Setting Research Agendas at the National Level

Dr. Erwin Gianchandani
Director, Computing Community Consortium
Computing Research Association

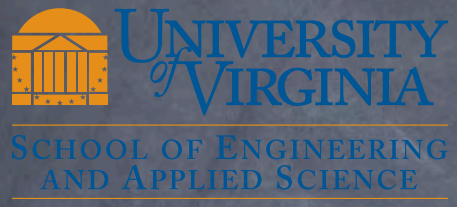
UVa Sources for Scholars
Sept. 10, 2010, Alumni Hall

Today's topic

"The place of research at R1 universities in their mission as educators as well as creators and discoverers of new knowledge from your perspective directing CCC."

My background...

A Triple 'Hoo goes to Washington



B.S., computer science, 2005
M.S., biomedical engineering, 2007
Ph.D., biomedical engineering, 2009

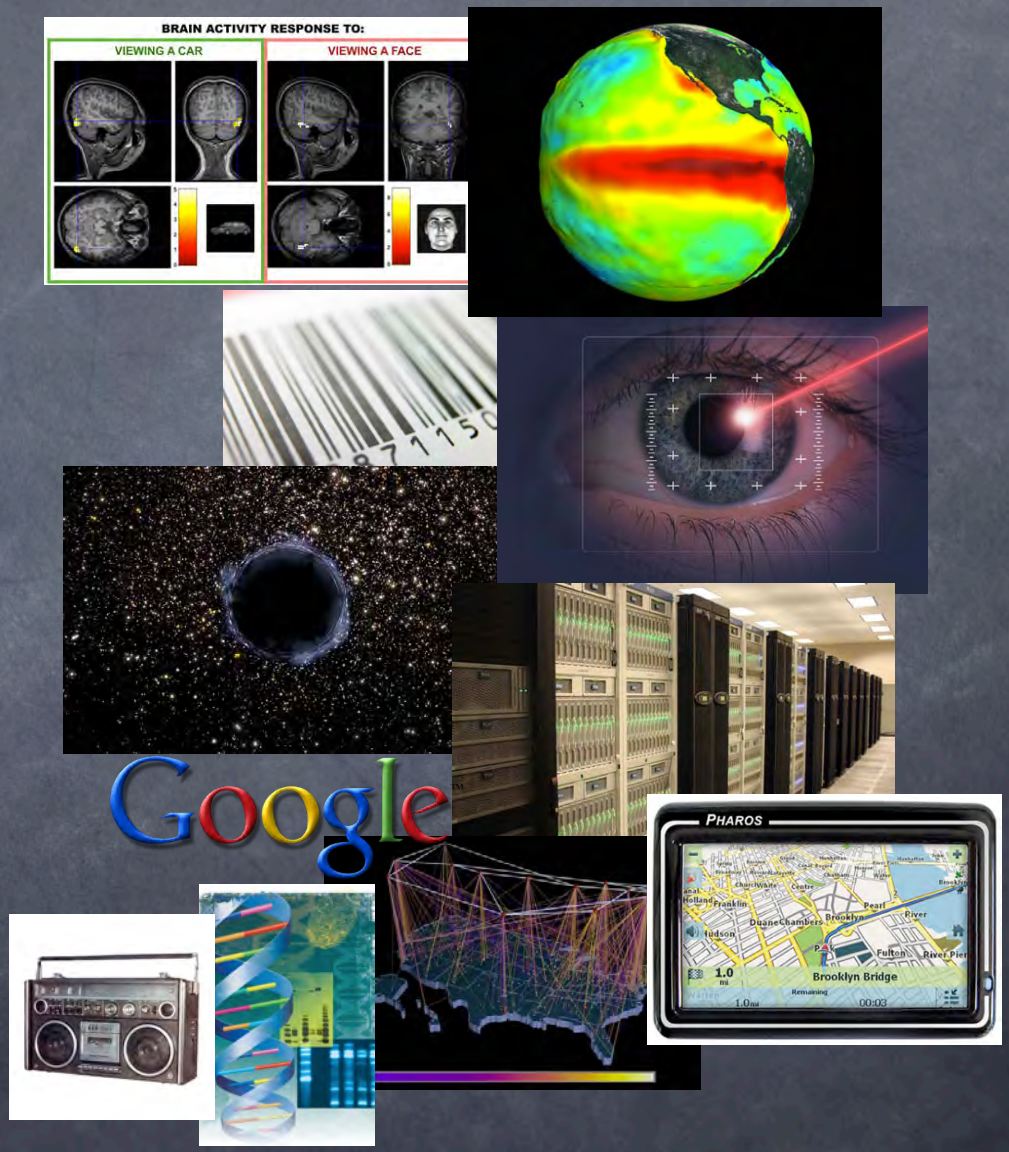
AAAS Science & Technology Policy Fellow
Directorate for Computer & Info. Sci. & Eng. (CISE)
"Smart health & wellbeing" initiative
Fall 2009 & spring 2010

