

ACS AMA: Hi Reddit! I am Danielle Buckley, a physical chemist and STEM education professional. Ask me anything about quantum dots or alternative career paths in science!

AmerChemSocietyAMA¹ and r/Science AMAs¹

¹Affiliation not available

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We were making quantum dots in my chemistry class once when I accidentally pricked my right hand with a broken glass pipette containing cadmium selenide nanoparticles.

My question is: what nickel based nanoparticle should I stab into my left hand to give me [battery](#)-themed superpowers?

As a slightly more serious question: when teaching undergraduate lab classes and tutorials, I feel hamstrung by the fact that I understand the physics well but am no good at converting into a palatable form for teaching others. What advice do you have for people who aren't interested in a teaching degree or career, but do want to become better at teaching science?

[NanotechNinja](#)

Although I love the idea of quantum dots giving superpowers . . . in all seriousness CdSe is toxic so would highly recommend people not purposefully stab themselves in an attempt at quantum super powers!

As for your other question, some of the best advice my advisor gave me when I was preparing for my oral exams was to answer each question and explain each concept as I would to a kindergartner, using simple words and avoiding jargon. I began applying this concept to my teaching and found the students were more engaged because they felt the topics were more accessible. Similar to the Feynman technique, I also used analogies whenever possible so students could better relate to concepts.

Im a recent graduate with a Biology degree and a 3.8GPA. I am having trouble finding a fun, meaningful job that I can enjoy. I currently work data analysis, get paid well under the national average for a recent graduate with a Biology degree, and do not enjoy my work. I am looking at Masters programs to pursue but don't know what I want my degree in.

In this demanding job market it is often difficult for a recent graduate to find work (especially with a biology degree). Do you have any recommendations for potential career paths that are in high demand,

for somebody who wants a fun work environment? What tips would you give young scientists who share the same passion of Science?

[rpboutdoors2](#)

One thing I found really helpful was to determine my priorities before beginning my job search! Is salary, job security, or job satisfaction most important to you? There's no wrong answer, but as others mentioned, a career in the medical field would be both meaningful and increase your salary. To avoid additional schooling, you might consider something in sales (medical or lab equipment), publishing, and especially in technology. Tech companies offer a fun environment and there are lots of start ups looking for people with STEM degrees.

Hello Dr Buckley! Thank you for being here today. I was wondering what your opinion is on returning to college after completing a university degree in science. I have recently completed my BSc, and I know that there are many science undergrads who feel unequipped to enter the job market with their current skill set. Do you think that going to do technical training (ie medical technology, respiratory therapy, veterinary nursing) is a good way to gain these skills? Or is it a step backwards, as many of these programs do not require university education? Would having a college and university background make someone more appealing to employers?

[EeveeAssassin](#)

I think this depends on your ultimate goal and career path. Additional training doesn't hurt, but getting this sort of training on the job is another route that can work just as well. Depending on your goals, it might be worth looking at an advanced degree in your field. Graduate school is another place where you develop a lot of skills that employers value, like data analysis and presentation skills. That being said, I know many people that used grad school as a place-holder after undergrad, and they were often the most dissatisfied.

Hi! I'm a physics and chem double major and I'll be looking into grad school soon. In your experience how do students from smaller universities stack up to those from large ones? I've been fortunate enough to be involved in a couple of research projects and to teach the lower level physics labs, and I'm hoping this gives me an edge over students from bigger schools who may not have these undergrad experiences. Thanks for your insights!

[campbellaxt](#)

I think the other posters already said it all! I never saw a difference in students based on the size of the school they came from. It boiled down to work ethic and study skills. It also depends on the school you're looking at and how competitive it is - I've heard horror stories about sabotaged research projects at other institutions but never experienced anything like that at CU. And imposter syndrome is something that no one talks about but is rampant so look to your fellow 1st years as a built-in support system.

I graduated with a degree in physics in 2014 and have been bouncing around jobs since. I simply can't find one that uses the skill set I developed. I love science but I don't want to teach. Do you have any recommendations for fields that use physics skills that no one would expect?

