Science AMA Series: Hi, we're editors and writers at Science Magazine, currently working on the Breakthrough of the Year issue. Ask us anything!

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[1]Affiliation not available

April 17, 2023

Abstract

Hi reddit! 2016 was an amazing year for science, and much of the breakthrough research appeared in the pages (both physical and digital) of Science Magazine. Now, we're working on a special end-of-year issue that will bestow upon one scientific achievement the title of "Breakthrough of the Year." Every December, Science magazine announces a Breakthrough of the Year and a short list of runners-up. We, the writers and editors, comb through the year's scientific advances–with help from the Board of Reviewing Editors and other scientists–and judge which have done the most to benefit humanity, answer long-standing questions, or pave the way for fruitful new research. It's a tricky task. Many discoveries take years to catch fire; others seem exciting but never fulfill their promise. And even when something big happens in science, it's not always obvious exactly when and where the "breakthrough" took place. Here is our list of "greatest hits." All that said, we also have People's Choice award, and this year, we wanted to come to Reddit to talk about the year in science and what you think might deserve the Breakthrough of the Year award. Ask us anything! Participants, from Science Magazine: Tim Appenzeller, News Editor Adrian Cho, Science writer Catherine Matacic, Associate Online Editor Valda Vinson, Deputy Editor Lisa Chong, Deputy Editor We'll be back at 1 pm EST (10 am PST, 6 pm UTC) to answer your questions, ask us anything!

the WINNOWER

REDDIT

Science AMA Series: Hi, we're editors and writers at Science Magazine, currently working on the Breakthrough of the Year issue. Ask us anything!

AAAS_BREAKTHROUGH R/SCIENCE

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The incoming President and his cabinet have been accused by many of having beliefs and viewpoints which are "anti-science". What areas of scientific study and progress, if any, do you believe will suffer the most during the next 4 years? Do any of you see any silver linings to this situation?

jcargile242

CM: Like everyone else, we don't know what's going to happen—but there are a lot of concerns about climate science and basic science, things that are not directly aligned with business interests. Other areas of concern are research into embryonic stem cells and fetal tissue.

FWIW, the carbon accounting story I linked to above has a great interactive graphic showing how just 90 companies and government-run industries account for nearly 2/3 of manmade carbon emissions since 1751 (yep, you read that right).

Breakthrough of the Year issue. Ask us anything!, *The Winnower* 3:e148189.96257 , 2016 , DOI: 10.15200/winn.148189.96257

A lot of science based news outlets always refer the current year to be "an amazing year for science" and I can't get over how gimmicky and BuzzFeedy it sounds. Could you name a few years that actually weren't all that great for science?

EasyAndy1

Tim Appenzeller: There's always tons of good science, but there are definitely some years when there's no standout breakthrough. Last year, for instance, we ended up choosing CRISPR, the genome editing technique, which is a huge deal but was developed well before 2015--but last year was when it really took off.

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EasyAndy1

Hi EasyAndy1,

Adrian Cho, physics reporter here. I once told a colleague from another publication over lunch that some year, I honestly don't remember which one, was "a bowser for physics." And ran off and told his editor that I had said so, as if I were some sort of authority and not just making conversation. Never again!

Hey! I have two questions:

- What do you think has been the biggest breakthrough in the past 100 years?
- What do you think will be the next biggest breakthrough in the next 100 years?

Thanks guys! Merry (soon to be) Xmas.

dukfuk

Hi,

This is Adrian Cho, the house physics nerd here in the Science news section. I have to say, that's a big question. Richard Feynman said that the most important fact in science is that everything is made of atoms, so I guess the discovery and explanation of atoms would be a pretty good one, although that's not a really one discovery. As a non-biologist, I would say that the discovery and understanding of genetics is pretty spectacular. Again, not a single breakthrough, but I would think that would be another big one.

As for the next 100 years, it's hard to say. One this is clear, however. In terms of fundamental principles--relativity, quantum mechanics, etc.--there's almost surely going to be a lot less of that in the 21st Century than there was in the 20th. You can't rediscover relativity.

