

Ceremony Speaker

The University of Toledo

Spring Commencement 2016

Saturday, May 7, 2015 | 9:30 a.m. | Savage Arena



Rush D. Holt

Chief Executive Officer

Rush D. Holt, Ph.D., became the 18th chief executive officer of the American Association for the Advancement of Science (AAAS) and executive publisher of the Science family of journals in February 2015. In this role, Holt leads the world's largest multi-disciplinary scientific and engineering society.

Over his long career, Dr. Holt has held positions as a teacher, scientist, administrator, and policymaker. From 1987 to 1998, Holt was assistant director of the Princeton Plasma Physics Laboratory (PPPL), a Department of Energy national lab, which is the largest research facility of Princeton University and one of the largest alternative energy research facilities in the country. At PPPL, Holt helped establish the lab's nationally renowned science education program. From 1980 to 1988, Holt served on the faculty of Swarthmore College, where he taught courses in physics and public policy. In 1982, he took leave from Swarthmore to serve as an AAAS/American Physical Society Science and Technology Policy Fellow on Capitol Hill. The Fellowships program, dating to 1973, places outstanding scientists and engineers in executive, legislative, and Congressional branch assignments for one or two years; by early 2015, the program had served nearly 3,000 alumni working worldwide in the policy, academic, industry, and nonprofit realms. Holt has said that his AAAS S&T Policy Fellowship was "life changing," and served as a springboard to his role in Congress. He also served as an arms control expert at the U.S. State Department, where he monitored the nuclear programs of countries such as Iraq, Iran, North Korea, and the former Soviet Union. In 1981, Holt was issued a patent for an improved solar-pond technology for harnessing energy from sunlight.

Before coming to AAAS, Holt served for 16 years as a member of the U.S. House of Representatives, representing New Jersey's 12th Congressional District. In Congress, Holt served as a senior member of the Committee on Natural Resources and the Committee on Education and the Workforce. On Capitol Hill, Holt established a long track record of advocacy for federal investment in research and development, science education, and innovation. He served on the National Commission on the Teaching of Mathematics and Science (known as the Glenn Commission), founded the Congressional Research and Development Caucus, and served as a co-chair of the Biomedical Research Caucus. Holt served eight years on the Permanent Select Committee on Intelligence and, from 2007 to 2010, chaired the Select Intelligence Oversight Panel, which worked to strengthen legislative oversight of the intelligence community. His legislative work earned him numerous accolades, including being named one of Scientific American magazine's "50 National Visionaries Contributing to a Brighter Technological Future" and a "Champion of Science" by the Science Coalition. He has also received awards from the American Chemical Society, the American Association of University Professors, the National Association of Graduate-Professional Students, the American Institute for Medical and Biological Engineering, the Council of Scientific Society Presidents, the American Geophysical Union, and the Biotechnology Industry Organization. Holt is also a past recipient of two of AAAS' highest honors: the William D. Carey Lectureship Award (2005) and the Philip Hauge Abelson Award (2010).

From December 2014 to February 2015, Holt was appointed a Director's Visiting Scholar at the Institute for Advanced Study in Princeton, New Jersey.

Holt is a Phi Beta Kappa graduate of Carleton College in Northfield, Minnesota, and he holds M.A. and Ph.D. degrees in physics from New York University. He is an elected fellow of AAAS, the American Physical Society, and Sigma Xi, and he holds honorary degrees from Monmouth University, Rider University, and Thomas Edison State College. He is married to Margaret Lancefield, a physician, and they have three children and seven grandchildren.

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Eager degree recipients, exhausted faculty, spent parents, proud trustees, President Gaber, Toledo Rockets, Thank you I am honored to be here to honor you and to wish you well.

Congratulations! You have learned a lot. That's good. But you cannot possibly have learned enough to deal with all you will encounter over the next half century which will surely have more changes than any previous period. I hope that you

are not too worn out from all the learning of the past few years and that you are ready for a lifetime of learning to come. Well, are you?

As you commence from here, just remember, as Mark Twain said, “It ain’t what you don’t know that gets you into trouble. It’s what you know for sure that just ain’t so.”