Director, Computing Community Consortium
Since April 2009

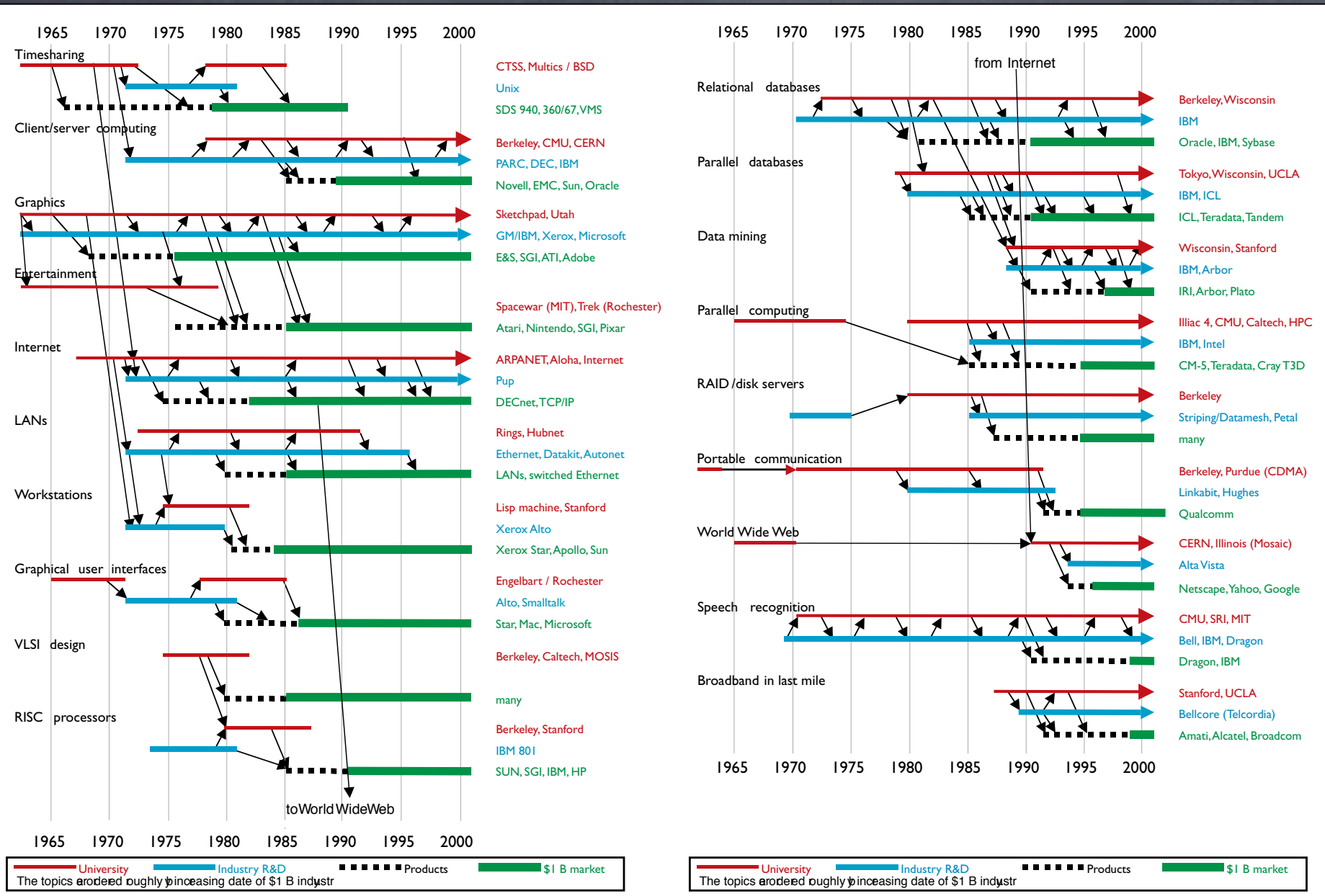
Basic research is the bedrock of our future

Advances have changed the world...

How we live, work, learn, and communicate.



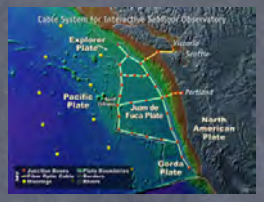
...Research has built the foundation...

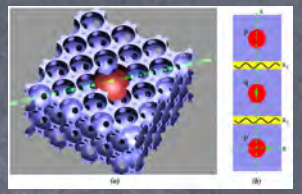
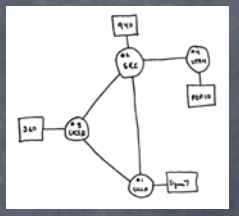


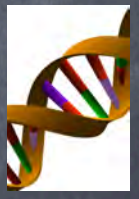
Source: From [6], reprinted with permission from the National Academy of Sciences, courtesy of the National Academies Press, Washington D.C. ©2003.

...And the future is full of opportunity

- Driving advances in all fields of science and engineering
- Pursuing digital scholarship
- Improving quality of life through personalized health monitoring
- Revolutionizing transportation
- Personalizing education
- Creating a smart grid
- Assessing and mitigating the effects of climate change
- Empowering the developing world





But we must work together...

to establish, articulate, and pursue **audacious** visions

- The challenges that will shape the intellectual future of the field
- The challenges that will catalyze research investment and public support
- The challenges that will attract the best and brightest minds of a new generation

So how do we do it?

Audacious visioning requires...

- Aligning ourselves with Federal government interests
- Being agile and flexible
- Bringing leading researchers together
- Being willing to take risks & fail
- Let's take a look at a couple examples...

Computing was at a crossroads...

- In the mid-2000s, NSF leaders and computing research leaders had similar deep concerns
  - The Federal commitment to research in general, and to computing research in particular
  - Public and policymaker perception that "computer science" is "yesterday's news"
  - Failure to articulate and coalesce around exciting research visions in computer science that could galvanize the public, policymakers, researchers, and students
  - Need to groom the future leadership of the field
  - Decrease in student interest

...So something was done about it

- Increased focus by NSF leaders and computing research leaders in academia & industry
- A Computing Community Consortium solicitation & proposal
  - "[NSF] will support the CCC as a community proxy responsible for facilitating the conceptualization and design of promising infrastructure-intensive projects..."
  - "The purpose of the CCC is to provide a voice for the national computing research community. The CCC will facilitate the development of a bold, multi-themed vision for computing research and education... [communicating] that vision to ... major stakeholders."

