Science AMA Series: I am Francis Collins, current Director of the National Institutes of Health and former U.S. leader of the successful Human Genome Project. Ask me anything!

NIHDirector [1] and r/Science AMAs[1]

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April 17, 2023

Abstract

Hi reddit! I am Francis Collins, Director of the National Institutes of Health where I oversee the work of the largest supporter of biomedical research in the world, spanning the spectrum from basic to clinical research. In my role as the NIH Director, I oversee the NIH's efforts in building groundbreaking initiatives such as the BRAIN Initiative, the Big Data to Knowledge (BD2K) Initiative, the Precision Medicine Initiative Cohort Program, and the Vice President's Cancer Moonshot program. In addition to these programs, my colleagues and I work to promote diversity in the biomedical workforce, improve scientific policy with the aim to improve the accuracy of outcomes, continue NIH's commitment to basic science, and increase open access to data. Happy DNA Day! We've come a long way since the completion of the Human Genome Project. Researchers are now collaborating on a wide range of projects that use measures of environmental exposure, social and behavioral factors, and genomic tools and technologies to expand our understanding of human biology and combat human disease. In particular, these advances in technology and our understanding of our DNA has allowed us to envision a future where prevention and treatment will be tailored to our personal circumstances. The President's Precision Medicine Initiative, being launched this year, will enroll one million or more Americans by 2019, and will enable us to test these exciting ideas in the largest longitudinal cohort study ever imagined in the U.S. Proof! I'll be here April 25, 2016 from 11:30 am - 12:15 pm ET. Looking forward to answering your questions! Ask Me Anything! Edit: Thanks for a great AMA! I've enjoyed all of your questions and tried to answer as many as I could! Signing off now.

the WINNOWER

REDDIT

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NIHDIRECTOR R/SCIENCE

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I want to say thank you. When I was a junior in high school -2001 ish time frame- I wrote a research paper on the human genome project and you were kind enough to take time out of your day to let me interview you at the NIH. That always stuck with me and I ended going on to earn my masters in microbiology while working at NASA KSC.

I still have the educational materials you gave me (and I got an A on that project).

On to my question! What do you see as the future for public access to not just data, but published, peer reviewed papers? And along with that, how can we best improve scientific literacy in the general population?

fishwithfeet

Congrats on the A and on what you have gone on to do in science! I am glad I had a chance to play a very small role in your development of these research interests. I agree with you that public access to scientific information is critical and the NIH has been working hard to make all of those publications freely accessible without public charge. An increasing numbers of journals are making that possible immediately, at the time of publication, but any NIH research has to be available in PubMed central

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within 12 months. Our preference would be to have everything available immediately.

Scientific literacy in the general population is a challenging problem and needs to begin with strong science curriculum in the schools. NIH provides a wealth of well curated, reliable scientific information at NIH.gov and in special resources like Medline Plus. A person interested in the progress of science can find excellent articles in the public press. Though science journalism has been, in many instances, the victim of budget cuts in the media. Finally, people interested in the latest breakthroughs in medical research should signup to review my blog which posts exciting new discoveries every Tuesday and Thursday: https://directorsblog.nih.gov/.

Hi Dr. Collins, as a postdoc in biomedical sciences, it pains me to constantly hear that we do not have enough young people getting into science when currently we have more PhDs being awarded than we are able to support. What are your thoughts on the PhD student basically being cheap labor where in many instances they do not receive the proper support and help with career planning, are not given a realistic view of the probability they will be able to get a faculty position down the road, and the fact that many scientists are stuck in the postdoc holding pattern, underpaid, overworked, and often feeling unappreciated?

ONeill_Two_Ls

Your words certainly underline the challenges currently faced by postdocs and NIH is profoundly supportive and sympathetic. You might want to review our working group report on the biomedical research workforce: http://acd.od.nih.gov/bmw_report.pdf. The good news is that unemployment among doctoral-level scientists is extremely low, but the finding that surprised many people is that only 24 percent are in tenure track or tenured faculty positions while many trainees assume that this is the ideal pathway. NIH recognizes that we have a responsibility that trainees appreciate the existence of many other highly rewarding professional paths. The BEST program (http://commonfund.nih.gov/workforce/index) is a pilot to allow exposure to lots of different scientific careers for graduate students and we are encouraging all institutions to do a better job of providing that kind of information. Being involved in biomedical research right now provides an amazing opportunity for a life-long, satisfying journey of discovery, but not all of those experiences have to happen in the traditional way.

As the head of the largest funding agency for academic biomedical research, how do you see the funding model for academia going forward? It seems to be a fundamentally flawed institution when people who are meant to be doing research spend most of their time trying to secure funding.

Additionally, how do you see the new overtime regulations as they apply to postdocs? Most academic postdocs make 40-50k/year working 60-80 hour weeks following ~10 years of postsecondary education, and they are the backbone of many research efforts!

minutethree

As for the first question, the best solution is to see the total amount of funding rise so that success rates for applications go up to where they have been historically, which was about 30 percent. Currently, they are at 19 percent, but we are optimistic based on strong bi-partisan support for medical research that we have turned the corner and will start to see improvement in those resources.

