

Recalling The Life Of Benjamin Franklin, Scientist

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Talk of the Nation

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Benjamin Franklin was a printer, politician, diplomat and journalist. But, despite only two years of schooling, he was also an ingenious scientist. Nobel Prize-winning chemist Dudley Herschbach and Franklin biographer Philip Dray discuss the achievements of America's first great scientist.

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IRA FLATOW, host:

This being the Fourth of July weekend, what more appropriate occasion to talk about one of America's founding fathers and a man many call the first American scientist, Benjamin Franklin.

We've all heard about the kite experiment, but did you know that he dabbled in a lot of other fields, like medicine, meteorology, oceanography, astronomy, statistics? He studied ants and even invented a musical instrument - all this with only two years of formal education.

Joining me now to talk about some of Franklin's scientific pursuits are my guests. Dr. Dudley Herschbach is professor emeritus of chemistry at Harvard and part-time professor of physics at Texas A&M. He won the Nobel Prize in Chemistry in 1986, and he's a long-time Franklinophile. Welcome back to SCIENCE FRIDAY, Dr. Herschbach.

Dr. DUDLEY HERSCHBACH (Harvard University): Glad to be with you.

FLATOW: I remember the first time I met you. You whipped out of your back pocket your little Ben Franklin pamphlet. You wanted me to know more than about what your chemistry endeavors were. Are you still doing that?

Dr. HERSCHBACH: Well, I discovered you're a long-time fan of Franklin as well.

FLATOW: That's true. Also with us is Philip Dray. He's author of "Stealing God's Thunder: Benjamin Franklin's Lightning Rod and the Invention of America," and a number of other books on American history. He's here in our studios in New York. Welcome to SCIENCE FRIDAY.

Mr. PHILIP DRAY (Author, "Stealing God's Thunder: Benjamin Franklin's Lightning Rod and the Invention of America"): Thanks, Ira, glad to be here.

FLATOW: Mr. Dray, when did you first get interesting in Ben Franklin?

Mr. DRAY: It was shortly after 9/11, actually. I mean, of course I'd always known and loved Franklin. I thought the story of the lightning rod was kind of a wonderful story to get into in that era after 9/11, when just because of its sort of illuminating effect on the late 18th century, the kind of chasing of superstition, it seemed sort of ideally suited to 2002.

FLATOW: Dudley, one of his electrical experiments, which is less famous than the kite experiment, was something people don't know a lot about, was electrocuting turkeys.

Dr. HERSCHBACH: Oh, yes.

FLATOW: Tell us...

Dr. HERSCHBACH: He almost electrocuted himself, in fact, one time trying to do that. He was distracted by his guests and grabbed the wrong thing.

FLATOW: Is that did he was that just out of a total experiment, to see if you could electrocute a...

Dr. HERSCHBACH: Oh, yeah, it flattened him.

FLATOW: Yeah?

Mr. DRAY: As I remember, he was trying to see if he could make the turkeys taste better by electrocuting them rather than some other means of sacrifice.

FLATOW: Mmm. Fresh killed turkey there. We're going to talk lots more about Ben Franklin. Our number, 1-800-989-8255 1-800-989-8255, if you want to talk about Ben as a scientist on this coming 4th of July weekend. Also, you can tweet us, @scifri, @-S-C-I-F-R-I, and go to our website. And you can join the conversation and leave your comments there too.

We'll take a short break, be right back talking more about Ben Franklin. Don't go away.

(Soundbite of music)

FLATOW: You're listening to SCIENCE FRIDAY from NPR. I'm Ira Flatow.

We're talking about Ben Franklin's scientific pursuits with my guests: Dr. Dudley Herschbach, professor emeritus at Harvard, Nobel Prize winner in Chemistry of 1986; Philip Dray, author of "Stealing God's Thunder: Benjamin Franklin's Lightning Rod and the Invention of America." Our number, 1-800-989-8255 1-800-989-8255.