NSF asked CRA to create a "CCC"

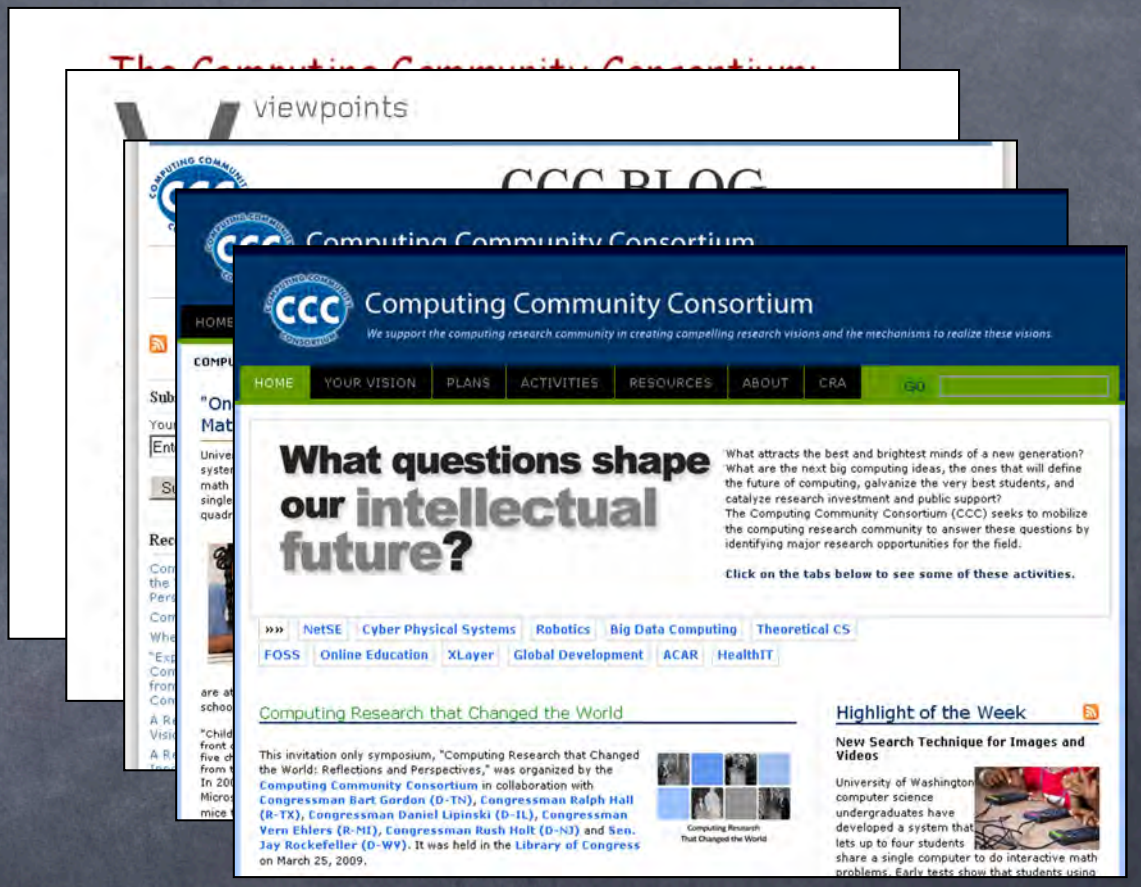
- To catalyze the computing research community to consider such questions
  - To envision long-range, more audacious research challenges
  - To build momentum around such visions
  - To state them in compelling ways
  - To move them towards funded initiatives
  - To ensure "science oversight" of large-scale initiatives
- A "cooperative agreement" with NSF
  - Close coordination

The CCC Council: a broad slice

- Director: Erwin Gianchandani
- Chair: Ed Lazowska
- Terms ending 2013
  - Randy Bryant
  - Lance Fortnow
  - Hank Korth
  - Eric Horvitz
  - Beth Mynatt
  - Fred Schneider
  - Margo Seltzer
- Terms ending 2012
  - Stephanie Forrest
  - Chris Johnson
  - Anita Jones
  - Frans Kaashoek
  - Ran Libeskind-Hadas
  - Robin Murphy
- Terms ending 2011
  - Bill Feiereisen
  - Susan Graham (vice-chair)
  - Dave Kaeli
  - John King
  - Bob Sproull
- Ex-officio
  - Andrew Bernat
- Rotated off
  - Dick Karp, 2010
  - Andrew McCallum, 2010
  - Dave Waltz, 2010
  - Greg Andrews, 2009
  - Peter Lee, 2009
  - Karen Sutherland, 2009

