson, M.D., M.S.**
Charles R. Drew University
- **Keith Yamamoto, Ph.D.**
University of California, San Francisco
- **Clyde Yancy, M.D.**
Northwestern University

ACD Working Group on the Future Biomedical Research Workforce

- Charged with developing model for sustainable and diverse U.S. biomedical research workforce that can inform decisions about training optimal number of people for appropriate types of positions that will advance science and promote health
- Questions to be considered
 - What is the right size of the workforce?
 - What are the appropriate types of positions to support?
 - What is the best way to support these positions?
 - What types of training should be provided?
- Timetable
 - August 17 – October 7, 2011: RFI seeking stakeholder input
 - Summer 2012: Final report anticipated

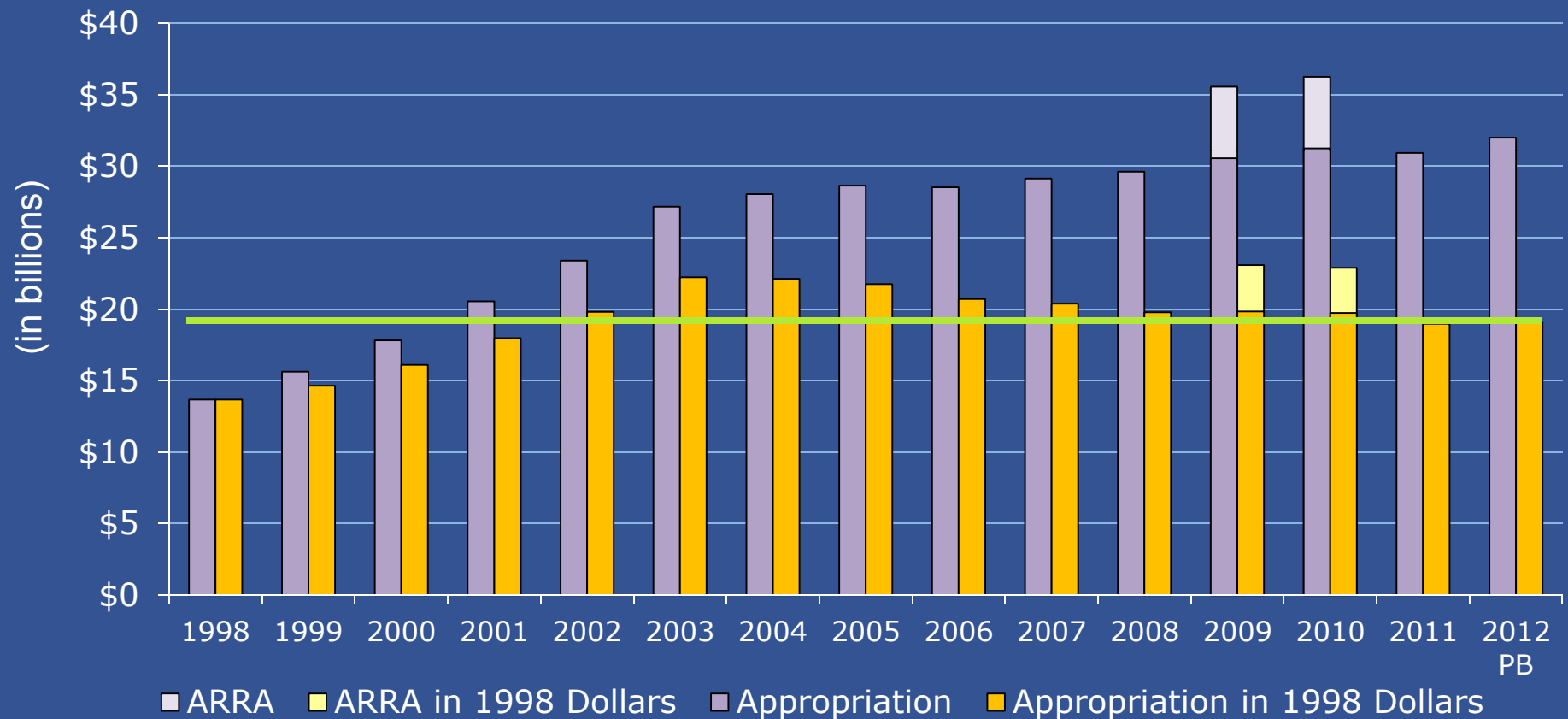
ACD Working Group on the Future Biomedical Research Workforce

- **Sally Rockey, Ph.D.**, co-chair
NIH
- **Shirley Tilghman, Ph.D.**, co-chair
Princeton University
- **Sandra Degen, Ph.D.**
University of Cincinnati
- **Laura Forese, M.D.**
Weill Cornell Medical Center
- **Donna Ginther, Ph.D.**
University of Kansas
- **Arthur Gutierrez-Hartmann, M.D.**
University of Colorado Denver
- **Freeman Hrabowski, Ph.D.**
Univ of Maryland, Baltimore County
- **James Jackson, Ph.D.**
University of Michigan, Ann Arbor
- **Leemor Joshua-Tor, Ph.D.**
Cold Spring Harbor Laboratory
- **Richard Lifton, M.D., Ph.D.**
Yale School of Medicine
- **Garry Neil, M.D.**
Johnson & Johnson
- **Naomi Rosenberg, Ph.D.**
Tufts University
- **Bruce A. Weinberg, Ph.D.**
The Ohio State University
- **Keith Yamamoto, Ph.D.**
Univ of California, San Francisco

