Science AMA Series: I am Carolyn Bertozzi, Professor of Chemistry at Stanford University, & Editor-in-Chief of ACS Central Science. I study how sugar molecules on the surfaces of cells let them "talk" to each other. AMAA.

self.science

1 year ago by * (last edited 1 year ago)
Carolyn_Bertozzi
Professor of Chemistry at Stanford University

Hi Reddit – I am a Professor of Chemistry at Stanford University. I am part of the new of Chemistry, Engineering & Medicine for Human Health (ChEM-H) center (https://chemh.stanford.edu/) where the goal is to bring together chemists, engineers, biologists, and clinicians to understand life at a chemical level and apply that knowledge to improving human health. That mission basically sums up what I have tried to do for my entire career. In my lab, we have pioneered new chemistries that allow scientists to look in and "see" inside cells and animals in a way that would never be possible otherwise. Last year, I signed on as the inaugural Editor-in-Chief of a brand new journal from the American Chemical Society, ACS Central Science (pubs.acs.org/centralscience). We aspire to publish the most exciting scientific research that highlights the centrality of chemistry, in an open access format that allows anyone to read it, anywhere in the world. Ask me more about my

2086

Welcome to r/science

Submission Requirements

1. Directly link to published peer-reviewed research articles or a brief media summary
2. No summaries of summaries, reviews or popular reposts (over 100 upvotes)
3. Research must be less than 6 months old
4. No sensationalized titles, all titles must include the model where applicable
5. No blogspam, images, videos, infographics
6. All submissions must be flaired and contain a link to the published article, either in the submission link or as a standalone comment.

Comment Rules

1. On-topic. No memes/jokes/etc.
2. No abusive/offensive/spam comments.
3. Non-professional personal anecdotes may be removed
4. Arguments dismissing established scientific theories must contain

research, deciding to change universities after twenty years, the new journal and what we hope to accomplish, advice for grad students and new faculty… I'll be back later to answer your questions, go ahead, AMAA!

Hi, I am here on line ready to answer your questions. Keep them coming!

Thanks for the great questions and participations. Signing off, Carolyn

185 comments share

All 185 Comments

sorted by: q&a (suggested)

[–] **halla14** 177 points 1 year ago

As a professor, how do you reconcile the growing unemployment rate of chemists with the desire to encourage them to be chemists? Should they be encouraged to pursue other fields with more promising outlooks?

Alternatively, do you think the chemistry and life sciences should change their curriculum to emulate engineers, who train for specific jobs. For example, majoring in drug development, catalysis, etc...

There are a lot of recent graduates who are very bitter at the time and effort they took to achieve a BS/MS/PhD only to be unemployed or moving between temp jobs.

Thanks for doing the AMA!

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 69 points 1 year ago

Looks like a good string of comments below that address various issues regarding chemistry employment. As said, the unemployment rate for chemists is quite low compared to general unemployment for people with matched educational degrees (I think it is below 3% for ACS members). Having said that, employment opportunities vary depending on subdiscipline as do unemployment trends. For example, whereas the percentage of US chemists employed in pharmaceutical industry has declined over the last decade, in other areas it has increased (analytical chemistry, fine chemicals, paints, and materials - in the oil and auto industries, for example). But new chemists (fresh BS and PhD) are having a harder time than

substantial, peer-reviewed evidence
5. No medical advice!

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Upcoming AMAs

(All times and dates are USA East Coast Time)

29 Aug-1pm
Carl Safina
Beyond Words: What Animals Think and Feel

30 Aug-11am
American Chemical Society AMA

30 Aug-4pm
Schmidt Ocean Institute ROV Team
Designing and Testing an Underwater ROV

31 Aug-1pm
PLOS Science Wednesday:

1 Sep-1pm
Gerbrand Ceder: Designing better batteries for a better future

2 Sep-1pm
Marko Russiver, Guaana

they did in former booming economies so there are some challenges to address.

