

# HELPING TO LEAD AND TO GOVERN

A Speech by Ralph J. Cicerone, President

National Academy of Sciences

Presented at the Academy's 153<sup>rd</sup> Annual Meeting

May 2, 2016

Good morning. This annual meeting of the National Academy of Sciences is our 153<sup>rd</sup>.

## ***An Oft-heard Exclamation***

As I have worked with many members of the National Academy of Sciences and with the NAS Council over the last eleven years, I have heard many of them say “I didn’t know that NAS is involved in so many different worthwhile activities.” It is true—NAS is involved in many activities and those activities stem from our mission. The NAS mission arises from, and is empowered by American history. Today I want to address the NAS mission and purpose and factors that support or threaten it, for example, the destructive tone of (the early months of) the U.S. Presidential campaign. First, what is the NAS mission and what does NAS do?

## ***NAS Mission and Activities***

Ten years ago, in 2006, I reviewed the mission of NAS and gave examples from each of four components.

- Validate scientific excellence
- Enhance the vitality of the scientific enterprise
- Guide public policy with science
- Communicate the nature, values and judgments of science to government and the public.

Under the first component, an important activity is the election of NAS members. NAS elects its own members using our own criteria, and we determine how many members to elect. (1) We try very hard to recognize excellence and to make good choices. We reexamine our processes and criteria frequently through discussions involving NAS members, Section Chairs, the Home Secretary and Council. Election to NAS is taken seriously by all concerned, so much so that some people think that it is all that we do!

In a related stream of activity, NAS awards prizes for achievements in many fields of science and for contributions to public welfare, for example, the 2016 Public Welfare Medal has been awarded to Mr. Alan Alda:

*For his extraordinary application of the skills honed as an actor to communicating science on television and stage, and by teaching scientists innovative techniques that allow them to tell their stories to the public.*

Our scientific journal, *The Proceedings of the National Academy of Sciences* has done much to enhance the vitality of science since its founding in 1914 and the publication of its first issue in January 1915. *PNAS* Editor-in-Chief Inder Verma marked the 100<sup>th</sup> anniversary with a number of special reports throughout the 2015 anniversary year. The scientific scope and size

of *PNAS* continue to grow as do the contributions from American scientists and from those overseas. Access to *PNAS* worldwide has been improved greatly, both electronically and in print. *PNAS* now includes new features under the heading “Front Matters” such as Inaugural Articles and Perspectives. Clearly, *PNAS* is enhancing the vitality of science.

The Editor-in-Chief of *PNAS* Inder Verma, will begin a second term in January, 2017.



Inder Verma  
Editor-in-Chief of *PNAS*

*PNAS* receives approximately 18,000 submitted manuscripts per year. The approximately 200 NAS member editors average approximately 90 manuscripts each annually. Approximately 18% of the submitted manuscripts are accepted for publication, and NAS members

make every final decision. Incidentally, press coverage of *PNAS* papers is high so that many exciting developments in science become discussed more widely.

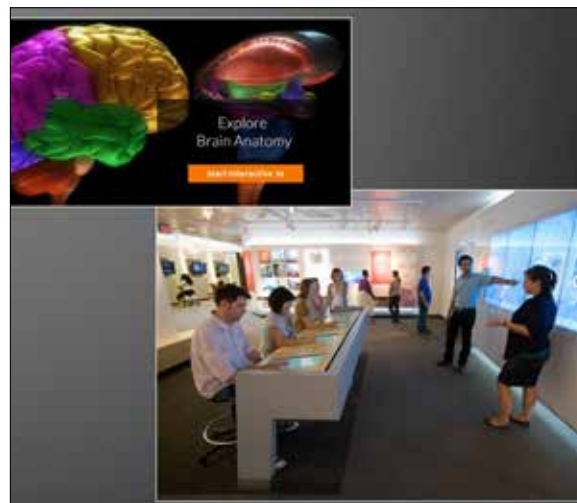
Contributions of outstanding African Americans to science, engineering, medicine, and to the nation’s welfare are recognized and exemplified by a collection of photos and online biographies of African Americans (Distinguished African American Physicians, Scientists, and Engineers). In addition to this website, we also display photographs of these individuals permanently in our Keck Center and in the NAS Building during each February, African American History Month. These materials also help to promote the understanding of science, engineering, and medicine and to enhance the vitality of science, while also validating excellence. The African American History Program is sponsored by the National Academy of Sciences, the

National Academy of Engineering, and the National Academy of Medicine and many of the photographs in this collection are of members of NAS, NAE and NAM.