To your second question, we are working with the Department of Labor on the postdoc overtime issue; we are strongly supportive of postdoc fellow and want to achieve an outcome that is fair to the incredible work they do.

Hello Dr. Collins,

Thanks to your AMA I am interested in reading your book. The Language of God to gain a new perspective. I am a science teacher who has faced a bit of persecution in a small town for teaching evolution in my science classroom. While I am not a theist, I have no problem with people believing in theistic evolution. I also follow the law and simply teach the basics of evolution to my students without anti-theist or theistic biases.

How would you sum up your feelings of the current public debate over the teaching of evolution in the classroom? And do you have any wise words for a teacher that has kept biases out of the classroom and just taught evolution, yet has faced rumors, lies, and misunderstanding about what is being taught in the classroom? I'm sure I'm not alone in this.

Also, how would you explain vestigial organs that appear to be total mess-ups like the larangyal nerve in the giraffe and tetrapods? I'm curious of a BioLogos perspective on those kinds of organizational issues of life.

onwisconsin1

I am sympathetic with the challenges you face teaching evolution in the public schools when regrettably there are still conservative religious groups who see this as an attack on their faith. With evolution now supported scientifically just as strongly as gravity, we would be doing a deep disservice to students to keep this information away from them. As Dobzhansky said, “Nothing in biology makes sense except in the light of evolution.” Given that today is DNA day, we should particularly celebrate the way in which DNA provides a molecular explanation for Darwin’s original theory. My own sense is that the tension about teaching evolution in the classroom is somewhat diminished following the Dover court case, but that may not be true everywhere. As to the question about vestigial organs, this is a long conversation, but a theistic evolutionist would find no discordance between those observations and the original plan for living things coming from a divine source.

Hey Dr Collins! Thanks so much for joining us today! I have two questions- as someone who works in genetic epidemiology, the lack of diversity in our largest genetic datasets is worrying. Setting aside the problematic societal and healthcare equality implications, it is a poor choice from a staight haplotypic diversity/gene localization/computational standpoint. The new precision medicine cohort initiative is an exciting oppotunity to improve the power of existing datasets and increase sample diversity. How is the cohort being designed in the face of these issues?

Secondly, despite the ESI bump, the average age of first NIH R01 has held steady at around 42. This represents an average of 10-12 years of failed large-scale funding, something that most universities won't tolerate, and resulting in a loss of innovative young minds to the private sector and elsewhere. In an age of increased competition for sparse funding, what more do you think we should be doing to encourage and support early stage investigators?

p1percub

I am glad you are following the planning for the Precision Medicine Initiative cohort and you are quiet right that one of its major goals is to over sample groups that are traditionally underrepresented in medical research and thereby makeup for some of the missing diversity in both genetics and other kinds of variables.

The ‘ESI bump’ has kept this from being even more distressing but you are right that we still have more that needs to be done. A small but significant program is the Early Independence Award https://commonfund.nih.gov/earlyindependence/index which allows talented individuals to skip the postdoc all together and go straight to an independent position. We are also putting more pressure on

training programs to limit the duration of pre-doctoral and post-doctoral training to allow independence to occur at an earlier point. For physician scientist, we are exploring ways to integrate clinical and research training to make them both more efficiency and more holistic.

Hi Dr. Collins. Due to the rising number of retracted papers and errata in the biomedical sciences and the lack of reproducibility of many key study results, it seems like the scientific community needs better quality control than our current peer review system provides. Does the NIH have any initiatives being developed to promote more reproducible science and better communication of science?

Edit: phrasing

catvender

Great question! NIH is very concerned about this issue and invested in finding solutions. NIH Principal Deputy Director Larry Tabak has taken the lead on this. You can read about the many steps we are taking at: https://www.nih.gov/research-training/rigor-reproducibility. One important issue for which you can see examples of training videos on the website is to do a better job in educating student researchers about experimental design. The need for carefully chosen controls and inclusion of biological replicates is crucial if the results are to be trustworthy. We've also worked with journals to make sure that experimental methods are fully described and even asked them to use checklists to be sure that the description of studies that are particularly prone to reproducibility problems (such as preclinical studies of drug therapy in animal models) have followed all of the necessary design considerations.

Hi Dr. Collins! Undergraduate genetics student here. What future do you see in the world of personalized medicine for technologies like CRISPR/Cas9, or do you think the ethical hurdles are too great for it to be used to treat/prevent genetic disorders?

IamA_reptile_AMA

The potential of CRISPR/Cas9 to revolutionize our understanding of biology is already happening. Virtually all labs trying to understand the relationship between genes and function including my own are utilizing this approach to get answers at unprecedented speed. CRISPR/Cas9 also provides the opportunity for somatic treatment of diseases like sickle cell anemia and we should all celebrate that opportunity. The ethically challenging application to editing the genome of human embryos deserves close scrutiny and is getting that through a variety of international workshops and deliberations. Virtually everyone agrees that modifying the human germline with the intent to create a modified human is something we should not do at the present time and maybe not ever.