Philip, Franklin was not the first to do that experiment, was he, the kite experiment?

Mr. DRAY: Well, he was the first to do the kite experiment. He had written, in a series of letters to a friend in London, a description of how one might test the electrification of the atmosphere by going up on a high, like a church steeple or something like that.

And so a man in France name Dalibard performed that experiment a month prior to Franklin's kite experiment. Franklin had not heard of it when he himself, failing to have an appropriate church steeple at hand, went out with his son William and performed the kite experiment. So he was the first to do that particular inquiry.

FLATOW: And he became a hero in France because of that...

Mr. DRAY: Absolutely. Franklin was overnight became kind of legendary in France, and when he showed up, of course, he was greeted as a scientific celebrity.

FLATOW: Uh-huh. How we all know him for that experiment and the associated work with the lightning rod. How controversial, I understand, was the lightning rod in those days?

Mr. DRAY: The lightning rod was kind of a major breakthrough, both culturally and scientifically. It sort of resolved a question which had been on many people's minds about what thunder and lightning really were.

Of course, people were scared to death of it, rightly so. It also kind of set off a reaction in the church because, of course, for centuries the idea that lightning and thunder were controlled by the god - were sent down even as a form of retribution.

After Franklin invented the lightning rod, which showed that lightning was a natural phenomenon and even could be controlled and defended against by man, lightning and thunder became a weapon of the people, as you see this in radical pamphlets in France. In other words, thunder and lightning toppling monarchs from their thrones, this sort of thing. So Franklin had this effect.

FLATOW: Dudley, you said before that Franklin's type of science was curiosity-driven, not necessarily with any practical application in mind. Is that still true today? It doesn't seem like you can get funding for just curiosity-driven science research.

Dr. HERSCHBACH: Well, what scientists do, they get funding writing proposals and all that fill the current criteria. But then they sneak in the things that really get them excited and often open up whole new possibilities that they wouldn't have dared to put in a proposal, that wouldn't have been favorably reviewed.

FLATOW: Well, there are lots of great products and inventions we have that just came - we didn't know what we were going to do with, did we?

Dr. HERSCHBACH: That's right. That's quite right. Or had in mind a different thing altogether.

FLATOW: I mean, I remember when the laser beam was invented, they just cut razor blades with it.

Dr. HERSCHBACH: Well, in the earliest time, they thought it would be useful for communication because the waves were so precisely defined and all. You could modulate them and add a lot of information that way. And that is part. But no one imagined then its use in surgery, playing music, checking out groceries, all the myriad things that lasers do now in the world.

FLATOW: Philip, science is so complex today. Do you think Franklin could exist if he were around today doing what kinds of things he did?

Mr. DRAY: I think he could in a sense. I mean, obviously science has become much more specialized and much bigger than it was in his day. However, I think there is something universal and timeless about people having innovative ideas.

I think a good example recently would be those young people who have introduced technical improvements and advances with the Internet, things like YouTube and Facebook. Those are not coming out of huge science think tanks or universities. They're coming from young grad students in their early 20s.

FLATOW: Well, how was he free to do all these things? He studied medicine. He studied the Gulf Stream. He studied ants. He looked at astronomy. He...

Mr. DRAY: He invented a musical instrument.

FLATOW: Was it the harmonia?

Mr. DRAY: Armonica.

FLATOW: Armonica.

Mr. DRAY: Armonica, yes.

FLATOW: And he was able to have the freedom to do these things. He was sort of the...

Dr. HERSCHBACH: Well, many people don't realize he retired at age 42 to devote himself entirely to experiments and the study of what was called natural philosophy, we now call science. And of course within a few years he was carried into so many social responsibilities that he couldn't personally pursue it that much more.

But in the meantime, he had not done much more than fly the kite. He had done a whole series of experiments over a span of six or seven years that were described in these letters Philip mentioned to his friend in London, who read them before the Royal

Society, and they greatly impressed the savants who had been so puzzled by the nature of electricity.