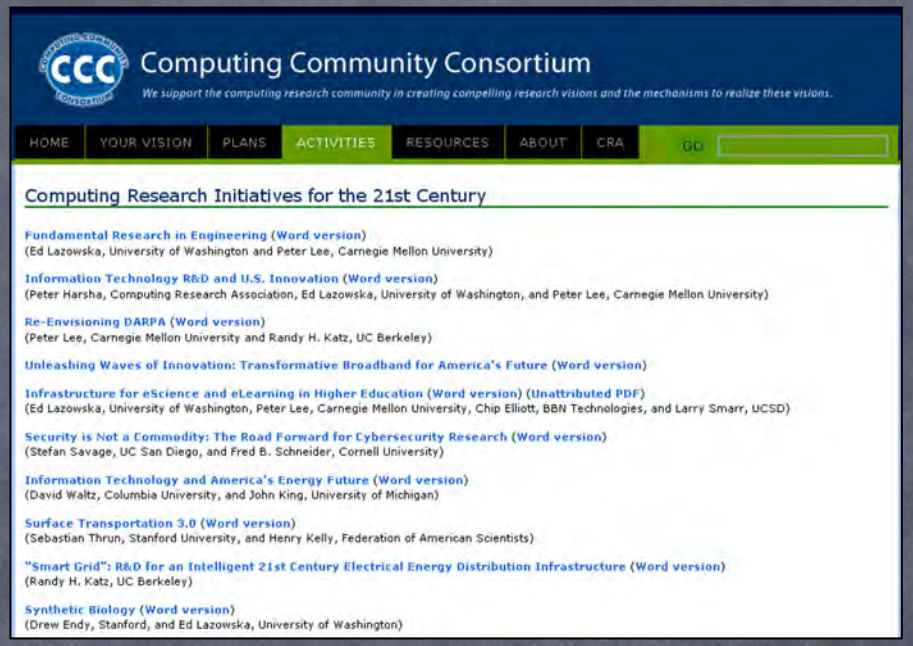
Major continuing activities

- Presentations
- Articles
- CCC Blog
- Computing Research "Highlight of the Week"
- Community visioning exercises



Major special initiatives

- "Transition Team" white papers



Computing Community Consortium

We support the computing research community in creating compelling research visions and the mechanisms to realize these visions.

HOME | YOUR VISION | PLANS | ACTIVITIES | RESOURCES | ABOUT | CRA | GO

Computing Research Initiatives for the 21st Century

Fundamental Research in Engineering (Word version)
(Ed Lazowska, University of Washington and Peter Lee, Carnegie Mellon University)

Information Technology R&D and U.S. Innovation (Word version)
(Peter Harsha, Computing Research Association, Ed Lazowska, University of Washington, and Peter Lee, Carnegie Mellon University)

Re-Envisioning DARPA (Word version)
(Peter Lee, Carnegie Mellon University and Randy H. Katz, UC Berkeley)

Unleashing Waves of Innovation: Transformative Broadband for America's Future (Word version)

Infrastructure for eScience and eLearning in Higher Education (Word version) (Unattributed PDF)
(Ed Lazowska, University of Washington, Peter Lee, Carnegie Mellon University, Chip Elliott, BBN Technologies, and Larry Smarr, UCSD)

Security is Not a Commodity: The Road Forward for Cybersecurity Research (Word version)
(Stefan Savage, UC San Diego, and Fred B. Schneider, Cornell University)

Information Technology and America's Energy Future (Word version)
(David Waltz, Columbia University, and John King, University of Michigan)

Surface Transportation 3.0 (Word version)
(Sebastian Thrun, Stanford University, and Henry Kelly, Federation of American Scientists)

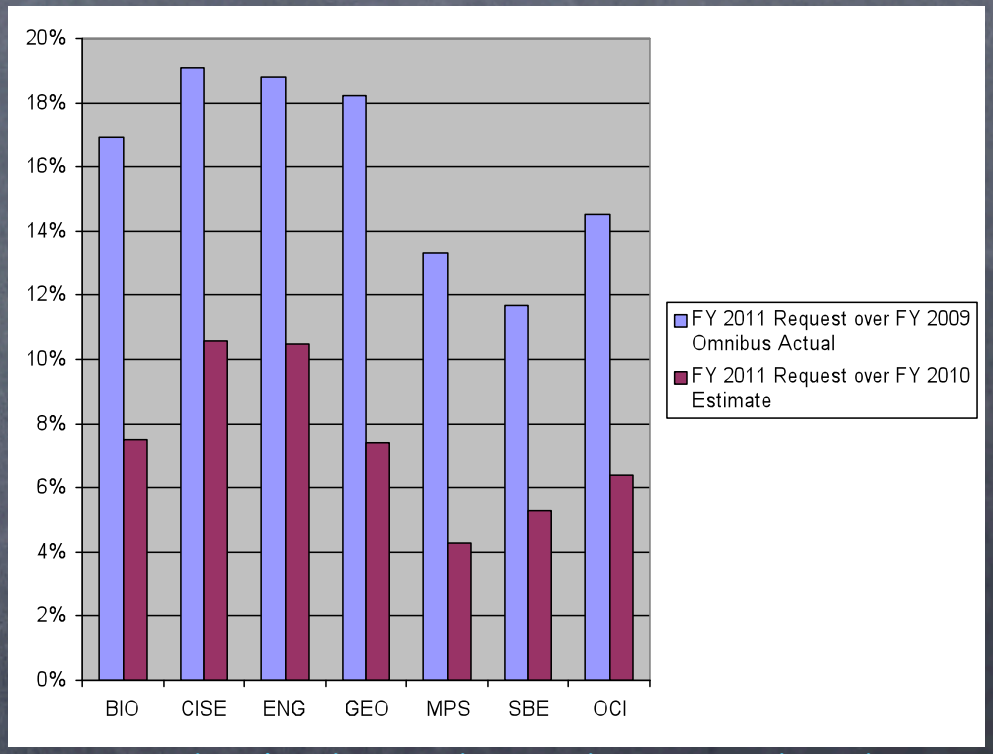
"Smart Grid": R&D for an Intelligent 21st Century Electrical Energy Distribution Infrastructure (Word version)
(Randy H. Katz, UC Berkeley)

Synthetic Biology (Word version)
(Drew Endy, Stanford, and Ed Lazowska, University of Washington)

"Transition Team" white papers

- Sensed and seized an opportunity to influence Federal science policy through the Presidential Transition Team
  - 19 papers produced in late 2008 & early 2009
  - 30 separate authors
  - Many highly influential:
    - Re-envisioning DARPA -- Peter Lee, Randy Katz
    - Infrastructure for eScience & eLearning/Unleashing waves of innovation -- Ed Lazowska, Peter Lee, Chip Elliott, Larry Smarr
    - Security is not a commodity -- Stefan Savage, Fred Schneider
    - Synthetic biology -- Drew Endy, Ed Lazowska
    - Big-data computing -- Randy Bryant, Randy Katz, Ed Lazowska
    - The ocean observatories initiative -- John Delaney, John Orcutt, Robert Weller
    - Cyber-Physical Systems -- Janos Sztipanovits, Jack Stankovic

A role in FY 11?



