

Financing Your Graduate Education in STEM¹ fields (Surely You Are Looking For Grad School Money, Mr./Ms. Future Scientist?)

Fahmida N. Chowdhury
Professor, Electrical and Computer Engineering
fchowdh@louisiana.edu

This is not a motivational lecture on the virtues of going to graduate school – if you are convinced that graduate school is a lot of bunk², I am not going to try to change your mind. On the other hand, if you are one of those undergraduates who would like to go to graduate school, but decided not to try because you think you couldn't afford it, this essay is meant for you. If you are one of those undergraduates who never thought about graduate school, you may want to read along just for the fun of it, if you haven't anything better to do at the moment. If you are thinking: why on earth would people wish to prolong their student lives beyond the four years of torture they (you) are going through right now? I don't presume to give you an answer to that (rather valid) question – but I would like to assure you that such people do exist; otherwise, this essay would not have been written or published. Not only do such people exist, but there are groups of people – foundations and agencies and university departments – that will actually finance those extended years of schooling. And clearly, there are professors (like yours truly) who will volunteer their time to motivate, encourage and mentor students into and through graduate school. One possible explanation for this phenomenon may be that the professors themselves have gone through so many years of (perhaps torturous) graduate school that they basically don't know anything else – about the real world, that is - and therefore try to inflict the same torture on the young folks around them. There may be other explanations, and you can have a lot of fun trying to figure this out. It may be one of the great mysteries of life.

If you are still reading, then I assume that you are one of those students who would like to try graduate school if it were free; maybe you are enjoying your undergraduate years, and wouldn't mind prolonging the enjoyment for a few more; maybe you have even heard that you eventually make more money with a graduate degree – sorry, I'll not say anything about the degree-income relationship; there are plenty of people without any college degree who make plenty more money than a hundred PhDs lumped together; so, if I say that I got a PhD NOT because I wanted to earn more, I say it *not* out of nobility but out of humility. Because of that reason, I refrain from making any comments on the earning potential of folks with graduate degrees – however, the Bureau of Labor Statistics (BLS) collects data like that, and anyone with internet access can have hours of fun (if she or he is so inclined) Googling the BLS looking for salary data for the various professions and various degree levels.

At this point, a confession: the target audience for this essay is not ALL those students who might go to graduate school if only they could afford it; my target is those students who are in the STEM (Science, Technology, Engineering and Mathematics) fields. At first glance this may seem like a rather small segment of the student population; but note that the government (and the National Science Board) includes “social sciences” such as economics, sociology, anthropology, psychology, and linguistics within STEM fields: so this is not so narrow after all. For various reasons, policy experts in the country have decided that we must encourage more people to join the highly educated and trained STEM workforce in order to maintain the economic and technological competitiveness of this country. “More” in this case needs to be understood in the context; I don't think the goal is to turn this country into a country of nerds:

¹ Science, Technology, Engineering and Mathematics

² “Bunk”, which is not a common word in American English, means humbug, empty talk; one of my favorite characters in a great piece by G. B. Shaw (“Doctors’ Delusions”) uses it a lot, and I like the sound of it: Bunk!

the fact is, STEM education in this country attracts a really tiny portion of the population, and the government is worried that if we don't do something about this quickly, we'll be in serious trouble: what kind of trouble? What evidence is there that we need more folks in the STEM fields? Will there be jobs for these STEM graduates? All of these are valid questions, and I can give you some references to study³ if you are seriously considering investigating this important (and entertaining, depending on your taste) issue during the free time between all your homework projects and weekend parties and part-time jobs; I am not going to attempt to answer those questions here, because as I said in the beginning of this essay, my target is those students who would like to go to graduate school anyway, and my goal is to give them useful information regarding where to look for money – I am leaving out student loans, and more unorthodox avenues such as robbing your rich aunt.

The story right now is that if you wish to go to graduate school for a Master's or PhD degree in any STEM field, but particularly in physical or natural sciences or engineering, and you are a US citizen or permanent resident, then you should be able to do it for free⁴. There is no free graduate school for folks studying to become physicians, but there is for folks studying to become physicists; presumably this is because in later life, the physicians will make plenty of money treating the patients, while the physicists spend all their time figuring out a unified grand theory of the universe or trying to detect gravitational waves or some such strange stuff – so the physicians can (and should, and do) take out student loans, and the National Science Foundation (that's the group with the biggest pot of graduate fellowship funds) keeps them away from the fellowship competition.