Hey! I have two questions:

- What do you think has been the biggest breakthrough in the past 100 years?
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dukfuk

[LC] One of the greatest biomedical advances has been induced pluripotent stem cells. Who would have thought that four transcription factors could reprogram an adult mature cell into a stem cell capable of giving rise to every other cell type in the body? This has revolutionized regenerative medicine!

Hey! I have two questions:

- What do you think has been the biggest breakthrough in the past 100 years?
- What do you think will be the next biggest breakthrough in the next 100 years?

Thanks guys! Merry (soon to be) Xmas.

dukfuk

TA: biggest breakthrough of the last 100 years: quantum mechanics. It changed our whole understanding of reality, and led to tons of technology. I'll leave the next 100 to someone else!

Thanks!! What do you think about doing a follow-up issue on where the 'Breakthroughs of the Years' past have ended up. Learning about why some technology moved faster or burned out or shifted uses may help our judgment ability for picking winners going forward.

steelhammerhands

TA: good idea! We do a small version of that already: Each year we pick areas to watch for the next year, and then a year later we score ourselves on how well we did--whether those areas did turn out to be exciting. But maybe we'll take a longer look.

How has the rise of fake news and sensationalized reporting affected the way your publication has handled this report?

Also, I'm curious about your opinions on Reddit as a means of communicating science!

lzawwlgood

CM: Another good one! At first, I was going to say not much—we source our stuff pretty thoroughly here—but then I realized that it does matter *a lot* when it comes to our audience. If we are talking to people we already know—researchers, students, well-educated members of the public—then it shouldn't make much of a difference. But if we're talking about the people we want to reach, in the sense of bringing scientific literacy to the public, then it makes a very big difference! It's something that we haven't discussed much in the newsroom, but I know that our policy and education folks are thinking about it.

As for your second question: I think Reddit is actually a great source, both for news and for figuring out what readers care about, and we should use it more!

Hello and thank you for taking the time to do this.

On the other side of the coin from 'it was a great year' there are negative feats worth highlighting too I'm sure. Many users of social media and the internet in general lament 2016 was a bad year for a number of reasons revolving around the deaths of musicians, actors, and all celebrity types - as well as some controversial moves in political theatre.

I imagine in every craft there are blunders and setbacks so extreme they are marked in the respective calendars of that community. The kind of sobering events like a nuclear reactor meltdown adding to the stigma of nuclear power - that sort of thing.

So what then are the remarkable lows for the science community this year?

labortooth

TA: yes, we've picked four Breakdowns of the Year, along with Breakthroughs. I won't give them away (they're out Dec 22), but as an example last year our Breakdowns were the eruptions (or revelations) of sexism in science, the controversy over the Thirty-Meter Telescope in Hawaii, and the destruction of antiquities in the Middle East.

I took a research misconduct course this quarter and obviously one of the focuses was on data falsification and fabrication. High-impact journals like Science tend to have a higher number of retractions than other journals. When you consider Breakthrough of the Year, do you give any consideration to whether or not the claim is valid? Or do you fully trust the peer review system and assume that everything written is truthful?

penguinberg

TA: we certainly don't just assume that because something has passed peer review, it must be valid. Peer review is a good screen, but we also do our own checking to see what the community thinks. We want the Breakthrough of the Year to be new, exciting, important--and (probably) true.

What are your thoughts on newer awards such as the Breakthrough Prize offering large cash incentives? Are they competition for something like a Nobel or an Einstein World Award?

PHealthy

Hi PHealthy,

Adrian Cho, the physics reporter at Science. I like this question because we all tend to forget that the Nobel Prize was also just a publicity stunt when it started. It now has a well-earned cache for highlighting the best science. The Nobel committee generally does a pretty good job of selecting what is really important. The Breakthrough Prize doesn't seem to have quite figured out how to be selective. They kind of have given a big slap on the back to a lot of people who are actually pretty high profile for scientists anyway. But I don't think you can fault Yuri Milner and company for lobbing money at people. Most scientists aren't motivated by lucre, anyway, it seems to me.