Did the impact on human health of the human genome project meet your expectations?

Are we where you thought we would be? I saw you at a talk shortly after the publication of the first draft human genome and you talked about aiming for the $3000 genome that you thought would make personal genomics feasible. Are we there now? Why or why not?

Edit: The talk was both yourself and Craig Venter. I can't remember which of you originally proposed the $3000 price point but you both seemed to agree that there was some threshold that would make personal genomes feasible.

spinur1848

It might well have been me because I have been dreaming of a $1000 genome since 2003 and we are there now. The impact on human health is growing by the day especially in the field of cancer, but most of the impact on daily care of average individuals still lies ahead. The technology that has arisen from the Human Genome Project has made a profound difference in how we approach virtually all research questions. But so far, most of us have not had a detailed analysis of our genomes. Here on DNA Day 2016, get ready, because that time will be coming before long and if you want to be an early participant on how that might influence human health, stay tuned to the launch of the Precision Medicine Initiative Cohort: https://www.nih.gov/precision-medicine-initiative-cohort-program. Maybe you would like to be one of the 1 million national adventurers.

Why do some major science iniatives fail while others succeed? Kennedy: go to moon in ten years. Reagan: cure cancer in ten years. Thank you for your work.

hhp_runner

Science is unpredictable. If every initiative succeeded, we would probably not be bold enough. But some efforts like going to the moon depend upon sophisticated engineering advances working with well-established principles whereas initiatives in the life sciences are challenged by how much we still don't know. For cancer, previous initiatives were launched at a time where we lacked a fundamental understanding of the nature of the disease. While we still have a lot to learn, the current 'cancer moonshot' program, led by the Vice President, has a realistic opportunity to accelerate progress at a time of great scientific opportunity. But, let's be clear, cancer is hundreds of disease and progress will occur at different rates for each of them.

Hi Dr. Collins, thank you for doing this AMA! In short, my question is what your goals are for the BRAIN Initiative, what would be necessary for you to consider it a success worthy of its time and money investment, and what would be something that you would hope, although not necessarily expect for it to accomplish?

twominitsturkish

The goals are laid out in the report that you can find on the NIH website: http://www.braininitiative.nih.gov/ and they extend through 2025. Simply put: the goal is to understand how circuits in the human brain involving millions of neurons carry out complex functions in real time. My hope is that that foundation of normal function will provide profound insights into brain disorders like autism, schizophrenia, Alzheimer's, epilepsy and traumatic brain injury.

Hello Dr Collins,

Thank you for doing this AMA! My question is as follows. I am an undergraduate student studying Life Sciences and I will be completing my degree within the next year. Naturally, I've begun to search for graduate programs and such, however, many professionals in the field of biomedical research have told me that funding is getting increasingly more difficult to obtain, and to consider options outside of graduate studies due to this lack of available funds. What advice would you have for a student in my position who has a keen interest in biomedical research and medicine, given what I have been told by a multitude of professionals?

corefor

While it is true that funding is tight right now, I would not want anyone who has a passion for pursuing graduate studies in life sciences to be discouraged from doing so. We have gone through challenging

times in the past and come through reasonable well and there is a sense that the difficult decade we have just been through is about to turn a corner. Even if your graduate studies don't lead you to becoming an academic professor, there are zillions of other career paths that will be opened up to you if you have a PhD in biological sciences. So go for it!

I recently had my DNA sequenced through 23andMe.

They said that a percentage of my genome couldn't be sequenced because it was "too unique to definitively match" to any specific data they had.

What could be so different about my genome?

Barracuda00

If you look closely enough, all of our genomes are unique unless we have an identical twin. Each of us has about 60 new mutations that were not present in our parents and may never have been present in anyone until us. Some of those variations involve duplications of large segments of DNA, which may be difficult to map back to the reference sequence. So, don't assume that there is something seriously awry with your genome. We are all in the same boat.

As director of the NIH, do you believe your institution is achieving an appropriate balance between intramural and extramural research funding? What would you say are the pros and cons of these two different models, and are they each living up to their full potential?

Solfatara

We currently invest about 84 percent of the NIH budget in extramural research projects chosen after rigorous peer review that supports biomedical research in all 50 states. That investment has led to advances in everything from basic to translational to clinical research and to the awarding of more than 140 Nobel prizes. The NIH intramural program is about 11 percent of the budget and is particularly focused on projects that require long-term investments (like making vaccines) and on projects that benefit from access to the world's largest research hospital, the NIH Clinical Center, where many medical breakthroughs have occurred over the decades. Research in the intramural program is also rigorously peer reviewed. Right now, I think we have the balance about right and it has been consistent for decades.