[trog12](#)

My advice would be not to limit yourself to the "obvious" skillset you developed with your physics

degree - there are soft skills that you develop in STEM programs that are useful in a variety of fields. But depending on your interests and jobs you've already tried, you can look at something in publishing, patent law, or at a tech company - all of these career paths can let you stay involved in physics without doing it in the lab or teaching it in the classroom.

alternative career paths in science!

Hello and thank you for doing that AMA

I'm a PhD student in particle physics, and I'm very interested in teaching. Especially at university level.

I know that usually, teaching at university level is a side-occupation for professors and other senior researchers, who focus their activities on research. I would personally dream of the opposite : focusing on teaching, and doing some research as a side activity. Would you have any tips for people in my situation, or generally speaking for academics who would like to teach more?

[Milleuros](#)

Take a look at smaller liberal arts schools that prioritize teaching over research. In addition, community college is a great option - it's viewed by many as a step down from the university level, but I'm a huge advocate of providing quality education at the 2-year level for those students that can't afford to begin at a 4-year institution.

What exactly is a quantum dot?

[apophis-pegasus](#)

A quantum dot is a type of nanocrystal that has different electronic and optical properties depending on the size. What does that mean? It's a very tiny particle that's smaller than the width of a human hair and some of its properties change when you change the size of it. For example, the same material at two different sizes can appear red or green.

So my biggest question is something that been bothering me for a while. I spent 3 of my four years of high school in STEM classes and loved every second of it. I learned my way through the software and even got to a point where I was teaching the new students as they came in. It's probably had the biggest impact of my high school life. But why are we still pushing STEM so damn hard if it's as much of a super saturated field as it is? I mean people say it has a relatively low attrition rate but they never consider the reason it's low. It's because the raw data doesn't reflect the fact that the reason the attrition rate is so low is because there's SO MANY PEOPLE GOING FOR IT. I mean seriously can't we atleast let these kids know that by the time they graduate high school let alone college, the ratio of the number jobs needed vs the number of people in school for it will be even lower and almost abysmal. It's not necessarily a competitive field by nature it only seems that way because of the multitude of people flossing in to these classes. Meanwhile trade based careers suffer and all the people in these trades are people who have been doing it for 20+ years. Shouldn't we be make kids aware of the, shouldn't we atleast of practical trade classes as an alternative, shouldn't we at the very least let them know that they'll likely not have a field to go into if they do choose to pursue it and then in turn SHOW them that there is a practical side to these STEM classes that aren't even being talked about? I wanted to do this stuff for years and I still want to, but I had to come to terms with this after it was too late and I put all my eggs in the STEM basket. I screwed myself over by not even considering what else there was because it was so heavily encouraged and I was told anything else would be a waste of my mind. But it's not true, now I'll be enrolling in machining and CNC operations classes.

There are jobs that fit just as well but sit on the other side of the proverbial coin ,face down and never touched. It's not right to blindly promote these fields as sure fire and not even acknowledge the potential short comings and it would certainly do kids well to learn this early on and not have to rewrite the way they've been hardwired to look at STEM like myself and I'm sure many others had to do as well. Rant over. Thumbs cramped. Imma go eat a banana because apparently I'm low in potassium. Peace.

[joshieboy96-17](#)

Some of this is due to the structure of our education system and the belief that a 4-year degree is the best path for everyone, which tends to lessen the importance of trade schools. That being said, STEM graduates are more likely than those in the Humanities to find employment after graduation even if it's not in directly in their field of study. The saturation that's been referred to is aimed more at academic careers - academic research and teaching.

Hi there! Thanks for the AMA. Since you say you've been involved with organizations in science policy, how does a strictly technical person make the switch over to policy? I have been working in the technical world/research for about 3 years now and I feel that science policy is more impactful (in my opinion).

[jvalenz](#)

The most common way that I've known people to make the transition is with one of the many fellowship programs through ACS, AAAS, or another scientific society. ACS: <https://www.acs.org/content/acs/en/policy/policyfellowships.html> AAAS: <https://www.aaas.org/page/stpf/become-st-policy-fellow> If this doesn't seem like the route for you, you can also begin your involvement by volunteering with a scientific society. I did a lot of work at the state-level with the ACS Government Affairs Committee and found state work more rewarding than the federal level.