NSF budget numbers, by Directorate

Major special initiatives

- "Transition Team" white papers
- Library of Congress Symposium
- Computing Innovation Fellows (CIFellows)
- Landmark Contributions by Students
- NetSE Research Agenda
- Health IT

Encouraging participation

Community visioning activities	Participants	Organizations
NetSE	109	44
Cyber-physical systems	100	47
Robotics	141	79
Big data computing	81	46
Theoretical CS	39	26
Global development	56	37
Education technology	55	30
Health information technology	121	102
Cross-layer reliability	121	45
Free and open source software	42	35
Advancing computer architecture	New in 2010	
Interactive technologies	New in 2010	
Selected other activities	**Participants**	**Organizations**
Library of Congress Symposium	128	71
CIFellows Project (2009)		
Selection committee	36	28
Applicants	526	145
Prospective mentors	1209	198

OSTP's FY 12 priorities...

"In the 20
focus on ...

- Economic
  - NIT
- Achieving
- Moving t
- Impacts
- Improved
- National
  - Cybersecurity

job creation

"inferences from enormous quantities of data"

better health outcomes

clean energy future

climate change

sustainability

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

July 21, 2010

THE DIRECTOR

M 10-30

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Peter R. Orszag
Director, Office of Management and Budget

John P. Holdren
Director, Office of Science Technology Policy

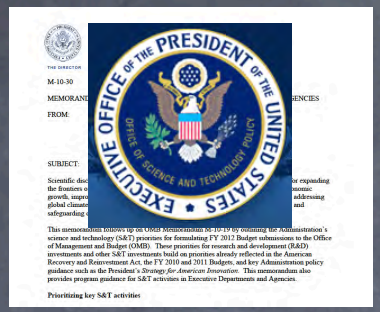
SUBJECT: Science and Technology Priorities for the FY 2012 Budget

Scientific discovery, technological breakthroughs, and innovation are major engines for expanding the frontiers of human knowledge and are indispensable for promoting sustainable economic growth, improving the health of the population, moving toward a clean energy future, addressing global climate change challenges, managing competing demands on the environment, and safeguarding our national security.

This memorandum follows up on OMB Memorandum M-10-19 by outlining the Administration's science and technology (S&T) priorities for formulating FY 2012 Budget submissions to the Office of Management and Budget (OMB). These priorities for research and development (R&D) investments and other S&T investments build on priorities already reflected in the American Recovery and Reinvestment Act, the FY 2010 and 2011 Budgets, and key Administration policy guidance such as the President's *Strategy for American Innovation*. This memorandum also provides program guidance for S&T activities in Executive Departments and Agencies.

Prioritizing key S&T activities

...Aligning our activities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MEMORAN ENCIES

FROM:

SUBJECT:

Scientific disc or expanding the frontiers o economic growth, inspir addressing global climat and safeguarding

This memorandum follows up on OMB Memorandum M-10-14 by outlining the Administration's science and technology (S&T) priorities for formulating FY 2012 Budget submissions to the Office of Management and Budget (OMB). These priorities for research and development (R&D) investments and other S&T investments build on priorities already reflected in the American Recovery and Reinvestment Act, the FY 2010 and 2011 Budgets, and key Administration policy guidance such as the President's *Strategy for American Innovation*. This memorandum also provides program guidance for S&T activities in Executive Departments and Agencies.

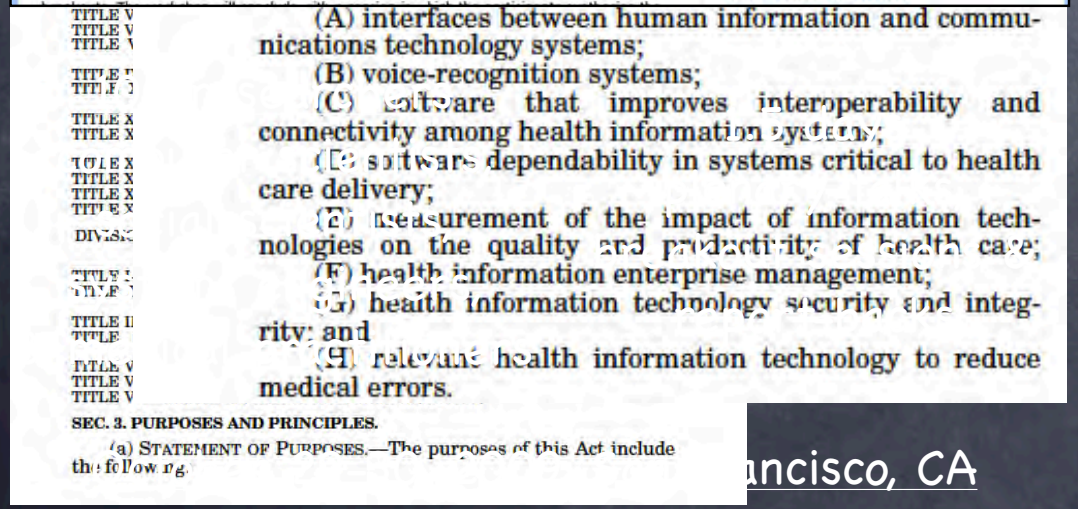
Prioritizing key S&T activities

"In the 2012 Budget, agencies should focus on ... six challenges."