What metrics do you use to choose which one is the breakthrough of the year?

For instance you have Male birth control being tested and outside of males being widely whiny when we can't take hormones lol it sounds like its being successful.

Then you have something like HIV cure entering phase 2 which is , in itself, a huge step forward for everyone.

I'd have a hard time deciding about just those two and i'm sure theres a million other ones (like aliens ;)) that are probably hard to choose from as well.

KRISKSU

Dear KRISKU,

Adrian Cho, physics writer here. Actually, there are no cut and dried objective criteria for Breakthrough of the Year. There are even differing opinions in the about what makes the best candidate--an obviously important trends involving multiple smaller results or one big result that fulfills some big prediction or opens up some new field? Most years, we generally agree on what the big story was. Some years, there's a lot more debate. Funnily enough, often the hardest critics of advances in particular fields are the writers and editors who cover those fields. You might think the deliberations would involve everybody pushing for the advance in his or her beat. It is basically never the case. One take-home message, though: The Breakthrough of the Year is largely a journalist judgment. It's not some sort of objective scientific comparison. People shouldn't take it too seriously and should remember that it started out as the obviously playful Molecule of the Year.

What metrics do you use to choose which one is the breakthrough of the year?

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KRISKSU

TA: Sometimes the big news of the year is obvious, and sometimes it’s hard to winnow the list. We don’t have any one metric; we weigh importance, the likelihood that a result will spawn further developments, enthusiasm in the community, and plain old fascination. But last year and this, we asked readers to vote on a list of candidates, and their top choice was different from ours.

Would each of you mind just telling a little bit about your personal favorite breakthroughs?

TheHungryScientist

TA: my favorite goes way back, to 1998, when we chose the accelerating universe as the Breakthrough. We were nervous: the key discoveries were just months old, and some people thought the finding might just go away, because the measurements of distant supernovae were really hard and open to all kinds of confounders. But we took the plunge, and we were right: It turned out to be the biggest discovery about the universe since the detection of the cosmic microwave background.

Would each of you mind just telling a little bit about your personal favorite breakthroughs?

TheHungryScientist

VV- my favorite was Cancer Immunotherapy in 2013. We picked this early enough that it had an impact on how the field was recognized.

Would each of you mind just telling a little bit about your personal favorite breakthroughs?

TheHungryScientist

CM: I can't tell you what my personal favorite is from this year (results are out next week!), but my favorite from last year was reproducibility in psychology, third one down.

Hi Science Magazine!

I'm a sophomore in college, and though I'm on the pre-vet track right now I'm really considering going into pop-science writing. I write for the newspaper and run a science/history blog, and I plan on taking a course in pop-science writing next semester.

Is science writing a viable career option? What other steps can I take?

Thanks for educating the public!

DragonLadyoftheWest

TA: It's a viable career but it's not an easy road, given the turmoil in journalism. It's easier than ever to get readers, harder to earn a living wage. If you want to get paying assignments, and maybe even a job, you'll need published clips--your blog and newspaper are a good start. You can also take a graduate course in science journalism, which will give you more skills and connections, and might open the way to an internship.

In the time you've having Breakthrough of the Year, what is the biggest scientific discovery that you have overlooked, or has been overshadowed by another discovery, and hasn't been named Breakthrough of the Year?

MarsNirgal

MarsNirgal,

Wow, this is a tough question! I guess it comes down to things I wish I had written about but haven't. I'll say I should have written about black hole firewalls and the idea that when you fall into a black hole you run into this all-obliterating wall inside of the event horizon--although this is a theoretical prediction and not an established fact.

Another one: Back in 2007, DARPA held its Urban Challenge, in which the first fully autonomous vehicles had to navigate traffic. We covered the event--which was more of an engineering advance than a scientific event--but we didn't cover it in Breakthrough of the Year. Given the speed with which autonomous vehicles are emerging as a real technology and the potential impact on society, I would argue that, in retrospect, that should have gone on the list of Runners Up for 2007 at least.