I want to talk to you today about the kind of thinking I most value – thinking like a scientist and why it matters. This way of thinking just might help you recognize what you know for sure that just ain’t so.

Wouldn’t it be great if, as you go through your life decisions, you had a way to sift sense from nonsense? If you knew how to recognize what you know for sure that just ain’t so. If you knew how to make the right decisions for your personal life, for public policy, for our economy?

Well it shouldn’t surprise you to hear me say that there is no foolproof method. But to my mind, scientific thinking is the best approach. And here is the big news: it’s not just for scientists alone. Much of the advance of civilization over the past four or five centuries has been because some people thought like scientists. Most were not professional scientists.

Now, if you are like most people you think science is complicated terminology, combined with mathematical procedures, and lots of specific facts and processes. That’s not how I think of science, at all. Science isn’t just a collection of facts, a checklist of what is known; it’s a mindset. What is science? The simplest definition I have come up with, and the best definition, is: Science is a way of asking questions so that they can be answered empirically and verifiably – in other words asking questions so that they can be answered with evidence and so that other people can check your work.

After representing the people of New Jersey’s 12th district in Congress for 16 years, I’m now at the helm of the American Association for the Advancement of Science, AAAS, the world’s largest general science membership organization with the mission to “advance science, engineering, and innovation throughout the world for the benefit of all people.”

We are best known for publishing the world’s preeminent science journal called *Science*. We do many great things to advance science and serve society through

initiatives in science policy; science education; science communication and more. We have a long track record of applying science to the issues of the day.

So maybe you think I want to turn you all into scientists. Definitely not. But today I am making a much more general point. Everyone should at least know what it means to think like a scientist.

As Lewis Thomas, a physician and essayist, once wrote, “Very few recognize science as the high adventure it really is, the wildest of all explorations ever taken by human beings, the chance to glimpse things never seen before, the *shrewdest maneuver* for discovering how the world works.” In other words science is not just a path to knowledge that is beautiful, useful, even wild and exciting, but even more, it is the cleverest way of thinking- the shrewdest maneuver—ever devised.

In a commencement address it is customary to say to the graduates, “Believe in yourself.” I have a different message: “Demand the best evidence you can find, and then believe in that.”

Rather than “Follow your dreams” or “Follow your passion” whatever commencement speakers all over the country are saying today, I say to you “Follow the evidence.” Considering how successful science has been over the centuries, it is surprising how often people avoid thinking like a scientist.

Wouldn’t it be nice if we approached problems with an open mind, with consideration of each other’s ideas? Is there a world where evidence beats ideology? Not Capitol Hill. Not main street, either.

In most discussions these days what passes for reason is spin.
What passes for analysis is assertion.
What passes for debate is posturing.

With your diploma in hand today, flee that way of thinking. Flee it as fast and as completely as you can. If you want to succeed, to come out on top, demand evidence from others. Demand evidence of yourself. Follow the evidence rather than your preconceptions. It’s better than your preconceptions. Yet our tendency is to hold onto our preconceptions for dear life. Evidence can save you from being duped by charlatans or smooth-talking politicians. It can overcome even the most respected authority. It can save you from fooling yourself, who, you may have discovered, is the easiest person in the world to fool.

Some middle school students asked me the other day, “Do you believe in climate change.” Maybe you would agree with me that the right answer is, “It is not a matter of belief. What counts is what the evidence says?” For climate change let’s debate the causes, effects and costs empirically.

More than a decade ago the US went to war in Iraq at great cost in lives and dollars because we had to stop Saddam Hussein from using weapons of mass destruction. Not many Americans demanded of their leaders evidence that Saddam Hussein even had such weapons to use. There was no great outcry, “Where’s the evidence.” It is to America’s everlasting grief that we did not demand it.

When was the last time you heard a politician arguing about some economic matter say to her opponent, “Wait! Economics is an empirical science. What does the evidence say?” It seems that every economic argument nowadays amounts to each side making assertions based on pre-baked ideology. For example, I hope the next time you hear a politician say, “Tax cuts generate net revenue for the government.” You’ll say, “Where’s the evidence?”

