

Suggestions on how to support low-income physics majors

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While all undergraduate students at Yale have access to need-based financial aid, students' financial circumstances still very much influence their Yale experience. This is not any different for physics majors. Most physics majors have the ability and the privilege of focusing on their studies and research, but low-income majors have to juggle with multiple student jobs in order to buy textbooks, pay for graduate school applications, pay the student income contribution portion of their financial aid package, buy tickets to visit their families, support themselves to do research over the summer, among other expenses.

All of this puts low-income undergrads at disadvantage with respect to wealthier physics majors, taking time and mental space away from their studies, applications and research, as well as restricting their summer and extracurricular opportunities. Moreover, I bring this to the attention of the Climate and Diversity Committee because these issues disproportionately affect students in minority groups hoping to pursue academic careers.

I have faced some of these obstacles myself, and I have also seen a few other physics majors going through similar experiences. Below, you'll find some suggestions on how to make the department and the physics major more inclusive to low-income students, so they can afford the same opportunities that their classmates can take advantage of.

1. Make research for pay a viable option.

It is nearly impossible to find paid research positions in physics at Yale, while it is fairly common to find paid research in, for instance, Geology and Biology on the Yale student employment website. Often, if a student wants to do research over the academic year (especially freshmen and sophomores, who can't do it for a letter grade), he/she has to do volunteer work, which might be tricky because of time constraints and the need to work a paid student job. Making paid positions available in physics would make it feasible for low-income undergrads to drop their other student jobs in order to pursue research, allowing them to be on the same level of preparation of their peers who can afford to volunteer in labs. While you can do research for pay junior and senior year through the Bouchet Fellowship or the STARS program, these programs are solely for juniors and seniors and they also restrict your options. For example, if you're on the STARS program and you need to do research for credit in your senior year, you cannot receive the STARS stipend. Also, realistically, most students won't get into either program.

2. Increase the amount paid in summer fellowships for students who want to do research at Yale.

Most Yale undergrads on financial aid have to pay something called the student income contribution (which is usually roughly \$3000). However, if someone wants

to do research at Yale, his or her fellowships are capped at a combined total of \$4300 for the entire summer. This is the amount the Dean's Fellowship pays to students who want to do research for a total of 10 weeks. If the student gets another fellowship, the amount of the second fellowship is deducted from the Dean's Fellowship. Say the student's sublet rent is \$800/month and she spends \$450/month on food for 3 months in New Haven, adding up to \$3750 and leaving \$550 for all remaining expenses (utilities, transport, hygiene products, etc). So, a student doing research in New Haven during the summer is barely left with any savings, leaving the burden of Yale's student income contribution and other school-related expenses solely to the student's on-campus job and, again, taking time away from academic year research and classes, which is something other physics majors don't have to go through. Hence, it is much more attractive and affordable for low-income physics majors to work other jobs during the summer, which shouldn't be the case if they intend to apply for graduate school. This is even worse for students who are non-US citizens.

3. Make these fellowships slightly higher for international students, to compensate for the 14% on taxes that foreign aliens have to pay on fellowship income.

We, international students, start with a stipend of \$4300 minus 14% on taxes immediately applied to our paychecks; this leaves us with \$3698 for the entire summer. An international student is faced with a decision of either staying for an extra month in New Haven on top of the 10 weeks of research or paying for round-trip tickets to go home during that time; both options cost around \$1000. Hence, if you also account for the expenses mentioned on item 2, international students actually have to pay about \$1052 dollars out of their pockets to be able to do research at Yale, and they save no money over break to pay for school expenses. As someone on full financial aid, my summers at Yale cost me more than my personal expenses for an entire semester in school.

I found myself working as a summer science tour guide in my sophomore summer on top of doing research, which gave me about \$200 extra dollars to compensate for how much I was spending, and I tried to save as much as possible on food over my summers here. However, since last summer, you cannot work 40 hours in research and be a tour guide (Yale Admissions simply won't hire you), so it became even trickier for students to make more money to add to their fellowships over the summer. In fact, it is forbidden that students under Yale research fellowships be paid for other jobs.