Thanks for joining us!

What's the craziest/wackiest research you've come across this year? What has been the most viewed article on Science this year? What about the most shared on social media?

shiruken

TA: Our top stories were all over the place, but all fascinating (IMO). Here are some of them:

http://www.sciencemag.org/news/2016/07/humpbacks-protect-seals-and-other-animals-killer-whales-why

http://www.sciencemag.org/news/2016/08/just-90-companies-are-blame-most-climate-change-carbon-accountant-says

http://www.sciencemag.org/news/2016/01/feature-astronomers-say-neptune-sized-planet-lurks-unseen-solar-system

Thanks for joining us!

What's the craziest/wackiest research you've come across this year? What has been the most viewed article on Science this year? What about the most shared on social media?

shiruken

CM: Here are the top five most viewed stories this year (from all sources):

*Astronomers say a Neptune-sized planet lurks beyond Pluto *Scientists gear up to drill into 'ground zero' of the impact that killed the dinosaurs *How to (seriously) read a scientific paper*Who's downloading pirated papers? Everyone *Gravitational waves, Einstein's ripples in spacetime, spotted for first time

By day I do infectious disease research, and in my free time I am a fledgling science writer.

As a freelancer, how does one find and pitch interesting and compelling stories that aren't necessarily the big "breakthrough" stories that are already being covered by staff writers?

And what tips do you have for constructing a good pitch that will grab an editors attention?

Thanks for doing this AMA!

marzeepan

CM: This awesome column on pitching from TON might help. If you have other questions, feel free to email me!

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Thanks for doing this AMA!

marzeepan

TA: Find a niche that isn't being covered widely. It could be some field of research that especially strong in your university or region, or a field that doesn't get a lot of press attention, say some areas of ecology, evolutionary biology, archaeology. Don't pitch stuff from Science, Nature, PNAS--you'll have too much competition. Scan TOCs from secondary journals and develop sources who can tell you

about work that won't make the big journals but is still interesting. And look for stories about people in science--those don't get press-released, and you're more likely to have them to yourself. As for pitching, stress what's new and why it matters, show that you can write clear and lively prose, and link to some of your other clips.

What are your thoughts about the zika virus? Do you see any resolution soon?

lillz99

[hello this is LC] Many aspects of Zika are not well understood. We don't know how many different species of mosquitoes can transmit the virus, how the virus infects its hosts, or what the long term effects of infection are, for example. Good Zika diagnostics and a vaccine are urgently needed. Such things will be discussed at this meeting early next year: https://www.astmh.org/news-events/events-calendar/first-international-conference-on-zika-virus

Hi everyone!

I follow the Science feed so skim through when I can to see what new and noteworthy research has come out over the last week, even outside my field. A question I have for the news team is how you find research in other publications that's worth sharing in the pages of Science? How do you keep on top of the relevant literature (or do you?) and how do you navigate the tension between publishers, as a lot of the research you highlight might be in your competitor's journals?

superhelical

CM: Hi superhelical, I think that Adrian can probably answer this question better than I, but the number one answer IMHO is *talking to people.* That might sound obvious, but it's something that fewer and fewer reporters—particularly outside of science reporting—feel they have the luxury to do: develop a beat, and check in regularly with sources and "guides" who are in the know about new developments in a particular field. The cool thing about reporting on science is that you can quickly get a sense of who's who in an area by figuring out the relationships between advisers and students, coauthors, etc.

Other great sources: scientific meetings, meeting abstracts, obscure journals, non-press released papers from TOCs, and social media. And those are just the obvious ones.

Does a PhD interested in science writing/editing *have* to do a postdoc first?

SEXPILUS

TA: No, most science writers I know haven't gone further than a PhD. And some didn't go that far. Face it, when you're reporting on science, you'll almost always be writing about something outside your field.