The NAS conducts numerous activities aimed at *enhancing the scientific enterprise and communicating about science* including the Kavli Frontiers of Science meetings (annually or biennially with China, Germany, India, Indonesia, Israel, Japan and South Korea). Each KFOS meeting is 2.5 days long and is aimed at young scientists and scientifically multidisciplinary topics. A large number of current NAS members have participated in these meetings and their planning. Separately, the Arthur M. Sackler Colloquia (3 or 4 per year), the annual National Academies Keck Futures Initiative, are very stimulating scientific conferences. Press releases and webcasts flow from some of these meetings, as do YouTube videos.

A strong component of the NAKFI is the recognition of excellence in science communication, with awards for book, print and electronic media.

Scientific sessions at our Annual Meeting are usually very lively and they engage both disciplinary experts, guests and scientists from many fields, for example, in special breakout sessions. The NAS Koshland Science Museum (overseen by an advisory board of NAS members) offers interactive exhibits and special



NAS Koshland Science Museum

events to the public; see its website [koshland-science-museum.org](http://koshland-science-museum.org). *Issues in Science & Technology* discusses many science-policy issues, such as human gene editing and nuclear fusion for electricity generation, and it publishes opinion pieces. With the NAE and NAM, NAS hosts Mirzayan Fellows (advanced graduate students) and provides exposure and involvement for them in science policy, while our Ford Fellows program provides financial support for a diverse group of early career scientists and engineers.

The NAS mission to *guide public policy with science* arises from the original (1863) Act of Incorporation from the U.S. Congress and President Lincoln. It says (in part):

*“... the Academy shall, whenever called upon by any department of the Government, investigate, examine, experiment and report upon any subject of science or art...”*

This important component of our mission is distinctive (and likely unique worldwide). It differs from those of other national academies of sciences around the world and stems from the fact that NAS is not part of the United States Government. For a national government to involve a non-governmental entity at all is significant and rare. I want to discuss this part of NAS's mission more fully, to note its political and historic importance, after giving a few examples of our activities.

In 1863, NAS was given a role in advising the USG. Today, much of our work in this regard is conducted in partnership with the National Academy of Engineering (since 1964) and the National Academy of Medicine (since 1970) through the National Research Council (2). A great deal of the work to analyze issues, to write reports and to provide peer review of them is performed by volunteers, unpaid expert participants including Academy members and external experts, along with our professional staff.

NAS is non-partisan politically and has attained high credibility so that our reports often have significant impact on public policy. NAS reports usually have no direct or immediate role in legislation (although sometimes they do) and, of course, NAS is not part of the USG. As you review titles of recent reports, however, you can easily see how they might lead to national legislation or actions in individual states, or provide relevant and immediate guidance to institutions like hospitals, schools or regional utility companies.

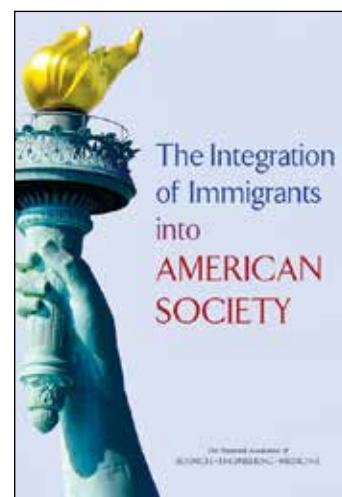
The value of NAS through this part of our mission can be seen in many ways. For example, in most foreign countries this kind of input from outside the national government is absent. Consequently, NAS receives visits and requests from representatives of other countries asking how this role of NAS in the United States might be introduced in other countries, for example, by their own academy.