Challenges to Biomedical Research

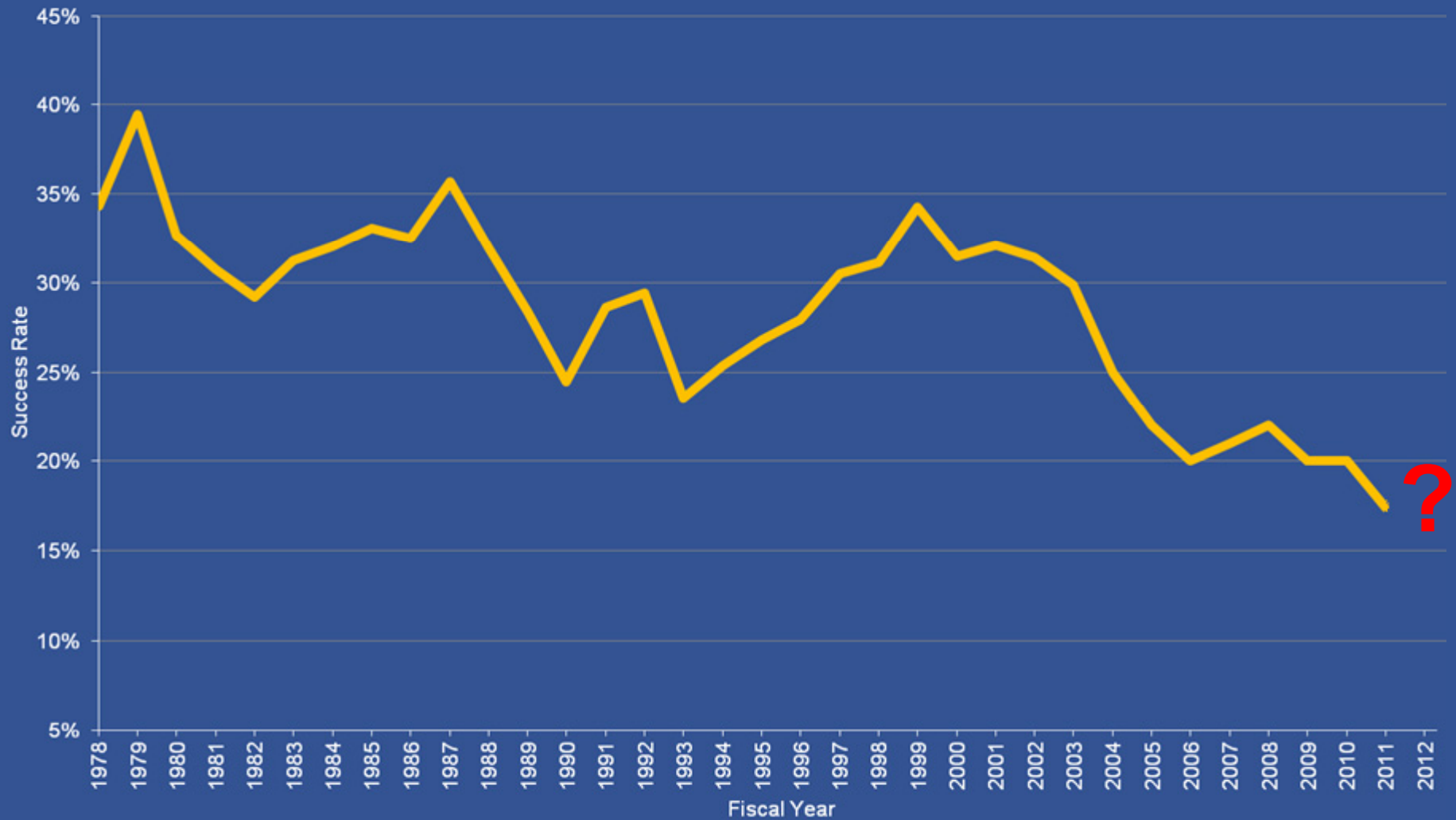
Appropriation History vs. Actual Purchasing Power

FY 1998 appropriation – FY 2012 Presidential Budget (\$ in billions)



Grant Success Rates

FY 1978-2012



Possible Strategies for Dealing with Budget Challenges

- Make the case for NIH
- Trim spending across the board
- Evaluate, rearrange research portfolio
- Change ways of managing NIH resources

Your suggestions?

For more information, go to:

http://report.nih.gov/budget_and_spending/index.aspx



To comment, send emails to:

NIHResourceManagement@nih.gov



“If we’re going to create jobs now and in the future, we’re going to have to out-build and out-educate and out-innovate every other country on Earth.”

*President Obama
Signing of America Invents Act
Thomas Jefferson High School
September 16, 2011*





NIH...

Turning Discovery Into Health