My own personal experience with students and postdocs supports the notion that opportunities vary depending on a chemists' specialty. For example, my students and postdocs who work on projects heavy in biological mass spectrometry (protein analysis, proteomics methodology, for example) are in high demand. I send them to an ASMS meeting and they come back with job offers, right out of grad school with no postdoc if they want. Also, my students and postdocs with bioconjugation expertise are getting plucked left and right - antibody-drug conjugates are hot in biopharma and many companies are building their own internal groups.

When I first started my academic job in the mid-1990s it was a very different market. Medicinal chemists were in high demand in pharma and students from my lab, with more interdisciplinary training, had a hard time competing for those jobs with the more "hard core" synthetic chemists (having said that, the economy was so good that even my students went into pharma with no postdoc necessary, just with 2 or 3 offers rather than 7 or 8 - hard to picture these days!). One of my former PhD students even chose to do a postdoc in a total synthesis lab to position herself for such jobs.

Now, it is the opposite trend. I am saturated with postdoc applications from synthetic chemists who want to diversify their skill set into biology, biochemistry, mass spec, whatever, to compete for a more diverse job pool.

In the Bay Area, the big employment wave is running toward IT-turned-biopharm giants GoogleX and, soon, 23&me. They are snapping up chemists from chemical biology, materials science, and other interdisciplinary training environments. message to students is to think broadly about your training experience and if your PhD work is focused in an area that does overlay well with current hiring trends, do a postdoc in something totally different that will expand your mind in new directions and position you for new opportunities.

Agree that salaries could use a boost....

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[–] **chemjobber** PhD | Chemistry | Process Chemistry 33 points 1 year ago*

> As said, the unemployment rate for chemists is quite low compared to general unemployment for people with matched educational degrees (I think it is below 3% for ACS members.)

The 2014 ACS Salary Survey shows a 2.9% unemployment rate. The unemployment rate for chemists from the American Chemical Society is from the ACS Salary Survey, which is

a survey of only members who respond. The response rate for the survey is miserable at 23%.

The responses also reflect the the heavily-academic membership of the organization (38% academic, 52% industrial), the PhD-heavy nature of ACS (over 69% of respondents have a Ph.D.) The unemployment rate does NOT cover the 2.3% of respondents who are in temporary postdoctoral positions.

It should be noted that the US Bureau of Labor Statistics shows a 2.1% unemployment rate for all workers (scientific or not) with a Ph.D. and a 2.8% unemployment rate for those with a master's. I believe that BLS probably has better numbers and a better read on unemployment than ACS. Even if we are going to compare ACS members to "people with matched educational degrees", ACS members come out *worse*, not better.

Finally, Prof. Bertozzi (who I like and admire) missed the overall salary trends from the ACS Salary Survey:

> Looking at the data in the longer term highlights stark trends in chemists' purchasing power. Compared with a decade ago, median salaries have **shrunk** 11.7% for Ph.D.s, 6.8% for chemists with M.S. degrees, and 7.9% for those with bachelor's degrees, in terms of constant dollars.

TLDR: Apples and oranges. Even then, the apples are smaller than the oranges, and potentially getting sour-er.

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[–] **owiseone23** MD|Internal Medicine|Cardiologist 25 points 1 year ago

Hi Professor Bertozzi, I am a cardiologist and used to always value practice over academia. However, I recently gained a thirst for something more. I attained an additional degree in healthcare management and co-authored a paper in the NEJM. Do you have any advice for someone looking to become more involved with the academic side of their profession?

On a slightly different note, how do you see your role as a researcher vs. an educator? When I was in school, I generally thought that there were two types of profs: those there mainly to research and those there mainly to teach. Do you think you have to choose a side, or can professors do both well?

Thank you.

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 21 points 1 year ago

Physician scientists are a rare breed and I applaud you for pursuing your interests in research, especially when there are so many demands and incentives to focus entirely on your clinical practice. I imagine there are programs (fellowships, sabbatical opportunities?) that would enable physicians to participate in substantial research activities (NIH, HHMI?). To be sure, at Stanford ChEM-H we are keen to recruit MD-PhDs who seek to run a word-class research program as well as maintain clinical activity; they are hard to find! I think having conversations with academic researchers aligned with your interests is the perfect place to start.