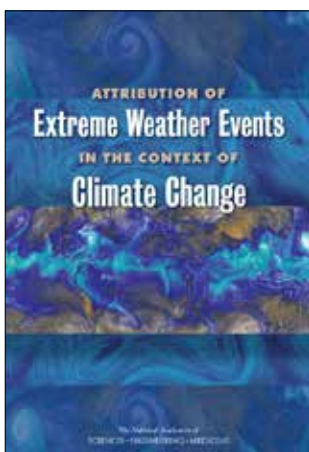
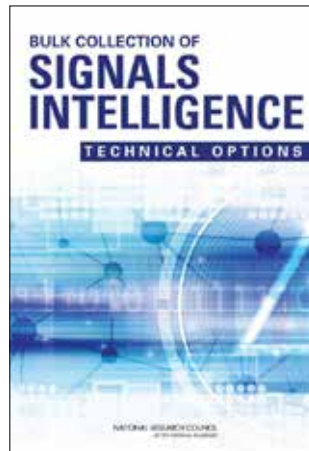
Any review of the titles of NAS/NRC reports also reveals a large scope of topics such as capabilities and limitations of various technologies, issues in public health, standards of conduct in science, education at all levels, education and human resources, environment and natural resources, how to advance fields of science.

### Recent Reports

A few examples from 2015 are:

*The Integration of Immigrants into American Society* (3, 4);





*Sea Change: 2015-2025 Decadal Survey of Ocean Sciences* (5);

*Improving Diagnosis in Health Care* (6);

*Bulk Collection of Signals Intelligence: Technical Options* (7);

*Optimizing the Nation's Investments in Academic Research (part I)* (8);

*Attribution of Extreme Weather Events in the Context of Climate Change* (9);

*Guide to Implementing the Next Generation Science Standards* (10).

All of our NAS/NRC reports are peer-reviewed and the reviews are overseen by our Report Review Committee, (each of whose members is a member of NAS, NAE or NAM). Individuals who serve on study committees that produce reports must be screened for conflicts of interest and must disclose specific COI's. Our reports continue to be requested mostly by the federal government although a growing fraction is requested and supported by private foundations and occasionally by individual states. To better *communicate the nature, values and judgments of science to government and the public* our reports are distributed freely over the Internet and in addition are made available as paper copies for purchase.



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Our mission of communicating with the public is also advanced by our three published volumes (1984, 1999 and 2008) on science, evolution and creationism, for teachers, students and the public at large. These reports were not requested or funded by a government, but were driven by the obvious need to provide a scientific viewpoint, especially for teaching. Our Science & Entertainment Exchange (SEE, an NAS office in Hollywood started in 2008) provides assistance to the entertainment industry on plots, scripts and concepts involving science for TV and films. SEE has conducted 1,400 consultations and 250 live events with scientists for writers, producers and directors in less than eight years, with private support. We do not ask for credits to SEE or to NAS but we are finding great interest in science from these contacts (see this YouTube video: <https://youtu.be/sMuxRnpeP0A>).

### **Convening Activities**

The NAS and the NRC are asked not only for in-depth studies that lead to peer-reviewed reports but also to convene experts for discussions and workshops on various topics—to fulfill our missions *to enhance the vitality of the scientific enterprise and to guide public policy with science*. Our ability to convene (unpaid) experts as volunteers is strong, probably because we remain non-partisan politically and the reputations of our distinguished members and the NAS as an institution are high. These workshops and discussions can be very valuable—to federal agencies and departments, to private sponsors and to individual scientists. Occasionally, a larger in-depth study project develops.

Let me mention two such convening activities. The Transportation Research Board's Annual Meeting (in January every year). This meeting is the most important of its kind and it is the largest; it involves public and private experts in transportation, including students and young professionals. In 2016, over 12,000 persons attended the week-long meeting, 17% from overseas, focusing on many modes of transportation of humans and goods, not just highways and cars. Disciplines including engineering, economics, law, human-factors psychology and the environment were discussed in 800 sessions.

A separate notable gathering in 2015 was on human gene editing. It was requested originally by members of NAS and NAM and by the U.S. Congress. The meeting was co-sponsored by NAS, NAM, the Chinese Academy of Sciences and the Royal Society, and was chaired by David Baltimore (11). Presentations and discussions focused on the state of gene-editing science and technology, potential clinical applications, international differences in ethical, regulatory and legal aspects, social and philosophical views and commercial possibilities. Attendees came from 20 different nations and the proceedings were webcast live to viewers in 70 nations.