4. Provide room and board on top of Yale fellowships recipients who are staying on campus and are on financial aid.

Programs like STARS Summer give housing and board to freshmen, as well as a \$2500 stipend and a class credit. It would be ideal if undergrads on financial aid and receiving a Yale fellowship could get room and board in a residential college that is open during the summer; undergrads could then save their fellowship money for their academic year and student income contribution expenses. Even if the

fellowship amount were reduced in this scenario, this would still cause less of a financial burden on low-income physics majors interested in doing research and later applying to graduate school. This option could even be cheaper for Yale than what's currently in place.

5. Make it possible to get a fellowship to do research with faculty outside of Yale – especially for low-income non-US citizens, who can't apply for REUs nor afford to simply support themselves over the summer.

Yale should have fellowships that can fully support its students to do STEM research (these fellowships exist for the social sciences and humanities!) with non-Yale faculty. The few fellowships that can support that are either insufficient in terms of amount awarded or have such early deadlines that students are barely able to make any arrangements with labs outside of Yale or hear back from other programs before they can apply for these fellowships.

As non-US citizens, applying for REUs, national labs or national fellowships is not an option, since we're not eligible for them. Yale fellowships that fund work for faculty in other universities is in general restricted to fellowships that you can get from your residential college, whose amounts are insufficient to cover summer living expenses and which are highly dependent on which college you live in. Working for a professor at another institution for a summer is beneficial not only because it introduces you to a new environment, but also because you'll have a professor at a different institution supporting your graduate school applications and who can have a different perspective to evaluate you. I have seen students who volunteered to do research in other places and whose parents funded their summers. That is not an option for low-income undergrads. Again, this puts low-income students at a disadvantage when competing against other students, regardless of the effort they put into their education or research at Yale.

I personally got a position in my sophomore year, after emailing almost 20 professors around the country, to work for a UC Berkeley AMO professor who was starting a project in Germany. I wasn't able to take the position, because I could only get \$1000 in fellowships from my college (it only has one fellowship capped at \$1000). The one other fellowship I could apply for had extended its deadline by a month for other applicants doing research in Germany through DAAD, but refused to accept my application despite the fact that I had submitted all of my materials, including a letter of support from the lab's PI. I had to stay at Yale that summer, because I would have to spend less money to stay here. As someone applying for PhD programs to do AMO research, that experience could have been crucial for me to get admitted to graduate school, as similar experiences were useful to my peers. Had I decided to just stay in a non-Yale lab in the US, there would have been only one fellowship to support me, capped at \$2000.

6. Start a fund to support students on financial aid to pay for graduate school application and standardized exams fees.

Graduate school applications are extremely expensive. The General GRE costs \$200 and the Physics GRE \$150 per time you take it (seniors usually take it twice in order to improve their scores). Sending scores costs \$27 dollars per school you send them to, and each school has an application fee of about \$100. If you apply to 15 schools, your expenses add up to around \$2500. On top of that, in case you're not a US citizen, you cannot apply for fee waivers.

Personal example: Last semester, I contacted Dean Hashimoto (then the Dean of Science QR) to see if there were funds for students on financial aid in any Yale office to cover graduate school application fees, and I was notified that such a thing does not exist. In order to pay for my applications, I increased the number of hours I was working in my two student jobs (especially in tutoring) so I would be able to afford paying for standardized exams, application fees and official transcript fees. Needless to say, while most physics majors were doing Physics GRE practice exams, writing their applications or doing research, I was tutoring extra hours to make money and be able to pay for my applications. It is not fair that low-income students have to compete with higher-income undergrads who can use more of their time to do productive research, study more for their GREs and devote more time to their classes, things that actually enhance their application. Also, I was lucky that my jobs allowed me to work extra hours last semester, but some undergrads might not even be able to do that.

The physics department should absolutely have a grant to help low-income students to apply to PhD programs, if our goal is to increase the number of minority physics majors continuing in physics after college.

7. Have a system in place for physics majors on financial aid to borrow textbooks for physics classes.

Yale undergraduates can use Borrow Direct to get access to textbooks available in libraries from other universities. However, the number of copies can be limited and sometimes can only be borrowed by a limited amount of time. In the past, I have seen students borrowing textbooks from upperclassmen. It would be nice if there were a (organized) system in place that allows students to borrow commonly used textbooks (such as Griffiths' books, Taylor, Halliday/Resnick, etc) directly from the physics department for the entire semester.