As for teaching and research, many people discuss these activities as if they are in conflict with each other; and we all know that professors have various skill and passion levels when it comes to teaching! For me, there is no tension between teaching and research - they each strengthen and motivate each other. The goal of our research is to teach the world something not known,

and the goal of teaching is to share with young scientists new knowledge, some of which we acquire in the lab, that enables and inspires their growth.

From a practical perspective, teaching can be a muse for new research ideas. Indeed, we developed a reaction called "copper-free click chemistry" that exploits the ring strain of a cyclooctyne reagent to activate its reaction with azides. That idea came when I was writing my lecture on ring strain for sophomore organic chemistry students.

I think if you are hired at a top-notch research university, the expectation is that you should do your best job in both research and teaching, and not sacrifice one or the other- there should be some pride in that effort.

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[–] **owiseone23** MD|Internal Medicine|Cardiologist 2 points 1 year ago

Great answers, thank you!

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[–] **Comment removed** 1 year ago

[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 11 points 1 year ago

NIH has tried various experiments with study section compositions throughout the course of my career, trying to do justice to the hard work of PIs. In my own field of glycobiology, we have seen all variations of the clustering issue - putting them all into one niche study section, and spreading them out so thin that no one study section has the core of expertise to review them. I don't know the best approach, but I am glad that NIH staff (an impressive bunch, if you meet them) are willing to try new approaches when problems arise. I would be curious to see how other chemistry-related funding agencies (NSF, DOE, DOD agencies, etc) manage these issues.

The last question is timely as I recently taught a chemical biology graduate class and asked myself this very question. When I started my career, chemical biology was a new term and everyone was excited about the potential impact on human health. 20 years later we are seeing the products of our basic research finally making an impact clinically (and as a comment below pointed out, this is a typical duration between discovery and implementation). Here are some examples: oligonucleotide therapies. Check out the antisense molecules now on the market (i.e., ISIS, Kynamro) - this is a product of chemical biology, including an understanding of the antisense mechanism, design of chemical modifications that enhance potency and PK, etc. Also, site-specific antibody-drug conjugates which populate preclinical pipelines - these reflect the convergence of protein engineering methods and bioorthogonal chemistries straight out of academic chemical biology labs.

So the time has now come when the fruits of chemical biology are now entering clinical practice and I am excited to see where we go next!

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[–] **Gambit45** 29 points 1 year ago

As a new graduate student I'm struggling to develop networking skills along with finishing my experiments. I'm passionate about science but I also want to complete work in a timely manner and be pragmatic about my career. As an extremely successful scientist what are those personal traits you have that separate you from other scientists in your field? What are those traits you have learned along the way?

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 23 points 1 year ago

I echo Krett's thoughtful advice. To be honest, I did not give much thought to my career or really anything beyond the boundaries of grad school while I was a PhD student. I had enough on my plate getting experiments to work and papers written. When it was time to think about my next move, I found something interesting in a new field I wanted to learn about and pursued it, and that worked out well for me. One thing I did learn in grad school which has been immensely helpful in all areas of life is how to be a "closer". That is, how to bring a project to a stage of completion where you have a product to show for it (in grad school, that product being a publication of some substance). When projects did not look like they had a path to closure, I learned how to redirect them toward such a path. The lesson was learned the hard way. My PhD advisor, a new assistant professor when I joined his lab, left the profession after my third year of grad school. For the last two years, I and two lab mates had to figure out how to finish our PhD work, get published and get jobs, with little "grown up supervision". Now in my own job, "closer" is the trait I value above all in my students and postdocs.

Another important trait that I got from my mother is a sense of humor. Can't over express how important it is to retain that in the face of life's curve balls!