- Economic growth and job creation
  - NITRD -- "inferences from enormous quantities of data"
  - Data analytics WPs
  - Big data visioning activity
  - NSF CDI
- Achieving better health outcomes
  - Health IT workshop
  - NSF/CISE SHB
  - ONC discussions
  - NIH discussions
- Moving toward a clean energy future
  - Multiple WPs
- Impacts of global climate change
  - NSF CRI
- Improved sustainability and biodiversity
  - NSF SEES
- National security
  - Cybersecurity
  - Multiple WPs

Where can we contribute?

Signs of a health IT R&D initiative?



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(A) interfaces between human information and communications technology systems;

(B) voice-recognition systems;

(C) software that improves interoperability and connectivity among health information systems;

(D) software dependability in systems critical to health care delivery;

(E) measurement of the impact of information technologies on the quality and productivity of health care;

(F) health information enterprise management;

(G) health information technology security and integrity; and

(H) relevant health information technology to reduce medical errors.

SEC. 3. PURPOSES AND PRINCIPLES.

(a) STATEMENT OF PURPOSES.—The purposes of this Act include the following:

ancisco, CA

On Feb. 17, 2009, Congress passed the American Recovery & Reinvestment Act.

The legislation included language specifically calling for Health IT research.

And program staff at NSF immediately sought to run an interdisciplinary workshop.

Workshop to white papers

Information Technology Research Challenges for Healthcare: From Discovery to Delivery[1]

Susan Graham (University of California, Berkeley)[2], Deborah Estrin (University of California, Los Angeles), Eric Horvitz (Microsoft Research), Isaac Kohane (Harvard University), Elizabeth Mynatt (Georgia Institute of Technology, Ida Sim (University of California, San Francisco)

Wellness and healthcare are central to the lives of all people, young or old, healthy or ill, rich or poor

"NSF's investment in healthcare research is essential in order for the opportunities [to enhance wellness, healthcare, and the clinnical sciences] to be realized."

subtle but important causal signals in the fusing of clinical, behavioral, environmental, genetic, and

"The importance of collaboration between information technology researchers, social scientists, and biomedical researchers is an essential component of the research agenda we have laid out."

to strengthen the uses of information technology that are already underway in healthcare and in other domains.

From Data to Knowledge to Action: Enabling Evidence-Based Healthcare

The National Academies' Report "Computational Technology for Effective Health Care: Immediate Steps

The SHARP program

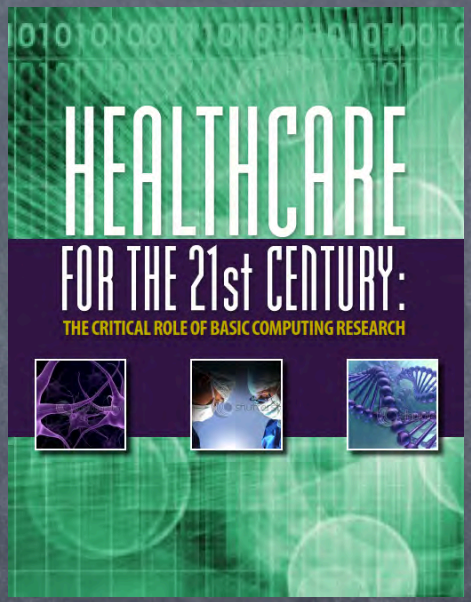
- Announced in December 18, 2009, with a late-January deadline for submission
- Run by Office of the National Coordinator for Health IT in HHS, not NSF
- Focused on "breakthrough advances ... to the adoption and meaningful use of health information technology"
- Four awards totaling $60 million announced in March 2010

But the seeds had been planted...

A program within NSF/CISE on "smart health & wellbeing" for FY 11.

...And there's hope for more yet

- A cross-cutting initiative within NSF (including ENG, SBE, and CISE) for FY 12?
- Involvement of other relevant agencies, such as NIH, AHRQ, CDC, FDA, and the Office of the National Coordinator for Health IT?



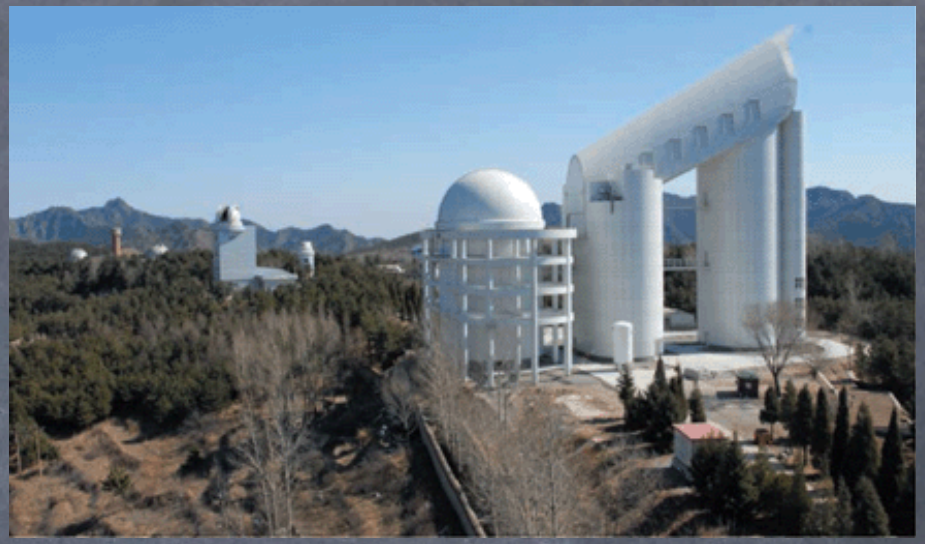
Astronomy's decadal survey...

- Every 10 years, astronomers release a "decadal survey" recommending which astronomy & astrophysics projects should be funded by the government

- The 2010 survey was the result of 9 appointed panels, 17 town hall meetings, and 324 white papers

...Speaks with a unified voice...

