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Why Every College Student Needs To Take Science Courses

My “day job” is as a physics professor, and one of the things those of us in the business agonize about is the steep drop-off in students taking physics at various levels. Using statistics from the AIP, [nearly 40% of high-school students take physics](#), while putting together [enrollment numbers](#) and the [total college population](#) suggests that the fraction of college students taking physics is a factor of ten smaller (this is a crude estimate, and seems low but not wildly implausible). Very few of those take anything beyond an introductory course required for some other major— years ago, I went to a conference on introductory physics teaching, and the factoid I remember is that only around 3% of students who take the intro course go on to take another class.

The problem is particularly acute for physics, because we have a (not undeserved) reputation as the hardest and most mathematical of the sciences, but it’s part of a more general phenomenon. Lots of students take [science](#) in high school because it’s required (either formally as a graduation requirement, or informally as a “you need to take this set of elective courses if you want to get into a good college” kind of thing), then

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run away as fast as they can when they get to college, and have (nearly) full control of their course selections.

Students who aren't already planning to major in science often regard it as a waste of their time, a message unfortunately echoed by [powerful politicians](#). Most colleges and universities have some sort of "general education" requirement forcing students to take at least a couple of math and science courses, but many non-science majors will take the barest minimum, and work very hard to put those off as long as possible.

Disgruntled spring-term seniors who don't want to be in the course but can't graduate without it are a regular and unpleasant feature of our "Gen Ed" courses in physics and astronomy.

This approach is a major mistake, and having offered some [advice to future science majors](#), let me offer some encouragement for non-scientists facing the prospect of having to take science in college. There are lots of reasons why you *should* take science, or at least shouldn't avoid it; here are a few.



The passage tomb at Newgrange, outside Dublin (photo by Chad Orzel).

Science Is What Makes Us Human

Academics studying art and literature aren't shy about claiming fundamental status for their subjects, regularly declaring that art and literature capture something essential about the nature of being human. They've even

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successfully branded themselves as “the humanities,” as if all other areas of study are inhuman and alien.

In fact, though, [science is every bit as fundamental to the human experience as art](#). Art scholars will point to ancient paintings and sculptures as evidence of the fundamental human drive to make art, but science is a necessary precursor to those. Before some proto-human could paint hand prints on a cave wall, they needed to figure out what rocks to grind up to make the pigment, and how to mix them with ash and animal fat to make paint. That process demands reasoning that is fundamentally scientific.

Branding aside, the [scientific mode of thinking](#) is not alien and difficult—scientists are smart, but [not that smart](#). When you actively avoid engaging with science, you’re cutting yourself off from a deep and fundamental part of the human experience.

Science Is More Familiar Than You Think Following closely on the previous point, I would argue that scientific thinking, broadly defined, is an essential part of all manner of everyday activities. Things that non-scientists do for fun and relaxation are, in fact, making use of the same reasoning process as scientists making discoveries. Hobbies like [stamp collecting](#), [hidden-object games](#), or [playing sports](#) draw on the same process that scientists have used in the past to make great discoveries.

Bridge to Dark Matter



Yes, science requires a good deal of specialized background knowledge; so does anything worth doing. The core process is fundamental and universal, though, and if you focus on that, you'll find that science is not so different from ordinary hobbies. If you understand how to play cards, you can understand the path to dark matter, and pretty much any of the other great discoveries that have reshaped our understanding of the universe.

(As you can tell from those links, this is a Thing for me– I have a [whole book](#) about the ways scientific thinking shows up in everyday activities.)



Leah Roth (2R), a junior biology and pre-medical major, attends physiology class before soccer practice April 15, 2015 at the University of Mary Washington, a coed school and Division III member of the National Collegiate Athletic Association, in Fredericksburg, Virginia. The 2015 FIFA Women's World Cup, hosted by Canada, will be held from June 6th to July 5th. AFP PHOTO/BRENDAN SMLALOWSKI (Photo credit should read BRENDAN SMLALOWSKI/AFP/Getty Images)

Turnabout Is Fair Play At this point you might be thinking “You may be right that I *can* use scientific thinking, but I’m not comfortable doing that.” And, sure, personal inclination plays a big role.