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[–] **adenovato** Science Writer | Editor | Science Around Michigan 38 points 1 year ago

Welcome Dr. Bertozzi and thank you for joining us to share your knowledge.

You mention in your title that cells are utilizing sugar molecules to 'talk' with one another. Playing along with our anthropomorphic analogy here -- what are they saying?

Thanks!

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 15 points 1 year ago

Great question, what are they saying indeed! The comment below about HA is a great entry into this discussion. For decades, since grad school even, I have been reading papers that correlate altered cell surface glycosylation patterns with disease states such as cancer and inflammation. The correlations are so strong that in some cases the altered glycans can be used as diagnostic or prognostic indicators. But what is the functional significance of these glycosignatures? For example, do cancer-associated glycans contribute to cancer progression, or are they ancillary consequences of dysregulated gene expression?

The field is starting to answer these questions and early indications are that cancer glyco-traits, like other molecular changes in cancer, are selected for during the microevolutionary process of tumor progression. They confer some advantage to the cancer cells, and this can occur at any stage in disease. Early on, altered glycosylation might be selected because it protects cells from immune surveillance, a mechanism that helps us avoid cancer throughout most of our lives, or because it promotes signaling in pathways that promote cell proliferation. Later, altered glycosylation might enhance survival of metastatic cells in circulation, and emigration into distant tissue sites in metastatic disease. There are now examples where certain glycoprofiles have been shown to contribute to each of these steps in cancer.

The cool outcome of these studies is new ideas for therapeutic intervention. I am personally quite interested in how we can manipulate the immune reaction to cancer cells by modulating their glycosylation patterns.

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[–] **jedisauce** 12 points 1 year ago

Dr Bertozzi, I was fortunate enough to have lunch with you wen you visited Iowa last year. During the lunch with a group of grad students and post docs you talked at length how you never "planned out" your career but, instead, kept following your genuine interests and curiosities. I remember seeing a disheartened look on man of the post docs faces. How much of the emotional struggles in academia do you think come from people being caught up on their "plan" rather than following their genuine interests and curiosities?

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 16 points 1 year ago

Hi lunchmate from Iowa! So sorry I made the postdocs sad! The problem with an overemphasis on a "plan" is that the economic (and scientific) winds can change direction and all of a sudden the plan becomes untenable. And, when one has fixed expectations, they are more likely to be disappointed then when they have flexible (or no) expectations.

A better approach might be to "plan" to keep one's eyes open for opportunities when they arise. I learned this as an undergrad, actually:

I started as a biology major, maybe premed, but then fell in love with organic chemistry - synthesis and mechanism, really - when I took the intro organic chemistry course my sophomore year. After that year, I tried to get a summer job in an organic synthesis lab but the doors were not open to women at that time (there is another discussion that can be had here, of course, that even involves Title IX, but I digress...). So after many unsuccessful attempts, I finally conceded that my destiny would like squarely in biology and found a lab that would take me for the summer.

Then, out of nowhere, the professor teaching my advanced physical organic chemistry course came up to me after class and offered me a summer research job. I didn't know what he did - turned out to be a physical chemist - but accepted on the spot simply because someone in chemistry wanted to hire me. So I did undergraduate research in P-chem, not exactly what I had in mind for my future but an opportunity in the present.

And what happened after that was: I got an internship with Bell Labs (still P-chem), where I worked for a guy who later ended up on the Stanford faculty, he followed my career through grad school, encouraged me to apply for academic jobs, and 20 years later we are now colleagues. Sounds brilliantly planned in retrospect but really, it was the opportunity of the moment all along.

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[–] **applesbananaspeaches** 17 points 1 year ago

Hi Dr. Bertozzi! Thanks for doing this AMA-you're one of my biggest inspirations.

How do you go about choosing the postdocs in your lab? What can one do to make their postdoc application stronger?

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 15 points 1 year ago

As in the response to Gambit45, I look for evidence that the postdoc applicant is a "closer". Did they publish papers (not so important which journals, just good stuff) or is everything "in preparation" (which could mean they dream about it every night and may do that forever). Sometimes their recommendation letters can testify to their closer skills if papers are not across the finish line.