Should we be concerned about issues with the peer review process , and published research that cannot be replicated, or are these problems only isolated cases.

madmaxges

This is VV - We seek to run a review process that is as fair and thorough as possible. We recently instituted cross-review where, once reviews are in, reviewers see each others reviews and find this a useful cross-check. Data availability is also important to replication - we have always had strong data availability policies and are working to improve data accessibility further. However good our processes

are, there will be some papers that are found to have problems after publication. We consider this post-publication "review" an important part of the scientific process.

What can the consumers/readers interested in these breakthrough's do to help promote this information on more 'mainstream' mediums?

barker5227

CM: Share them with your friends (or your soon-to-be friends)! Then talk about them in the same spirit of curiosity and wonder that most people reserve for celebrity news. Not sure how actionable that is, but there you have it! ;)

How often do you accept an article from less well funded sources? I mean, it seems to me like the greatest science advancements and discoveries are made only in huge projects, especially in the physical sciences (places like CERN, fermilab, LIGO, Joint institute, etc.)

flankling

Many of our papers come not from big consortia, but from single labs. We don't consider the funding when evaluating papers. That said having funding sure helps with doing exciting research

How likely is it for information technology/computer sciences to be a contending player over the more traditional science fields this year? Secondly, what are the focal points of technology breakthroughs of 2016 that we would becoming more common of next year?

stayoungodancing

Dear stayoungodancing,

Adrian Cho, house physics nerd here. Information technology and computer science are definitely things we're interested in and should follow more closely. A couple of challenges with these fields include that they are often seen more as engineering than science and that advances tend roll out in overtime in incremental--and patented, not published--results. As for technology breakthroughs, we generally stick more to the basic research side. And one year is an awfully short time for a technology to go from breakthrough to market!

Hey! Just a quick question:

What advancement in experimental physics do you think will change the life of the "everyday man" the most in our lifetime (next 50 years or so)?

HyperbolicPerson

Dear HyperbolicPerson,

Adrian Cho, house physics nerd here. I have to say, I think the most important physics innovation in recent history came about in 1947 with the invention of the transistor. It's hard to point to a basic technology that has had a bigger impact on humanity or to imagine one that will compete. That said, if perovskite solar cells can really work as hoped, then they could greatly benefit us all. https://www.sciencemag.org/news/2016/12/low-cost-solar-cells-poised-commercial-breakthrough

This Reddit Ask us is AWESOME.

What Breakthrough of the Year in the future would you like to see? I know something that changes the weather to alleviate massive droughts is it for me.

Ellexoxoxo33

vv- I'd love to see a cure for Alzheimer's

What are each of your personal, favorite breakthrough's, thus far?

Endy_

Dear Endy,

Adrian Cho, house physics nerd here. I really liked reaching the quantum limit of mechanical motion, which was the Breakthrough of the Year in 2010.
http://www.sciencemag.org/careers/2010/12/breakthrough-year-bridging-quantum-and-classical-worlds
The Higgs in 2012 was great, of course, but it was a lot more predictable. It was a lot of fun to have a "table top" physic experiment.

What are each of your personal, favorite breakthrough's, thus far?

Endy_

CM: (see above) I can't tell you what my personal favorite is from this year (results are out next week!), but my favorite from last year was reproducibility in psychology, the third one down.

What are each of your personal, favorite breakthrough's, thus far?

Endy_

VV - Cancer Immunology in 2013 would be my favorite. We made the call early enough that I think it had an impact on how the field was recognized?

Thanks for doing the AMA!

How do you sort through the many "this could be big if confirmed" papers to find the one which is actually likely to be confirmed?

I feel like this is a similar question that grant reviewers face (although grants are sometimes "high risk")--how likely is this to actually work. Do you feel like a focus on that sort of question improves science?

formative_informer

CM: Hi! Is this one intended for the editors who review papers for publication, or the reporters who decide which stories to write about? I'm guessing it's the former...

Hi! I have a question concerning the impact of your decision: do your highlight of specific breakthrough impacts future fundings in the corresponding fields? And, in the past, how the fields associated with the breakthrough issues have evolved?