I mean, Franklin did very fine experiments, and he interpreted them and in fact provided a lot of the vocabulary we still use in talking about electricity.

Mr. DRAY: Sure, such as electrician.

Dr. HERSCHBACH: He was called the Newton of electricity in his day.

Mr. DRAY: That's right. That's right.

Dr. HERSCHBACH: He would have been buried next to Newton in Westminster Abbey if he had remained a loyal British subject. His reputation was that large in science.

Mr. DRAY: It's worth mentioning, too, and I think Professor Herschbach would agree, that what was astounding about Franklin to the European scholars was that they weren't used to important science coming from America, let alone from someone who was really a tradesman or a publisher of a newspaper, and at first they were inclined to almost disbelieve that there could be such a man.

Of course, Franklin was always tickled by this, but not only Franklin, but the book he wrote, "Experiments and Observation on Electricity," came as a really like a major breakthrough, one of the most American books of the 18th century in Europe. It was translated...

Dr. HERSCHBACH: Yes, it was a collection of letters.

Mr. DRAY: Yes.

Dr. HERSCHBACH: And Franklin was a fine writer, and it was revised repeatedly, I think, as you said, five or six editions, three French editions alone, I know. And probably for more than 20 years, every literate person had to take a look at it, it was such a stunning, key thing in that time, key to the Enlightenment.

FLATOW: I'm sorry. Paul in Tucson, Arizona. Hi, Paul.

PAUL (Caller): Hi, how are you doing?

FLATOW: Go ahead.

PAUL: Stimulating discussion. I think that one of the best things we could take away from this is that, you know, Ben Franklin's very existence is an antidote to the punditocracy and over-reliance on experts - I had a chance to write stuff down while I was waiting that defines contemporary culture.

And he's right in line with Emerson, you know, who said: Don't read books, go out and take a walk in the woods. You know, and so all we need to do today is engage the natural world, and we can make our own discoveries, make up our mind and dare to think, like Kant said. Anyway, that's it.

FLATOW: That's a good way to begin. Philip, do you have a comment on that?

Mr. DRAY: Well, it's certainly true about someone like Franklin that he was he almost seemed to be unable to stop inventing things. When he'd be on a ship, he'd realize that they needed a different type of soup bowl that wouldn't spill the broth. He also, of course, was one of the first to explain how the Gulf Stream functioned.

At home, when he found he couldn't reach the books on his top shelf, he invented that pinching device we all see that takes the books down, this sort of thing.

So he was kind of relentless with it, and even when he was engaged in international diplomacy and all these very tense political negotiations in France. If you look at his correspondence, he's always, when he's even not doing something himself, he's corresponding with other scientists, encouraging them, reviewing their work. So it really was a kind of obsession with him.

Dr. HERSCHBACH: It's amazing what he did. The Franklin papers at Yale have 15,000 documents in his handwriting. Many of them are very long, all handwritten. So that alone took a lot of effort.

FLATOW: 1-800-989-8255 1-800-989-8255. Let's go to Zach in Detroit.
Hi, Zach.

ZACH (Caller): Hi.

FLATOW: Hi there.

ZACH: I just don't know if I heard you guys correctly, but did you say that he invented the harmonica?

Mr. DRAY: No, the armonica.

FLATOW: We'll describe it now. Go ahead.

Mr. DRAY: Well, the armonica was a is an instrument in which cups or glasses that are turned on their side are spun and rubbed by hand and emit a very kind of beautiful, ethereal sound.

What Franklin got the idea because he was living in London, and he went to a concert at which a man was rubbing the tops of wine glasses filled with different levels of liquid.

And, of course, Franklin with his practical bent thought, well, that looks like a lot of wasted. Why not just tip them on their side, put them on a spindle and then turn the whole thing with a foot treadle? And of course that made it much easier.

And the armonica caught on. It was a beautiful instrument. Mozart composed for it, and of course Franklin himself learned to play it and taught many other people how to play.