The National Science Foundation (NSF) has been awarding graduate research fellowships for more than fifty years. Currently the annual stipend is \$30,000, you get funded for three years, and your institution gets \$10,500 per year for your tuition and fees. Of course, you probably will not finish a PhD in three years; typically the universities give you a teaching assistantship or research assistantship for the rest of the time period so that you can complete your degree. Here, an explanation of the terms is in order: basically, if you have a fellowship, you are not obligated to do any work (besides your own studies, that is) for the department or for your professor; with a research assistantship (RA), you must work for your professor - assist him or her with research, cook chemicals in the lab, collect data by observing chimpanzees, run computer simulation programs all night long, and so on, depending on your field of research; with a teaching assistantship, you teach an undergraduate course, grade papers and quizzes, show undergraduates how to cook the chemicals, keep them under control so that they don't blow up the lab, etc. The workload for a full-time RA or TA is 20 hours/week, and the salary varies by university; in most places, it will not be as high as the federal fellowships. The NSF Graduate Research Fellowship (GRF) is very prestigious: I have seen academic Deans proudly display in their resume' that forty years ago, they had won the NSF Graduate Research Fellowship! I'm not implying that the other fellowships are less prestigious: the reason I didn't see or hear any Dean mention them may simply be because they were not around forty years ago. If this NSF fellowship has piqued your interest, visit the web site http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=6201&org=NSF and also see http://www.nsf.gov/funding/education.jsp?org=NSF&fund_type=2 for links to other direct and indirect opportunities for graduate students. If you are interested in the NSF Graduate Research Fellowship, feel free to contact me for more information and some general advice; I used to work for the NSF, and I spent one year running the fellowship program, and I have an itch to see some UL students apply for this thing, so go ahead and send me an email. This year (2007) one student from Louisiana State and one student from Louisiana Tech University won this fellowship; I am sure that some of you will be able to win it too. The application deadline is in November, but you need to start the

³ Rising Above the Gathering Storm (http://www.nap.edu/catalog.php?record_id=11463); American Competitiveness Initiative (<http://www.whitehouse.gov/stateoftheunion/2006/aci/>)

⁴ This is because foreign students are not eligible for the federal fellowships.

process much earlier; you will need serious time and effort to complete the application package. Go sign up for the GRE (Graduate Record Examination) – although not mandatory, good scores will help your application; and start chasing professors for letters of recommendation – you need to pick the letter-writers very carefully. There is no cut-off point for GPA or GRE in order for you to apply, but the fellowships are extremely competitive. The selection criteria are a combination of “intellectual merit” and “broader impact”. In the NSF GRFP on-line application module, these items are explained and examples are given; many graduate students and awardees run blogs and actually post essays from successful applications (you have to write three essays). The essays are crucial, as are the letters of recommendation.

That GRE scores, and those letters of recommendation will also be needed if you are going to apply for the National Defense Science and Engineering Graduate Fellowship (NDSEG), awarded by the Department of Defense (DoD). Their application procedure is almost the same as NSF, but they don't support social sciences. See (<http://www.asee.org/ndseg/>) for more details. If you have research interests in certain fields that are considered important for national defense (say, detecting nuclear threats – believe it or not, this could be a project for a computer science PhD), your chances are excellent.

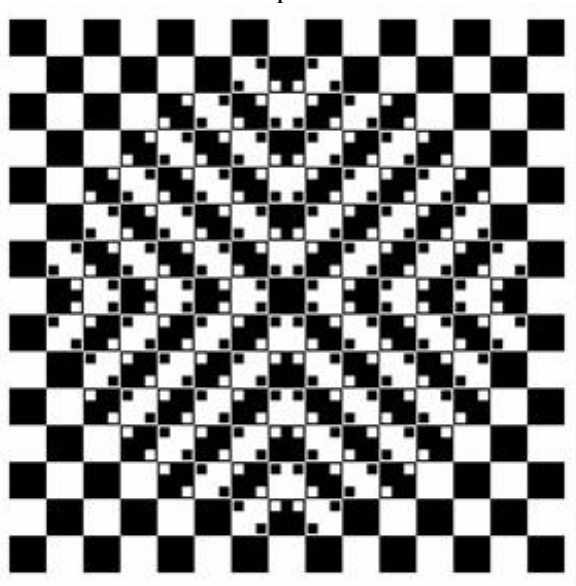
The Department of Energy (DoE) has graduate fellowships for computational sciences (<http://www.krellinst.org/csgf/index.shtml>); the National Aeronautics and Space Administration (NASA) has a program for various science and engineering fields (<http://fellowships.hq.nasa.gov/gsrp/nav/>). In addition, graduate fellowships are given out through the National Space Grant Consortium – see (http://calspace.ucsd.edu/spacegrant/webmap/sg_homepages.html) for the Space Grant homepage; most states have Space Grant programs ... see (<http://laspace.lsu.edu/fellowships.html>) for Louisiana Space Grant Consortium's fellowship page. Louisiana Board of Regents also has a graduate fellowship program (<http://www.laregents.org/www2/index.htm>). The Department of Homeland Security awards graduate fellowships (<http://www.orau.gov/dhsed/>).