But then, the same thing is happening to many of your classmates who plan to major in science. Those same general education requirements that make English majors take science classes force science majors to take English classes. And in the very same way that many future literary scholars find it uncomfortable to work in an explicitly scientific mode, many future scientists find it uncomfortable to grapple with the fuzzy ambiguity of literature. If anything, the non-scientists often have it easier, because science departments generally offer special courses tailored for the interests of non-majors. Pretty much any college or university will have some variant of “Physics for Poets,” but it’s exceedingly rare to find anyone offering “Poetry for Physicists.”

So, yeah, you may not necessarily find the scientific mode of operation congenial. But some of your classmates feel the same way about whatever you’re majoring in, and they have to take those classes, too. It’s all part of the essential process of “[making yourself into the person you want to spend the rest of your life with.](#)”



In this April 3, 2009 photo, Vassar College biology and cognitive science professor John Long, second from right, and his students look on as swimming robots navigate in a science lab pool in Poughkeepsie, N.Y. Long is among a small group of researchers worldwide building robots that can do things like shimmy through water or slither up shores to aid the study of biology and evolution. They believe the practice is likely to grow as technological advances allow robots to mimic biological actions far better than before. (AP Photo/Mike Groll)

College Science Is Not High School

Science A lot of the apprehension new college students bring to math and science classes stems from bad past experiences. These often result from teachers with limited resources, sometimes working well outside their own areas of expertise, forced to teach a prescribed curriculum aimed toward a particular test.

Many of these constraints will be different at the college or university level. If you take physics in college, you'll be taking it from a physicist, not a biology education major who needed to pick up the physics class because the district can't afford a separate physics teacher. The people teaching your classes will be genuine experts in the subject matter in ways that high school teachers often are not. And the available resources for labs and hands-on investigation are often far better than you'll find at the high school level.

More than that, if you're taking one of the targeted "gen ed" courses for non-majors, you'll be getting the "Good Parts Version" of the subject in question, a selection of the most interesting topics presented in an accessible

way. Last fall I taught a non-majors course on relativity, where in a single course we got to topics that only show up in senior-level electives in the major sequence. You don't need to go through two courses' worth of blocks sliding on inclined planes before getting to talk about black holes and wormholes.

You may think you don't like science based on bad experiences in high school, but it may just be that you don't like *high school science*. *What you see in college is a very different thing, and you may well find it more appealing, even inspiring.*



*The road ahead will be rough, and science will help you navigate it.
(Photo by Chad Orzel)*

Even If You Don't Care About Science, Science Cares About You There's really no way to avoid an "eat your vegetables" item on a list like this, so, well, you need to eat your vegetables. By which I mean that even if you don't personally find science congenial, your future life will be affected by scientific issues in a deep and profound way, and you need to understand at least a little bit about it to make informed decisions.

The biggest challenge facing future generations will be dealing with climate change and its consequences, which is fundamentally a scientific issue. In coming decades, critical policy decisions will need to be made— about energy sources, mitigation strategies, etc.— and getting those questions

right demands some scientific information. Public health is another huge issue, requiring informed decisions about how to fight pandemic disease, an aging population, etc. There are even strong scientific components to economic and ethical issues like the societal displacement caused by increasing automation and computerization of, well, everything.

Scientific knowledge even comes in to more personal decisions. Scientific thinking will help you avoid all manner of medical quackery and other scams, which can have disastrous consequences.

Successfully navigating the road ahead will require making informed decisions. This will demand not just trivial knowledge of facts, but some understanding of scientific standards and methods for evaluating information. This is acquired in, yes, science classes.

So, for these reasons (and many more), I would urge all students to take science classes in college, and take them seriously. They'll connect you with an essential part of the human experience, they'll probably be better than you fear, and they'll help you gain essential skills for navigating the future. Science courses aren't an arbitrary bullshit requirement imposed to protect faculty jobs, they're a necessary step in helping you become a better citizen and a better human being.

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Chad Orzel is a physics professor, pop-science author, and blogger. His latest book is [Eureka: Discovering Your Inner Scientist](#) (Basic Books, 2014).

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[Some Advice](#)

[Science Is Essentially Human; Or Why Better STEM Education Isn't A Threat](#)

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