- 2010 report not merely a "wish list"
- Identified 8 projects, all focused on the study of dark matter & dark energy
- Included independently vetted estimates of project costs



...And serves as another model

US survey sets cosmic priorities

Dark energy rises to the top in decadal report ranking future astronomy and astrophysics projects.

Recently, a colleague of astronomer Claire Max jokingly told her that, come 13 August, half her friends would love her and half would never want to speak to her again.

That is because Max, of the University of California, Santa Cruz, has for the past two years been helping to craft US astronomy's latest decadal survey, an influential report prepared for the National Research Council that recommends which astronomy and astrophysics projects NASA, the National Science Foundation (NSF) and the Department of Energy (DOE) should fund over the next ten years.

Using input from 9 appointed panels, 17 town-hall meetings and 324 white papers from individual research groups, the survey's aim is to assess opportunities and set priorities for US astronomy and astrophysics, while balancing scientific goals with fiscal realities. The report is now out, and although Max isn't aware of losing any friends, there are some in the community who have more reason to thank her than others.

Topping the list of the pleased and grateful is Anthony Tyson, an astrophysicist at the University of California, Davis, and director of the proposed Large Synoptic Survey Telescope (LSST), which ranks highest among the ground-based facilities considered by the survey committee. When completed in 2015, the 8.4-metre telescope will regularly sweep the entire visible sky in three nights with a 3.2-gigapixel camera, capturing short-lived phenomena ranging from fast-moving near-Earth asteroids to the flashes of supernovae in distant galaxies.

Over ten years, the US$465-million observatory will also build up an unprecedented 100-petabyte database for astronomers trying to discern the nature of two mysterious factors that shape the Universe. One is dark matter, thought to be an unknown particle or family of particles beyond the standard model of physics. Hidden in vast quantities among the galaxies, dark matter generates a gravitational pull that has shaped the evolution of the Universe. The other factor is dark energy, the pervasive but mysterious phenomenon that is causing cosmic expansion to accelerate. Crucial data on both factors can be derived from a three-dimensional survey of the surrounding Universe that the LSST is well suited to provide.

"Increasingly, we are able to ask new questions by querying huge databases," says Tyson. "The key is to populate those databases with calibrated and trusted data."

The LSST is expected to help US astronomers regain some momentum in ground-based astronomy at a time when European facilities have begun to dominate the field. To that end, the survey stresses the need for a swift decision on which of two competing mega-telescopes should receive federal funding.

The Large Synoptic Survey Telescope will capture short-lived cosmic events.

The proposed Thirty Meter Telescope, on Mauna Kea in Hawaii, and the Giant Magellan Telescope, envisioned for Las Campanas in Chile, are both supported by significant private money, and would have many times the light-gathering power and resolution of today's largest telescopes. Realistically, only one project will receive federal funds, which the survey recommends should be between $257 million and $350 million. Given that Europe has also prioritized a 42-metre telescope, the European Extremely Large Telescope, a choice needs to be made now to avoid a counterproductive stalemate.

"Increasingly, we are able to ask new questions by querying huge databases."

In space, the decadal survey proposes the Wide Field Infrared Survey Telescope (WFIRST), a 1.5-metre instrument that will map the whole sky at near-infrared wavelengths. Such data would contain subtle clues — in the distance–brightness relationships of supernovae, the bending of light (microlensing) from background galaxies and the three-dimensional clustering of matter in space — that can be used to independently measure dark energy.

WFIRST is effectively a rebranding of the Joint Dark Energy Mission, a NASA–DOE collaboration. The new name, says one survey reviewer, signals that the $1.6-billion telescope is not a one-trick pony, but a way of serving other astronomical needs as well. The survey committee stresses, for example, that WFIRST could spot microlensing events caused when exoplanets — planets outside our Solar System — pass briefly in front of background stars in the Milky Way. Although the method is unsuitable for studying individual solar systems in detail, it promises, through its sheer number of discoveries, to provide an unbiased sample of the kinds of planetary systems prevalent in the Galaxy.

This may not be enough to satisfy those who study exoplanets. "I don't think the report reflects that activity and the amount of young people going into exoplanets," says Sara Seager, an astrophysicist at the Massachusetts Institute of Technology in Cambridge. Seager notes that the survey abandons support for the Space Interferometry Mission, a project that would have detected planets slightly larger than Earth through their gravitational effect on the stars they orbit. However, Seager applauds another recommendation: a $100-million to $200-million allocation for the technical development of a future exoplanet mission.

Exoplanet researchers were stung when the Terrestrial Planet Finder, a mission endorsed by the previous decadal survey was later cancelled owing to cost overruns. So they welcome the chance to continue pursuing other approaches to observing Earth-like planets.

"Last week, I was worried," says Webster Cash, who is working on an exoplanet-mission concept at the University of Colorado, Boulder. "Now, I'm feeling like my career is going to be a lot of fun for the next ten years."

Adam Mann

See Editorial, page 903. For a full list of ranked projects, see go.nature.com/BrYVlu

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"...other disciplines planning their own reviews should follow [astronomy's] lead, as [its report] promises to be a steady guide for a bumpy decade ahead..."