Dr. HERSCHBACH: As a graduate student in 1956, I heard a performance on what was intended to be an exact replica on the 18th century armonica as described in that literature.

The American Academy of Arts and Science had commission the Corning glassworks to produce it. And they had a terrible time. In fact, E. Power Biggs, the great organist who performed first on musical glasses and then on this armonica, had trouble too. Some of the bowls broke as he was playing it.

Mr. DRAY: Oh, my.

Dr. HERSCHBACH: And you got the impression from the things they quoted of contemporary descriptions that they were aware they're pulling posterity's leg a bit on that.

FLATOW: Mm-hmm. 1-800-989-8255 1-800-989-8255. Let's go to Scott in Walled Lake, Michigan. Hi, Scott.

SCOTT (Caller): Hi. I was curious if, you know, Franklin did any other mathematics other than his magic squares? How involved he was with mathematics. I know it's a science program, but music plays with mathematics too.

Dr. HERSCHBACH: Oh, sure.

Mr. DRAY: The other example I can think of his using mathematics - and Professor Herschbach probably can talk about this too - is, you know, Franklin, he loved to project figures into the future and - about population and demographics...

Dr. HERSCHBACH: Right.

Mr. DRAY: ...and that sort of thing. And he was incredibly accurate, actually, in predicting, for instance, the future population of the United States of America, that sort of thing.

FLATOW: Mm-hmm.

Dr. HERSCHBACH: Yes, in fact, that was a strong element of his political philosophy, is that - in a time scale that he estimated, there would be more people of English births in the colonies than in the mother country. So he had hoped, originally, to avoid a

revolution, saying that in time this will take care of things. But he also used mathematics brilliantly in these magic squares. But he also used it in an interesting way once to estimate the number of people who could have heard a speech.

FLATOW: Oh, yes.

Dr. HERSCHBACH: A very interesting paper. Really, he could have been a gifted mathematician, I think, if he'd had an opportunity to really study it.

FLATOW: Talking with Dr. Dudley Herschbach and Phil Dray, who's author of "Stealing God's Thunder: Benjamin Franklin's Lightning Rod and the Invention of America." Years ago, Isaac - the late Isaac Asimov wrote a book called "The Kite That Won the Revolution," right? I think that's what it was called. And basically the point - that Franklin, being so famous and revered in France, was able to ask France to send Lafayette over and fight the American Revolution.

Mr. DRAY: Well, I think it's certainly true that Franklin was enormously popular in France. And he kind of played up - they loved him as a kind of rustic and he played that up by wearing this kind of silly beaver hat and dressing as a farmer. But yes, he was very charismatic, very beloved. And I'm sure that he had had a very low-key style of diplomacy that worked very well.

But I think probably what that title also referred to was, in a larger sense, the science - the republic of science, as they called it, of the 18th century, and that Franklin was so much identified with sort of a template almost for the political and social developments that included our Declaration of Independence, our Constitution.

FLATOW: Mm-hmm. 1-800-989-8255 1-800-989-8255. We're talking about Benjamin Franklin this hour on SCIENCE FRIDAY from NPR. I'm Ira Flatow.

Dr. HERSCHBACH: Well, it is amazing that he got from the French all the financial support, also for an enterprise - this ragtag colony -colonies undertaking to free themselves from the greatest military power the world had ever seen, and power that had defeated France in war after war for 20 years. So it was really an amazing thing that Franklin brought the French to support that effort. And it was crucial to...

FLATOW: Mm-hmm.

Dr. HERSCHBACH: ...I think, the success of the revolution. People don't realize when Cornwall surrendered, there was one side, Washington's army, the other side, the French army, and very important, the French fleet blocking the way to the British fleet that had tallied too long in New York. It didn't arrive in time.

FLATOW: Let's go...

Dr. HERSCHBACH: The French had a huge...

FLATOW: Yeah.

Dr. HERSCHBACH: ...role.