Maybe you see why I harp on this subject. The failure to use evidence-based thinking is very costly to us—individually, politically, and in society at large.

Are scientists naturally smarter and better thinkers than everyone else? Are scientists a better class of people naturally open minded to the ideas of others? No: scientists are not naturally more open-minded, more humble, less arrogant, or less interested in proving themselves right.

But they have made a pact—a pact that in their work they will ask questions and give answers based on evidence and framed in a way so that the answers can be critiqued by others. They publish their ideas so that their work can be criticized. They don’t like criticisms any more than you or I do, but they invite it.

They agree to let disagreements be settled by the evidence rather than by the rhetorical skill of each side in asserting or imposing.

They agree to communicate with a clarity that allows others to arrive at the same conclusion from the same starting point—even more, to communicate with a clarity and non-ambiguity that lets their mistakes, fallacies, oversights and presumptions to be exposed and exploded.

It works. The method is based on an understanding that certitude about your own correctness is the enemy of progress. Questions answered empirically and verified

with evidence so that others can check your work open the door to growth and progress. And the wonderful thing is any 3rd grader can do it. Indeed, third graders are very good at it. Even Members of Congress can do it. Sigh, if only they would.

Of course, scientists do not always reach the ideal of true evidence based thinking. Then the scientific community usually calls them to task. True the scientific way of thinking is not the only route to knowledge, but this scientific way of thinking leads to our most reliable way of knowing. It is not a replacement for philosophical, religious or aesthetic knowledge, but it is the best route to reliable, public knowledge. You cannot find beauty with evidence. You cannot replace faith with evidence. But by basing your choices and decisions on evidence when possible, you greatly improve your odds against making mistakes.

I hope you understand this scheme doesn't require calculus or formulas of organic molecules.

So instead of asking a child "what did you learn in school today?" we should ask "Did you ask a good question today?" and "Did you give an answer that let someone else tell you whether your answer makes sense?"

This allows self-correction and guards against self deception. You have to recognize that your knowledge is not final – your understanding is always somewhat tentative. But evidence is always better than ideological assertion. You may not be equipped to make the complete analysis and evaluation of the evidence. You may need assistance in interpreting it. But anyone can demand that the evidence be presented.

You demand it and ask how it was obtained and how it has been verified. And keep asking—demanding that the process of verification continue.

This is the American tradition – to think like scientists. Jefferson, Franklin, Paine, Madison, and many of the founders were scientists as much as they were politicians. They believed in evidence over ideology. They sought a self-correcting system like the scientific model. Thomas Jefferson, who thought like a scientist, wrote that "the theory of gravitation is better established by years of observation than if the authorities had asserted it.. Solutions will be arrived at empirically. Reason and experiment enter and error flees."

The science writer Tim Ferris points out that the Federalist Papers, leading to the ratification of our Constitution, used the word “experiment” 45 times, while using the word democracy only 10 times.

The founders expected progress through self-correction. They banished aristocracy and fostered an anti-authoritarian system that allowed, encouraged every individual to seek and read the evidence and take part in this self-correcting system. With a little thought you might see how this way of thinking leads to what we know as the American ideal of a country dedicated to the proposition of equality for all.

Let’s debate as if each person’s idea has a presumption of validity, subject to empirical testing, checked by what the evidence says, not what the aristocracy says. Let’s accept the presumption of equal opportunity.

In response to the horror of Sept. 11, 2001, the country was gripped by fear that terrorists were everywhere and all Americans were at immediate risk. We did some unwise things—invading Iraq, suspending some civil liberties, launching surveillance programs or even harassing some groups—ethnic or religious. Profiling of Muslims or others—treating them with suspicion in the absence of evidence of wrongdoing is lazy, ideological thinking.

There are so many examples of where asking for the evidence would improve the society and individual lives. You can carry this message. Believe it or not, the younger generation now looks up to you graduates. You are the teachers now. And you do the most teaching when you don’t realize you are doing it. Teach others by your example. Ask for the evidence, and don’t believe everything you think.