I also look for evidence that they are truly interested in our research (they should explain their interests in the cover letter, and there I can also get a sense of their writing skills) and have ideas for how to take it in new directions. I look at their recommendation letters for evidence of

independence - did they come up with their own project ideas, write their own grant proposals and papers?

And I want to see some evidence that they know how to work as part of a team. I like to a portfolio of papers where they are both first and later author. Does their recommendation letter comment on their generosity as a lab citizen, their uncredited contributions to other projects in the lab?

Sometimes they have a particular skill that resonates with me - experience with an animal model we are interested in setting up, or with molecules of a particular type that we want to study. But mostly, I am looking for smart, independent, helpful closers who write well!

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[–] **5thEagle** 11 points 1 year ago*

Hi Professor Bertozzi!

Huge, huge fan of your work; a lot of my undergraduate work with artificial metalloenzyme engineering hinged on the bioorthogonal chemistry your group developed. It's really cool stuff. Also very appreciative of your efforts to reach out to the public on behalf of chemists and scientists. Thanks for doing this.

Have a few questions for you today; feel free to answer as few or as many as you have time for.

1. I'm very appreciative of how vocal you are about science students needing training in communication and increasing public awareness of chemistry. Do you have any specific ideas as to how we can train undergraduate and graduate students in this aspect? My own personal thoughts is that I can't help but think something could be worked out with Stanford's School of Education; it's excellent, and they have a lot of centers there that are interested in this sort of thing. Perhaps students can get some form of outreach training there?
2. As a Silicon Valley native and someone whose interests lie squarely in between traditional catalytic chemistry and chemical biology, I was fairly ecstatic to hear about the establishment of ChEM-H. You've talked some about how you see this benefiting students at Stanford. Can you elaborate more on how exactly graduate students would get involved in the program and how this would benefit them, the next ? For example, I'm planning on applying to the doctoral program in chemistry there soon, but ChEM-H seems big enough that it might change up my interests. In other words, what would ChEM-H be able to provide for my graduate education that another program (elsewhere or on the Farm), even one more interdisciplinary like a doctoral program in Chemical Biology or Bioengineering, might not be able to?
3. There was a similar question asked elsewhere in this thread, but I want to reiterate some. What exactly is the role of ACS Central Science? It sounds like the goal is to push out papers that show off chemistry's importance specifically as a central hub toward other subfields, but it sounds to me like this is somewhat vaguely defined. I'm a little worried that over time, it could end up devolving into a pile of nano and chemical biology articles, which there are already journals for. So where do ACS's other journals fall in relation to ACS CS? As much as I'm interested in a more interdisciplinary approach toward chemistry and science, I'm almost certainly still going to be poring over the JACS press for new, potentially huge articles.
4. Was the establishment of the ChEM-H and your belief in Prof. Khosla's ability to build a truly interdisciplinary leader your primary motivation for moving to Stanford? I can't help but think Berkeley is still a very good place for this kind of chemical biology, even with the funding hits; was Stanford just more appealing at this point with its new center and chance for a new beginning?

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 4 points 1 year ago

Thanks for the many good questions and here are some thoughts:

1. Great idea! Scientists could use more attention to how we distribute our message outside of the echo chamber. I am developing a graduate program aligned with the mission of ChEM-H (and please do apply!) in which we will integrate a communication entity. Teaser: it involves Hollywood screenwriters...
2. We will have a program web site up and running soon but application instructions are linked through the ChEM-H web site at the moment.
3. JACS remains a flagship of ACS publications. ACS Central Science seeks to reach out beyond the boundaries of chemistry to allied fields, both in terms of readership and authorship. We focus on interdisciplinary work of broad interest, and we are open access. We expect that chemists will always read and publish in JACS - me too! We hope that scientists more generally will read and publish in ACS CS, and that our content - both research articles and nontechnical front matter - will help elevate the visibility of chemistry in the eyes of the public at large.
4. Chaitan had a brilliant idea and called me at the right time in my career, when I was interested in pursuing new challenges and ideas. At Berkeley I enjoyed being in the #1 chemistry department, ranked so for the entirely of my career and likely many careers to come. We built a chemical biology program at UCB that is unrivaled in the world and I will miss being at that helm of that ship. At Stanford, I am already enjoying a closer relationship to the clinical sciences and engineering, on top of an amazing chemistry department. And there is an opportunity to build a new chemical biology program that integrates engineering and translation to clinical science. I have been and continue to be the luckiest chemist on earth.