Separately, an in-depth study is underway on human gene editing (co-chaired by Richard Hynes and Alta Charo) that is overseen by our National Academies of Sciences, Engineering and Medicine Division on Earth and Life Studies (Board on Life Sciences), Health and Medicine Division. The study will examine many of the relevant issues that arise in human gene editing, including scientific, clinical, ethical, legal and regulatory ones, with attention to international aspects. This report is scheduled to enter peer review in the autumn of 2016.

Convening of such meetings is a valuable activity of the NAS, NAE and NAM because discussions amongst experts from differing fields and locales, can be very helpful to many parties to identify the focuses and experts for future activities, to identify outstanding questions, and to aid the planning of short term and long term actions of the parties. Over the last several years, we have experienced increased demand for convening groups of experts for discussions through workshops, continuing roundtables and for responsible groups to offer views and to debate. Topics with immediate need for attention, often unforeseen, can arise, and fast response is needed, for example, gain-of-function research, new virus-borne diseases.

A risk of such meetings is that proceedings of a workshop can be misunderstood and portrayed as “an Academy report” even though summaries of the proceedings are not peer-reviewed. We are taking extra care to distinguish between reports of studies and proceedings of meetings.

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Another important trend is that we are receiving more requests from private foundations and states. Requests from the federal government for full-length studies fluctuate with time but are slowly decreasing in number while workshop-like events are increasing.

### ***Volunteers, Civic Associations, the Public Interest and the Government***

In the future, will new members (or Council members) of NAS say “I didn’t know that NAS is involved in so many different worthwhile activities”? Given the four aspects of the mission of NAS—to validate scientific excellence; to enhance the vitality of the scientific enterprise; to guide public policy with science; to communicate the nature, values and judgments of science to government and the public—how active and effective can NAS be in the next decade or so? The answer depends on several factors: the demand for NAS participation (especially in trying to guide public policy with science), on the willingness of scientists, including NAS members, to contribute their time and expertise, on the public need for this activity and on availability of financial resources to cover costs.

Before I address each one of these four important factors, let us note that while there are some discouraging signs, there is a powerful tendency for Americans to take a strong hand in governing themselves, largely by forming associations outside of the government. This kind of civic behavior was seen in Benjamin Franklin and his generation in the creation of libraries, newspapers, schools and colleges and scientific and philosophical societies, along with the paving of streets and the installation of lightning rods, for example (12).

The writings of de Tocqueville (13) about America also illustrate this point. He wrote:

*“I have often admired the extreme skill with which the inhabitants of the United States succeed in proposing a common object to the exertions of a great many men, and in getting them voluntarily to pursue it.”*

Another relevant de Tocqueville quote is:

*“The health of a democratic society may be measured by the quality of functions performed by private citizens.”*

Such thoughts were on the minds of many leaders when NAS was created: the federal government was just developing, populations were small and not concentrated and local involvement was valued highly. Non-governmental groups and associations were created to provide responsible attention, expertise, resources and judgment. This national premise (that was important when NAS was created) has been carried through to today. Indeed, many scientists worldwide embrace this commitment. I think that these civic views create demand for the work of NAS.

The willingness of NAS members and of many other scientists to assemble and work voluntarily stems partly from this same sense but as I have spoken with many such people who have served on our study committees, as report reviewers and on our standing committees and boards, I have concluded that they are also motivated by the stimulation of contributing ideas and judgments on new, complicated issues, by receiving some recognition for their work and by the opportunity to learn from other experts.

To pay for the costs of the active involvement of over 13,000 volunteers (14) and of our professional staff, NAS (and NAE and NAM) need continued support from the Federal Government (NOTE: as reimbursement of project costs, not as an annual allocation to NAS), and this support is progressively harder to come by as federal budgets are tighter and more limits are emplaced. As I mentioned earlier, some increase in support from individuals and private foundations is occurring; such support is truly needed and it must increase. Philanthropy itself has been almost uniquely American (it is now appearing in several other nations) and its future at NAS will have to be encouraged even more.