The Department of Education awards a fellowship called GAANN (Graduate Assistantships in Areas of National Need), see <http://www.ed.gov/programs/gaann/index.html>. This award is given to universities, and if you are accepted in graduate school in a university that happens to have a GAANN award, you may be eligible for it. In fact, some universities recruit graduate students (check out those bulletin boards in your department for flyers) for the GAANN fellowships by advertising to undergraduate departments. There are a couple of secondary ways of getting an NSF fellowship, where you don't apply directly but get it through an already-funded program such as the IGERT or GK-12; IGERT stands for “Integrated Graduate Education Research and Traineeships”, and GK-12 stands for “Graduate K-12 Teaching Fellowships”. These are NSF grant programs awarded to universities, and the project teams recruit graduate students; the stipend is \$30,000 per year, just like the NSF GRF; but unlike the GRF, three years of funding is not guaranteed in IGERT and GK-12. If you are recruited for any of these programs, you have to work in the project team; GK-12 Teaching Fellows work with K-12 teachers and spend some time in the classrooms. If you are a graduate student searching for fellowships, it is a good idea to go on the internet and search for current IGERT sites and GK-12 sites, and see if there is a match between your interests and their themes. UL Lafayette campus currently does not have either of these grants, but that might change in the future. IGERT has a national graduate student recruitment program; see (<http://www.igert.org/>), and GK-12 has a central web site maintained by AAAS (American Association for the Advancement of Science, <http://www.aaas.org/>), see (<http://ehrweb.aaas.org/gk12new/>). The National Physical Sciences Consortium has certain fellowships, see (<http://www.npsc.org/>). The National Academy of Sciences has a fellowship office (<http://www.nationalacademies.org/grantprograms.html>).

Besides all these resources, each graduate department has RA (Research Assistantship) and TA (Teaching Assistantship) positions; for these, you have to compete with foreign students – for these are not protected for US citizens. A TA-ship is great vehicle for you to make an important discovery about yourself - are you professor material? I am not saying it's good and I'm not saying it's bad, but a few of you will

probably consider becoming a professor after getting out of graduate school (with a PhD, that is), and beware! if you absolutely hated being a TA, then you should stay away from students; and that pretty much rules out an academic career. No matter, there are plenty of other careers for PhD holders – in industry and in government. Also, if you are in engineering, there are plenty of jobs at the master’s level; for basic sciences, master’s level education is a mixed bag, but there is a program called Professional Science Masters (PSM) (<http://www.sciencemasters.com/>) in many universities, originally funded by the Alfred P. Sloan Foundation (<http://www.sloan.org/main.shtml>).

The resources I present in this essay do not constitute an exhaustive list; I mentioned the major fellowships and the most well-known (to me, that is) programs – in the hope that they will serve as a good introduction to the world of opportunities for you as a potential graduate student. You will have to spend some big chunk of time to do more research on them, find others that exist, contact various organizations, prepare yourself for writing excellent essays, write the essays again and revise them again (and perhaps again), etc., in short, this application process will train you to become a researcher (and eventually, a thesis-writer and paper-writer) at the graduate level. In fact, during this process, you will be able to decide whether you have the stomach for this “digging into information” and “extracting essential information from a vast array of available data” and “writing research-based essays”, which are essential ingredients in the recipe for cooking a successful thesis. After getting a PhD, some of you may consider an academic career – unless, of course, you’d rather stay away from students – particularly undergraduates, since a large chunk of them will always think graduate school is bunk. If you would like to find out what kind of life university professors have, I suggest you ask some of us; you should ask quite a few of us at different levels (ranks), and you may be surprised by what you find out. What you see of us in the undergraduate classrooms does not necessarily tell you what our lives are like; remember that perceptions can be misleading – see the picture below – are those lines parallel?



Here is another question: have you ever noticed that professors seem to delay retirement longer than some – actually a lot of – other professions? If you think this is because they just never make enough money to retire – think again: professors make decent money, actually (look up some salary data on the internet); and if they have not been fired within the first six or seven years of their job, they cannot be ever fired; except, of course, if they went bonkers and fired (with a gun, that is) someone else, or did something almost equally dreadful; this is called “tenure”. There must be some other reason (other than money) that professors delay retirement ... I think it is job satisfaction, and I think in general, people with graduate degrees have a higher probability of acquiring jobs with higher levels of job satisfaction. Keep in mind,

though, this is only a probability; and you know what they say about probability's cousin, statistics: if your head is in the oven, and your feet in the freezer, a statistician will say that on the average, you are just comfortable. So again, I confess that going to graduate school is a personal choice – it is not about more income, it is not necessarily about higher job satisfaction, and it is not even about gaining more knowledge; if you cannot decide whether it would be a good idea for you to go to graduate school, talk to some people – many different types of people – before making up your mind. If you think you would like to give it a try, and would like to see what types of funding may be available, check out the URLs I gave you in this essay.

Here are links to searchable databases of graduate fellowships that several universities maintain:

<http://www.gradschool.cornell.edu/?p=132>

<http://www.gdnet.ucla.edu/asis/grapes/search.asp>

<http://www.grad.nd.edu/gfd/>

I should like to close by adding that being a graduate student is quite different from being an undergraduate, particularly when you start doing your research project; it can be a life-changing experience, a fantastic journey: starting to look for graduate school money is a great way to start that journey – unless, of course, you have already convinced yourself that graduate school is bunk.