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[–] **5thEagle** 1 point 1 year ago

Thanks for the response! Will look into all of that, especially keeping a close eye on ChEM-H.

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[–] **1chemistdown** 8 points 1 year ago*

One more question...

There has been a lot of discussion going on about sexual discrimination in the lab, and rightly so given the recent comments thrown out by Tim Hunt. Given what's going on with the greater conversation, I'm curious to how you weathered this as a young scientist and what you're doing these days to foster women in science and any pressure you might be putting on senior male scientists to be better mentors, if any? How do you help women in your lab that choose to have children at early stages of their career, and do you allow them a bit more leeway in the time they spend completing their projects? Thanks. See also: http://www.nytimes.com/2015/06/18/opinion/what-its-like-as-a-girl-in-the-lab.html?_r=0

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 10 points 1 year ago

I just gave the commencement speech at Stanford chemistry and, in fact, mentioned Tim Hunt's blunder. Here are cliff notes of the speech: I was born in 1966 and experienced the world before and after Title IX, which was enacted in 1972 but not really enforced until much later. I implied in my response to Jedisauce that in college, many chemistry labs would not take women and in retrospect I now see that was a clear Title IX violation since professors pay students with federal grant money - our tax dollars. We kept our heads down, under siege, and looked for doors open a crack to sneak through. I am very encouraged by the very different response of today's young scientists to such insults - when Tim Hunt made those inane and denigrating remarks about

women scientists, where was an immediate Twitter uproar and real consequences to follow. This is very good news for the future.

I don't know what can be done to adjust the mentalities of older colleagues. But I do know that we can pay it forward - that is, make it better for your own students and postdocs. Many students and postdocs in my lab have or had children under my watch; knowing how far from equilibrium this can shift ones life, I tell them not to worry about their schedule for returning to work and thereafter, that everything has a way of working out fine and guess what, it does. Maybe they work more effectively because they trust that I have their best interests at heart. Maybe they come up with the most innovative and amazing idea of their career so far. My postdocs who had babies while in my lab are some of my most accomplished and impressive alumni. Deal with it, Tim Hunt.

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[–] **1chemistdown** 3 points 1 year ago

Thank you for the reply. What I found interesting in graduate school, was the female graduate students who had children in the middle of their Ph.D. always seemed to be the most successful. I know I only had a small window in which to perceive this, but they seemed to suddenly get more motivated to do more in a smaller window of time. They would fit in an eight hour day what the rest of us would carry out in our sixteen. They would get the Science/Nature papers and the rest of us ... I'm glad your young scientists are able to continue with life while working in your lab.

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[–] **bro_jiden** 9 points 1 year ago

Hi Professor,

Retractions in scientific papers are becoming more and more commonplace every year, and the study of chemistry is not immune to such scandals. As the editor-in-chief of a new journal, how do you plan to weed out fraudulent papers and those which cannot be replicated? How will your experience as a professional scientist make your efforts successful? Thanks.

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 10 points 1 year ago

I am not sure that retractions are more commonplace - recent statistics look like retractions are increasing at the same rate as total publications, at least from a distance. What is true, however, is that our ability to detect fraud, errors and irregularities has improved with data analysis tools, and the visibility of retractions is much higher with sites such as retraction-watch.