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In parallel, there is certainly no shortage of public needs. There are many emerging or continuing issues that strongly involve science such as:

- Synthetic biology
- Precision medicine
- Biosecurity and dual uses
- Nuclear waste storage and nuclear power safety
- Stability of electrical power grids
- Science and the courts
- Immigration
- Conduct of U. S. census
- Social mobility—is it increasing or decreasing in the U.S. relative to other countries? What factors are at play?
- Decadal surveys of several science fields like those in astronomy & astrophysics
- Water quality and water management
- Extreme weather events and natural hazards (fires, tsunami, earthquakes, droughts)
- Effects of ocean acidification
- Verification of estimates of emissions of greenhouse gases (how to do it?),
- Autonomous vehicles (technology, safety, acceptance)
- Transportation infrastructure (with states—roads, bridges, airports)
- Data security and privacy
- Effectiveness of the Affordable Care Act
- Toxicity and nutrition
- FDA practices and decisions
- Education—early childhood
- Education at all levels and inequality of incomes

- Effectiveness of online education
- Approaches to mathematics education
- Minority participation in science, engineering and mathematics fields and careers
- Replicability in science—activities and experiments
- Access to research data

This list is certainly incomplete but even so, it shows that there is no shortage of issues that will need the attention of the federal government—far from it, the list grows. The ability to formulate and analyze options objectively is required in the chain of national decision making. While NAS strives to be non-ideological on questions of the role(s) of the federal government, it is clear that a capable and knowledgeable federal government is highly needed and I believe that the National Academies of Sciences, Engineering, and Medicine can continue to be of great value in these ways, as they have historically.

### ***Looking Ahead***

It is our desire and indeed our responsibility to carry out each part of NAS's mission so as to contribute positively to the nation and the world. We accept the challenges to: validate excellence; enhance the vitality of the scientific enterprise; guide public policy with science; and communicate the nature, values and judgments of science to government and the public. In each of these activities, NAS has access to various resources, some internal like the talents of our members and other scientists, and NAS interacts with the surrounding society by providing benefits and receiving support.

Currently there is a factor at play that can diminish NAS's ability to help to guide public policy with science. It is the view that the federal government is somehow harmful and illegitimate as opposed to being necessary. Of course, this view is not universal but it is being voiced loudly, not only in this elongated Presidential election year and not just in 2015-2016. It leads to unnecessarily partisan approaches to individual issues.

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Each public policy issue does not necessarily require a federal government with exclusive authority, on the one hand, or totally uncoordinated action on the other. Our federal government needs access to pragmatic, often scientific analysis of options, not just ideologically based choices. Expertise is needed (sometimes from outside the government) yet there are also now many instances of public resistance to the authority of expertise.

What can scientists do? Calling attention to current and anticipated issues that require public attention, like the examples listed above is a good start. Such calls can be made very effectively as individuals or as members of civic groups.

A second route can be to focus on aspirations so as to elevate the public discourse and to identify common goals. Educational opportunities and access to effective medical care are sufficiently broad to attract much agreement. Scientists can also aid by supporting individuals who do announce aspirations—individuals who serve in elected or appointed offices in government. For those of us who are given opportunities to serve on government advisory bodies, there are many possibilities. Other scientists should help colleagues who are serving.

Giving constructive feedback and principled analysis can contribute to the governance of your university or research institution, of your scientific society and of your public schools. Providing enthusiastic support for students, through mentorship and guidance is very valuable. Keep the tradition of volunteering alive (15); help the government(s) and non-government groups to function and to improve.

The tone of our communications and actions is also important. We as scientists want to emphasize a reasoned, objective approach to applying evidence. We must refrain from ideological or *ad hominem* arguments. This tone is natural and common for scientists, it is needed and valuable everywhere. We can set good examples for constructive discourse.

In all of these ways, we can help to preserve and enhance science and its value to society while solidifying the capability of NAS to fulfill its mission. ONWARD!



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## NOTES AND REFERENCES

(1) In 1863, the Act of Incorporation limited the number of NAS members to 50. The Act was amended in 1870 so that NAS determines its numbers independently.

(2) The National Research Council was created under NAS in 1916 by an Executive Order from the President of the United States. The NRC was meant to expand the scope and capacity of advice of the NAS to the Government. NRC committees and products are now identified as those of the National Academies of Sciences, Engineering, and Medicine.