Hi Danielle,

I'm currently a rising junior at Virginia Tech with a major in Nanoscience. My current undergraduate research is working with silver plasmonic nanoparticles for integration into smart windows and photovoltaics, very similar to what you are doing!

I have a couple of questions for you, as a life of research doesn't particularly interest me. One if my older friends in the same major is planning on going to law school to try to be a patent lawyer, what do you think of that path? And do you have any other job/career path suggestions for those if us in the nano-related majors?

[J_sulli](#)

Yes, I looked into patent law myself! Nanomaterials are becoming more and more common in everyday things so law and policy are two career paths that I believe will grow. Regulation is not keeping up with the research, so there's a need for people with an understanding of the science to weigh in.

Hi Danielle,

In Canada I hear a lot about the lack of women in STEM and what I've read usually blames the culture of those jobs. Do you find that true, or could it be our societies culture or maybe our education system?

Are women hampered in their STEM careers? It seems as though more Eastern Europeans women excel in STEM careers, does that seem the same to you?

Do we need to address the lack of women in STEM, is it a problem?

[gingerindependence](#)

There are a lot of different layers to this question! Getting more women into STEM certainly begins with education and exposing girls to science, so I'm a huge advocate of improving the education system to address this. I agree that traditional STEM careers are male-dominated, which influences the culture, and can be a deterrent for some women to follow that path. I think one of the most important things for young women to look at when considering any job is the culture their direct supervisor/PI/manager brings.

Hello there!

Simple question: Do you have a brother named Jeff?

More serious question: Could it be possible to have TV screens made of quantum dots? Or tattoos that glow with the sunlight? And if you can make photovoltaic cells with those, can you make screens that recharge themselves while on?

[Morlunapp](#)

Sorry to disappoint but my brother's name is Chris!

There are currently quantum dot TVs on the market - QLEDs! I've read reviews and it seems like OLEDs still offer a better experience but with some bias, I think the QLEDs will undergo different iterations and improvements.

Hi Danielle! I'm currently working for an elementary school district with a brand new STEM academy. What are some of your favorite projects to get kids interested in science who may have never previously had an interest in the field, or thought they weren't "smart enough" to get involved? We particularly see this issue with our girls, sadly. Thanks so much!

[bossgalaga](#)

Absolutely! My favorite part of being involved in Earth Explorers was seeing girls that never thought science was accessible see that they could do it, and decide they wanted to be engineers. Here are links to a few of my favorites we did with students. The most popular ones let the kids eat something when we were done experimenting: Laser pointer projection microscope (we used pond water to see different organisms): <https://mad-science.wonderhowto.com/how-to/build-your-own-projection-microscope-with-syringe-laser-pointer-and-drop-water-0138420/> Solar Oven: <https://www.stevespanglerscience.com/lab/experiments/solar-oven/> Laser Jello: <http://www.physicscentral.com/experiment/physicsathome/laser-jello.cfm>

Ok, this is probably a dumb question, but what is the difference between a physical chemist and... A different kind of chemist? Like are you doing more physics-y stuff than other chemists? Or is it just more of a practical nature?

[ballen15](#)

Yes, a physical chemist tends to do more "physics-y" stuff than other chemists. For example, my

graduate lab more closely resembled physics labs on campus than chemistry labs - we had two large rooms with laser tables, etc. and a very small room as our wet lab.

I'm in the Bulovic group at MIT and we have been having this discussion a lot recently: Which do you think is the more viable technology, PbS or Perovskite?

[greengiant1298](#)

I'm biased towards PbS since that was my area of research but I actually think Perovskite is more likely to gain widespread use with the research going into finding Pb-alternatives.

Wow! I'm working on my PhD at CU right now in Mechanical Engineering and FOSEP sounds sounds like something I really would enjoy. I can't believe I haven't heard of it!

What was the time commitment for a typical FOSEP volunteer? I'm juggling 4 or 5 different projects at the moment so time is my most valuable resource.

[Bull3t_Th3ory](#)

Yes, you should definitely reach out to them! To be a member, you can just attend events as they come up and it doesn't require any kind of crazy commitment. If you're interested in a more active role, the time commitment can vary but you can talk with them about what you're up for and how often you can help with things.