Akrasik

[LC] We don't have metrics on the Breakthrough's impact on funding, but for example, when we recognized Cancer Immunotherapy as the winner in 2013, scientists in both cancer and immunology fields were excited. The Breakthroughs often receive greater public awareness, which can have an impact on public opinion, and possibly funding.

Thanks for giving us this opportunity.

My question is regarding scientific advancements. There are some people who say that if you look at the period of 1915 to 1965, there were some remarkable theories advanced in science and engineering (e.g. DNA; transistors; nuclear power). And that the last 50 years have seen less advancement -- in terms of something groundbreaking from a theory or 'way of thinking' point of view -- and have been more incremental. What are your thoughts on this?

FYI - My question is inspired by the recent PNAS article of "Science in the age of selfies" - http://www.pnas.org/content/113/34/9384.full?sid=19a1d9cb-bde7-46ee-b450-54732754c918

justacanuck

Dear justacanuck,

Speaking as a lapsed physicist, think that point is absolutely correct and undeniable. In the first half of the 20th century physicists determined the structure of the atom, fathomed the nucleus, discovered galaxies beyond our own, deciphered gravity, and put chemistry on a completely rigorous foundation. Most of this involved the enormous conceptual leap of quantum mechanics, as well as Einstein's theories of special and general relativity. Of course, chemistry, biology, materials science, electronics, and myriad other fields benefitted from the conceptual advanced made during this era. And it seems entirely likely that there are no similar conceptual advances on the horizon--the promises of string theorists notwithstanding.

That doesn't mean that science is ending or winding down. But it certainly suggests that, at least in the physical science, the emphasis has long ago switched from the search for principles to the exploration of what those principles imply. Just look at the growth of interest in quantum information and quantum computing. It's great science, but it's using quantum mechanics as a tool.

[deleted]

[deleted]

VV- We have a journal called Science Translational Medicine that has the goal of publishing science that advances that move from bench to bedside. That said I don't think we can cut corners in developing therapeutics.

Do you factor what the findings implicate socially in the decision-making process at all? Could you elaborate on how you rank/weight discoveries in different fields? Example: The magnitude of impact a breakthrough in controlling fusion reactions would have on the arc of humanity

treesperm

Dear treesperm,

Adrian Cho, house physic nerd here. There are no objective rules and standards for the Breakthrough of the Year. That said, something that is going to have a profound impact on society always has that going for it, no doubt about it. Imagine that eleven years from now scientists both cure Alzheimer's disease and build a quantum computer. My money goes on the cure for the disease, no question. As for something like fusion, I'd add that there has to be an a real advance before something is in contention. If ITER works, that would be great. But ITER isn't even in the running until then, right?

Hi! This'll probably get shuffled to the bottom of the deck but I wanted to say that your podcast is one of my favourite parts of the week. Especially this past year with the election you gave me a great way to escape from politics. Love you guys and thanks for all you do <3

FezezAreCool

vv-not at the bottom of my deck - and thanks, I'll pass this on to our podcast producer

What criteria are you applying to count a breakthrough as this year? Is it first publication, confirmation of it etc? How do you account for breakthroughs that have been the result of incremental progress over the course of decades from multiple teams?

mrcchapman

[LC] Certain basic science discoveries are not immediately recognized as breakthroughs, and only become so after years of further research lead to an amazing application. Take the microbiome. That field emerged several years ago with pioneers of gut biology like Jeff Gordon. Science has given a nod to this fast-paced field as a breakthrough runner up, and this year, human stool in fecal microbiota transplantation therapy was now approved for some gastroenterologic diseases.

Sad to see no mention of robot scientists - robots with AI that are actually deciding on which experiments to perform and learning the underlying science from experimental outcomes. It's automation of the scientific endeavor.

thirdworldprobs

CM: Depends on what you mean by "robot scientists." Machine learning could conceivably called one way that AI is already starting to solve problems in place of humans. Right now, it's focused on a lot of “small things”—voice recognition, pattern recognition, etc. But, and I think I’m right about this, there are some pretty cool new big-picture applications of AI, in areas like drug discovery.