FLATOW: Let's go to Jason in Naples, Florida. Hi, Jason.

JASON (Caller): Bifocals.

(Soundbite of laughter)

JASON: He invented the bifocal that everybody wears in glasses. I know because I'm an optometrist.

Dr. HERSCHBACH: A-ha.

Mr. DRAY: Yup, that's right.

JASON: And, you know, a lot of people - I mean, the one thing I would mention about it is, is that he wasn't really versed in, you know, the science of optics. But he just basically crudely one day got sick and tired of switching his glasses and took up two pair and cut them in half and glued them together and invented bifocals. And just - you know, it's indicative to me of how Ben Franklin, even though he didn't have a, you know, formal education - I mean, there he is, just basically took, you know, by the seat of the pants and invented these things. He'd also worked with the capacitors a lot too.

Dr. HERSCHBACH: Oh, yeah.

Mr. DRAY: There's a funny story about that, actually, which I understood, is that he - the idea for the bifocals came from his frustration, that when he would go out to a diplomatic dinner or state dinner in France, he couldn't both eat - look at the food on his plate and also see the lips of the people talking to him. And because his knowledge of French was imperfect, it was very important that he see people's lips moving. And so he became so frustrated, as this gentleman just said, he went home one night and started tearing up his own sets of glasses and had this idea to combine them.

FLATOW: Wow.

Dr. HERSCHBACH: It's very typical of him.

Mr. DRAY: Yeah.

FLATOW: You have a problem, go out and fix it.

Mr. DRAY: There you go. Yeah.

Dr. HERSCHBACH: But he did so many other things that are endearing. For example, the king became jealous of all the images of Franklin that was all over medallions and so on in France - they didn't have T-shirts then, but it was the same thing - so much so that the king gave his favorite mistress a chamber pot with one of the Franklin medallions on the bottom. When Franklin heard of it, he was so delighted he ordered supplies of the same chamber pot with medallions of George III.

FLATOW: Oh.

(Soundbite of laughter)

Dr. HERSCHBACH: Many, many episodes like that. The guy was just marvelous.

FLATOW: What would you ask him today? I've got about a minute and a half left. If you could speak to him today, what would you ask him, Dudley? Which one...

Dr. HERSCHBACH: Well, right now I'd want to ask him how to take care of this BP oil...

Mr. DRAY: Yes, that's exactly right.

Dr. HERSCHBACH: He would have fine ideas, I'm quite sure.

FLATOW: Do you think he'd be able to figure out how to stop the oil?

Mr. DRAY: I think so, because one thing about Franklin was he was very interested in what he called subtle fluids, things like current, water currents, heat, you know, electricity, et cetera. I think he'd also like to tackle global warming for us too.

FLATOW: Hmm.

Dr. HERSCHBACH: Yes.

FLATOW: Okay. Well, we'll see if we can channel.

(Soundbite of laughter)

Mr. DRAY: Okay...

FLATOW: Let's hope we can channel Ben Franklin. I want to thank you both very much for this holiday weekend.

Mr. DRAY: Thanks, Ira.

FLATOW: It's a great weekend to talk about Ben Franklin - for being with us today.

Dr. HERSCHBACH: Well, SCIENCE FRIDAY would delight Franklin, I'm sure.

FLATOW: Well, that's a great quote, Dudley. Thank you very much for that compliment.

Dudley Herschbach is professor emeritus of chemistry at Harvard. He's a part-time professor of physics at Texas A&M. He won the Nobel Prize in chemistry in 1986 and he is a long-time Franklinophile. So thank you, Dudley. Again, have a good holiday weekend.

Phil Dray, the author of "Stealing God's Thunder: Benjamin Franklin's Lightning Rod and the Invention of America" - a number of other books on American history. It's a good read, good for this weekend. Thank you, Philip....

Mr. DRAY. Thank you, Ira. Thanks for having me.

FLATOW: ...for taking the time to be with us today.

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