Of course any paper that merits a retraction is one too many, but I am glad that when problems are detected, action is taken. And of course as an EIC I want to take whatever measures possible to ensure that the highest quality and wholly valid research is published in ACS Central Science. To help with that endeavor, we have an experienced and very involved Senior Editorial Board and EAB and high standards of peer review. We will try our best.

Also, mitigation of the problem should start with taking on its roots: perverse academic career incentives and deficient training in scientific ethics that compound to promote poor judgment.

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[–] **alfredopotato** 10 points 1 year ago*

Hi Prof. Bertozzi,

I have been a fan of your work for several years now, and your work on bioorthogonal chemistry is very elegant! How are you able to consistently develop such innovative methodology? Finding novel, high-

impact ideas can be challenging, and I would love to hear your perspective.

P.S. Do you still keep in touch with Tom Morello?

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 9 points 1 year ago

Thanks for your kind words and of course great ideas are rarely the products of one individual - they reflect the collective minds of diverse contributors (my students and postdocs), and happened to be channeled through my individual voice. With a great team of people, innovative ideas abound and are never the rate-limiting step - reducing them to practice in the lab is what we should really celebrate!

I follow Tom on Twitter (can't say if the inverse is true however). I hear he is working on a new album so stay tuned for that.

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[–] **antediluvian** 1 point 1 year ago

And not to mention applying over a seventy year year old reactions...ahem Huisgen.

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[–] **leighsknees** 10 points 1 year ago

Hi Professor Bertozzi, I'm an undergrad studying political science (hardly a science, i know) and I'm currently learning about how politicized science has become over the last few decades. Is there an incident, of any kind, where you have felt the pressures of politics upon your studies? If so, how? Sorry. This question may be considered a little irrelevant. Nonetheless! Cheers for doing the AMA (:

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 7 points 1 year ago

Well let's face it, science has been political for a very long time - look what happened to Galileo, Einstein, Darwin! I work in fields that are not hot buttons of political tension, so I have not experienced political ramifications personally. But I have good friends who contend with such issues, especially in the emerging area of genome engineering and of course, the more tired and dated issue of climate change.

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[–] **jotun86** 10 points 1 year ago

Hi Prof. Bertozzi, how do you feel about the current funding situation? Specifically with how it seems all the work the grant would need to fund now has to be done prior to grant submissions, so it is almost as if NIH or NSF is reimbursing professors. Further, with the lack of funding, it seems as though basic discovery is slowly disappearing, especially in regard to total synthesis. Personally, I believe in application heavy work, as that's what I did during my PhD, but the reality is that there will always be a need for new synthetic discovery. With current funding mechanisms, I fear we are approaching the death of total synthesis.

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 5 points 1 year ago

Funding is a frustrating topic for many these days, and honestly, there were few moments in my 20-year career where it was not among the top 3 complaints of academics. NIH does not want to be "that agency", the one that only funds mostly-done work that is incremental in nature. So, NIH staff try to innovate with new programs where study sections (the perpetrators of grant scoring) are explicitly encouraged to value innovation without obsessing on preliminary data. At NIGMS, Jon Lorsch is starting a new funding mechanism in which investigators are evaluated

based on what they did in the past 5 years, rather than on what they are proposing - that is, to fund people rather than explicit projects. These are experiments whose success is yet unknown, but I give them credit for trying new things.

As for funding for total synthesis, again, NIH advocates for the field have tried various approaches to ensure fair and appreciative review, including reconstituting study sections so that synthetic chemists get reasonable airplay and won't "eat their young". The best total synthesis proposals - those that involve true innovation in methodology that impacts efforts outside their own - seem to do well. What is dying are total synthesis efforts where the impact in science that takes place outside their lab (i.e., in other synthesis labs, or in biology) cannot be demonstrated.

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[–] **[deleted]** 9 points 1 year ago*

Hi, Dr. Bertozzi....sugar scientist here too.