(3) *The Integration of Immigrants into American Society*, Committee on Population, Division of Behavioral and Social Sciences and Education (438 pp., 2015). This report provides a factual basis for discussions about immigration; it examines demographics of immigrants and outcomes in education, income, occupations, poverty status or not, residential integration and language ability. It was sponsored by the Carnegie Corporation of New York, the National Science Foundation, the Russell Sage Foundation and the U.S. Citizenship and Immigration Services.

(4) DBASSE = Division of Behavioral and Social Science and Education;  
DELS = Division of Earth and Life Studies;  
DEPS = Division of Engineering and Physical Sciences;  
HMD = Health and Medicine Division;  
PGA = Policy and Global Affairs;  
TRB = Transportation Research Board.

(5) *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences* (from Ocean Studies Board of DELS, 86 pp., 2015) is the first ever NAS/NRC decadal survey of ocean science. It was focused primarily on the National Science Foundation. The report identifies highest priority scientific questions and how to balance related infrastructure and facility needs.

(6) *Improving Diagnosis in Health Care*. (473 pp.) This 2015 report, issued by IOM, (now folded into HMD) is part of the “Quality Chasm” series. It notes the importance of minimizing errors of patient diagnosis. It reviews what is known about diagnostic errors and proposes recommendations to improve diagnosis.

(7) “While no software-based technique can fully replace the bulk collection of signals intelligence, methods can be developed to more effectively conduct targeted collection and to control the usage of collected data.” (from the report, issued by DEPS’ Computer Science and Telecommunications Board, 2015, 124 pp.)

(8) *Optimizing the Nation’s Investments in Academic Research (part I)* examines how federally sponsored research can be regulated and reported upon so as to maximize its great benefits while reducing burdens on investigators and research institutions. The report (143 pp.) was requested by Congress and expedited upon the request of Senator Lamar Alexander. PGA’s Board on Higher Education and the Workforce and the Committee on Science, Technology and Law collaborated.

(9) *Attribution of Extreme Weather Events in the Context of Climate Change* (DELS, Board on Atmospheric Science and Climate, 2015, 162 pp.) examines the developing science of attributing observed extreme events to causal factors. It describes the roles of underlying physical principles, environmental data and statistical tools in assigning confidence levels of attribution.

(10) *Guide to Implementing the Next Generation Science Standards* (DBASSE, Board on Science Education, 2015, 115 pp.). This report recommends how to introduce the Next Generation Science Standards successfully into K–12 teaching and learning by coordinating planning, phasing the changes, and following with sustained efforts to understand and improve practice.

(11) The December, 2015 Human Gene Editing meeting was preceded by an October, 2015 planning meeting, both supported financially by the Burroughs Wellcome Fund, the Wellcome

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Trust, the National Institutes of Health, the NAS Kellogg Fund, the NAS and the NAM.

(12) *Benjamin Franklin: An American Life* by Walter Isaacson, Simon & Schuster, 2003, 590 pp.

(13) *Democracy in America* by Alexis de Tocqueville appeared in two volumes (1835 and 1840) in French and have been translated into English by several scholars.

(14) In 2015, approximately 5,000 volunteers (excluding TRB (2)) served on panels, committees and boards of the National Academies of Sciences, Engineering, and Medicine (NRC), including many NAS, NAE and NAM members and a larger number of other experts. An additional 1200 served as report reviewers and 400 served as panelists conducted our Ford Foundation fellowship and associateship selections. Still more NAS members served as editors of PNAS, on NAS governance committees and the Committee on Human Rights. In addition, TRB involves approximately 7,000 individuals in its technical committees and cooperative research programs.

(15) NAS members also volunteer for NRC committees, board and as reviewers, for RRC service, as NAS Section Chairs, as members of our Auditing Committee, the Finance Committee, Nominating Committees, Class Membership Committees, as PNAS Editors, as convenors of scientific sessions, Koshland Science Museum, the Committee on International Security and Arms Control (CISAC), the NAS/NAE/NAM Committee on Human Rights and the NAS/NAE/NAM Committee on Science Engineering and Public Policy (COSEPUP).