Some lessons learned

1. We need to be vocal

- Funding agencies rely on the research community's voice when creating new funding programs
  - Does the community want to work on this problem?
- Workshops are important (not "just another workshop")
  - Bring people together
  - Allow us to understand the issues
- White papers have a role
  - Language makes its way into solicitations!
- **It's not always about a new funding program, but rather fostering new links and connections**

2. It's about the next generation

- We have to educate today's students to be tomorrow's **leaders**
- Scientific process, research, scholarship, innovation -- all very important
- But so is policymaking and decision-making
- Service and P&T cases

3. Service is ~~important~~ **critical**

- There's value to serving as a program officer
  - Some fields view this role in higher regard than others
- Learning how DC works can make us better scientists, researchers, and educators
  - We know what to propose and how to propose it
  - We know the skills set required of our graduates
- We must make sure there's a constant stream of people heading to DC -- they become "advocates" for a field
- **Stay involved -- even if you can't make it to DC**

We must work together today...

nature

www.nature.com/nature

Vol 467 | Issue no. 7312 | 9 September 2010

Science scorned

The anti-science strain pervading the right wing in the United States is the last thing the country needs in a time of economic challenge.

"The four corners of deceit: government, academia, science and media. Those institutions are now corrupt and exist by virtue of deceit. That's how they promulgate themselves; it is how they prosper." It is tempting to laugh off this and other rhetoric broadcast by Rush Limbaugh, a conservative US radio host, but Limbaugh and similar voices are no laughing matter.

There is a growing anti-science streak on the American right that could have tangible societal and political impacts on many fronts — including regulation of environmental and other issues and stem-cell research. Take the surprise ousting last week of Lisa Murkowski, the incumbent Republican senator for Alaska, by political unknown Joe Miller in the Republican primary for the 2 November midterm congressional elections. Miller, who is backed by the conservative 'Tea Party movement', called his opponent's acknowledgement of the reality of global warming "exhibit 'A' for why she needs to go".

The right-wing populism that is flourishing in the current climate of economic insecurity echoes many traditional conservative themes, such as opposition to taxes, regulation and immigration. But the Tea Party and its cheerleaders, who include Limbaugh, Fox News television host Glenn Beck and Sarah Palin (who famously decried fruitfly research as a waste of public money), are also tapping an age-old US political impulse — a suspicion of elites and expertise.

Denialism over global warming has become a scientific cause célèbre within the movement. Limbaugh, for instance, who has told his listeners that "science has become a home for displaced socialists and communists", has called climate-change science "the biggest scam in the history of the world". The Tea Party's leanings encompass religious opposition to Darwinian evolution and to stem-cell and embryo research — which Beck has equated with eugenics. The movement is also averse to science-based regulation, which it sees as an excuse for intrusive government. Under the administration of George W. Bush, science in policy had already taken knocks from both neglect and ideology. Yet President Barack Obama's promise to "restore science to its rightful place" seems to have linked science to liberal politics, making it even more of a target of the right.

"The country's future crucially depends on education, science and technology."

US citizens face economic problems that are all too real, and the country's future crucially depends on education, science and technology as it faces increasing competition from China and other emerging science powers. Last month's recall of hundreds of millions of US eggs because of the risk of salmonella poisoning, and the Deepwater Horizon oil spill, are timely reminders of why the US government needs to serve the people better by developing and enforcing improved science-based regulations. Yet the public often buys into anti-science, anti-regulation agendas that are orchestrated by business interests and their sponsored think tanks and front groups.

In the current poisoned political atmosphere, the defenders of science have few easy remedies. Reassuringly, polls continue to show that the overwhelming majority of the US public sees science as a force for good, and the anti-science rumblings may be ephemeral. As educators, scientists should redouble their efforts to promote rationalism, scholarship and critical thought among the young, and engage with both the media and politicians to help illuminate the pressing science-based issues of our time. ■

A destabilizing

Public allegations threaten the
misconduct inquiries.

Investigations into charges of scientific
for all concerned. Emotions run high a
As a consequence, it is crucial that all t
and indirectly, behave with dignity and r

But events around such an investigati
troubling and damaging turn from such
months. An unknown agitator using the p
Berns is engaged in an e-mail and Intern
medical researchers whom he accuses of

Berns's libellous messages are targeted
and immunologist Silvia Bulfone-Paus,
hold joint positions at the University o

many.
isturbing a formal investigation, organized
orstel in Germany and begun in July, into
ons.
ails to those involved in the inquiry shortly
ce widened his reach to researchers, poli-
provides links to an untraceable website
ontains more material.
estigation are rightly appalled by the desta-
accusations could cause. Claims of scientific
d in confidence to protect both accused and
urs that could prejudice the inquiry.
anonymity, it seems that little can be done
ncertainty will remain until the investiga-
involved must be presumed innocent until
uld report as quickly as possible without
tiality and normal procedure. That is the
is unfortunate affair. ■

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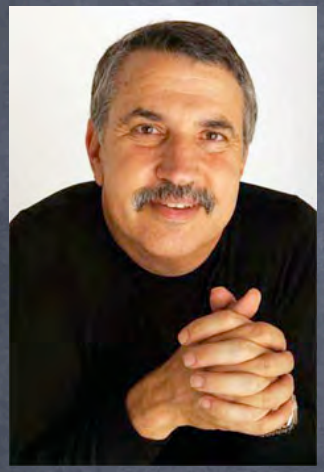
"Science scorned." Nature **467**(7312): 133 (2010).

"As educators, scientists should redouble their efforts to promote rationalism, scholarship, and critical thought among the young, and engage with both the media and politicians to help illuminate the pressing science-based issues of our time."

...To ensure a brighter tomorrow



Thomas Friedman
Pulitzer Prize-winning
author, reporter, and columnist

"People always say Britain took the nineteenth century, the United States of America took the twentieth century, and China will take the twenty-first century. Well, to those people I tell the story that my grandma used to tell me beside the fireplace in her tiny, inner city Detroit home:

"Grandma Friedman used to say, 'Son, never cede a century to a country that censors Google'."

Questions?

- E-mail: erwin@cra.org
- Phone: (202) 266-2936
- Online: www.cra.org/ccc