- How viable do you think bioorthogonal click chemistry really is in a clinical setting? Doesn't this require essentially TWO new molecules to pass through the FDA (azido/alkyne sugar + probe)?
- Even with new biororthononga techniques, are the kinetics of click chemistry still too slow for practical purposes? (I remember reading one of your labs' papers where the cyclooctyne probe had worse labeling efficiency than the staudinger ligation probe in vivo). Are there any more chemistry advances on this front for faster kinetics?
- Are there any advantages that click chemistry on cell surface glycans has over say just imaging changes in glycosylation directly using already established instrumentation like MRI such as what these authors have done: http://www.nature.com/ncomms/2015/150327/ncomms7719/full/ncomms7719.html
- Finally, many of the sugar probes are unnatural monosaccharides that contain azido or alkyne tags for click ligation. Have you quantified the changes in flux of these molecules as compared to the natural sugars in the metabolic pathways that uptake these molecules? Do these sugars end up randomly on cell surface proteins or do they end up targeting specific subsets of glycoproteins?

Anyways, keep up the good work!

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 3 points 1 year ago

Love your username! Metabolic labeling and in vivo bioorthogonal chemistry are still research tools that we hope shed light on the dynamics of cellular glycosylation processes. That MRI paper was pretty cool; wonder how many glycoconjugate subtypes could be discriminated that way.

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[–] **atamant** 7 points 1 year ago

Hi Carolyn, ChEM-H postdoc here. I think it's neat to see ChEM-H on the front page of reddit; thanks for doing this AMA! I have two questions:

1. You are clearly a strong believer in the power of interdisciplinary/interdepartmental research centers to drive research into new areas. How do we better equip future generations of scientists to be literate in multiple disciplines? In most institutions, departments are still highly segregated and most undergrads/grad students are trained in a narrow field. I spent an awful lot of time and effort focusing on chemistry and sure wish that along the way, someone had pulled me aside and said, "the way the field is going, you should try to learn some biology too!"
2. I keep hearing about cancer cells displaying surface proteins with unique glycosylation patterns: how far are we from using this as a drug target? Do you predict any unique challenges that we

should expect in developing new therapies that rely on these glycosylation patterns to deliver drugs or imaging agents?

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 3 points 1 year ago

Nice to hear from a ChEM-H conspirator!

1. sounds like you took the advice to heart since you are now affiliated with ChEM-H. Also, it is never too late for motivated people to learn new things. That was my whole idea in moving to Stanford - I thought I would learn a lot from the people here and from being in a new job where you feel pressure to "bring up your game". Doesnt matter where you were in the past - just where you want to go in the future.
2. See response to Adenovato

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[–] **Ivacaftor** 2 points 1 year ago

I read your recent publication about trehalose, desiccation tolerance and Saccharomyces cerevisiae, which was very interesting. My question is: What do you think future applications of this finding could be? In your article you mention desiccation tolerance in other organisms but what needs to happen before more substantial organisms can be aided?

Thank you for this AMA :)

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 3 points 1 year ago

This work was spearheaded by my collaborator Doug Koshland, who has an interest in "extreme biology". Many organisms that live in extreme environments use trehalose as an osmo and thermoprotectant. We humans to not. Interesting phenomenon.

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[–] **smbtuckma** Grad Student | Social Neuroscience 3 points 1 year ago

It's probably too late to get an answer from you, but just on the off chance -

I was at the Stanford chem graduation last weekend, and I loved your commencement speech. You seemed passionate about gender issues in science. I'm a woman about to start grad school in science myself, so I was wondering what else you would say on the matter to encourage and advise young female scientists, this time without the time constraints of a speech?

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[–] Carolyn_Bertozzi Professor of Chemistry at Stanford University [S] 3 points 1 year ago

Thanks, running out of time but I just answered 1chemistdown in a way that might address your question.

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[–] **Comment removed** 1 year ago*

load more comments (3 replies)

[–] nallen 5 PhD | Organic Chemistry [M] 12 points 1 year ago

Science AMAs are posted early to give readers a chance to ask questions and vote on the questions of others before the AMA starts.