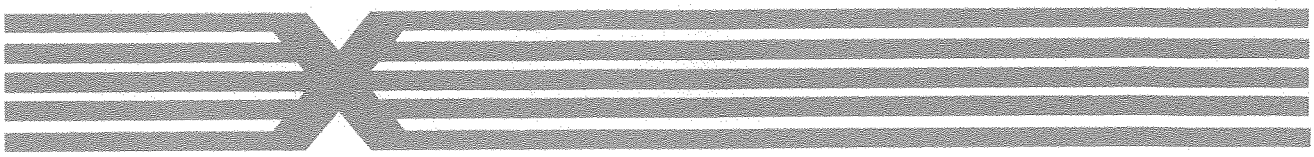
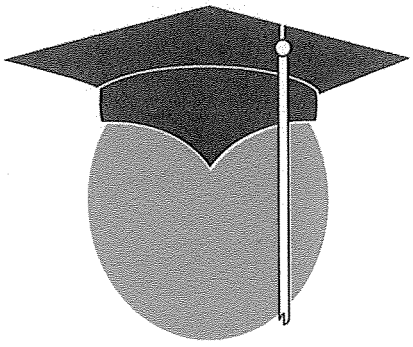
Quality Education for Minorities (QEM) Network



Pathways to the Ph.D.: A Handbook for Undergraduate and Graduate Students, and Their Mentors



February 2001

Prepared with Support from the Teagle Foundation, Inc.
and
The David and Lucile Packard Foundation

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Introduction and Acknowledgments

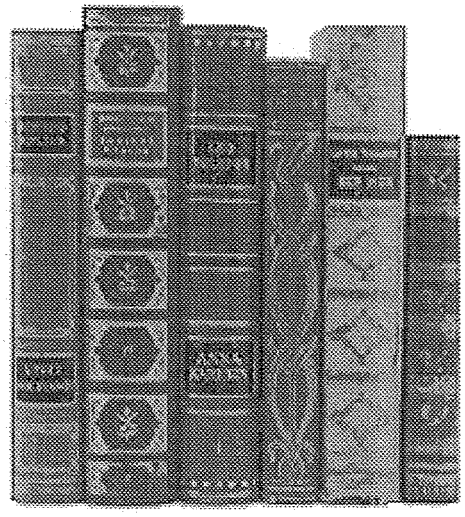
This handbook is a short guide for minority and other students interested in, or currently pursuing, a graduate degree in a mathematics, science, or engineering (MSE) field. Although information has been gathered from a variety of sources, the handbook is primarily based on opinions and experiences of current and recent minority graduate students. Their views were obtained through telephone conversations, campus visits, questionnaires, essays, and special sessions at the Ninth Annual Conference of the QEM/MSE Network in February 2000 whose theme was, *Preparing Ph.D.s for Success in the 21st Century*.

Every aspect of graduate school is not covered in this handbook. We have opted instead to focus on those topics identified as critical by the group of faculty, administrators, and graduate students interviewed for this purpose. The handbook is divided into several sections, beginning with an overview on preparation for graduate school and concluding with professional opportunities available to graduate degree recipients. The handbook is designed to be "user-friendly" so that the reader can easily find sections of interest at a particular point along the MSE graduate degree pathway.

The first two sections are designed to assist students who have not yet enrolled in a graduate program but are planning to do so. Sections three and four discuss issues relevant to students in various stages of their graduate programs while section five offers advice regarding "life after graduate school."

While we hope you will read the entire guide, we especially encourage you to read from your current stage (planning, accepted, or enrolled) forward. By doing so, you can get an idea of what may be in store at the next level.

We are grateful to the many graduate students and faculty who shared their views with us during the Ninth Annual Conference (see Conference Agenda at Appendix A), the David and Lucile Packard Scholars at various universities across the country, and to doctoral students at Howard University. We are especially indebted to four individuals who, at QEM's request, prepared papers that are included in this guide: Dr. Tasha Innis, a Packard Scholar who received the Ph.D. degree in Mathematics from the University of Maryland College Park in December 2000; Dr. Cynthia Winston and Ms. Melissa Wynn of Howard University's Alliance for Graduate Education and the Professorate, a National Science Foundation supported initiative; and Dr. Lesley Brown, a visiting assistant professor at Goucher College.



SECTION 1: PREPARING FOR GRADUATE SCHOOL

PREPARING FOR GRADUATE SCHOOL

Making the Decision to Attend

Before embarking on a graduate career, the first question you need to consider is "why should I do this?" Most graduate degree recipients will tell you that getting their degree was a "long journey" with a number of twists and turns but, when it was all over, they were glad they did it. While reasons for pursuing a graduate degree can vary from one student to the next, there are some clear advantages in having obtained a graduate degree. These advantages include: placement/advancement in terms of levels/types of professional responsibility given; monetary rewards; intellectual freedom; and the option of several career pathways.

Obtaining a graduate degree also allows you to contribute to the overall knowledge base in your discipline and to be a resource to others interested in your area of specialization. However, you should be clear in your own mind about why you want to pursue a graduate degree.

In addition, there are several questions that only you can answer. Do I like to solve problems? Do I enjoy intellectual challenges? Do I enjoy the exchange of ideas? Do I work well independently as well as in groups? Does the idea of doing original work excite me? Am I able to "re-group" and begin again when things don't turn out as I expect? Am I willing to devote the years that may be necessary to complete a graduate program? If your answers are "yes" to such questions, you have some of "the right stuff" for pursuing a graduate degree.

Undergraduate Preparation

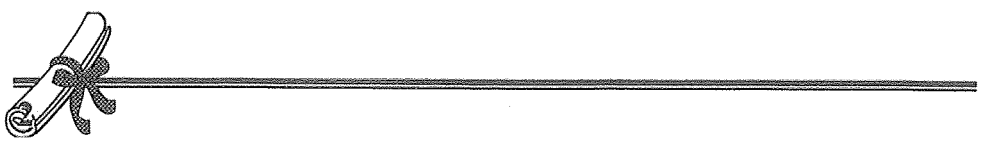
If you decide to pursue a graduate MSE degree, you will need to take several steps as an undergraduate.

First, be sure your course selections meet entrance requirements for MSE graduate programs. Consult faculty, advisors, counselors, and graduate school catalogues early in your undergraduate years to help you make the appropriate selections. Keep in mind that your transcript is a permanent record that follows you to graduate school and/or the workplace so it is important that it reflects quality and substance in both performance and course selection.

Second, identify and participate in as many enrichment opportunities as your schedule will permit such as seminars, public speaking and writing opportunities, literature searches, and library skills workshops. Proficiency in the use of various computer software applications also will help to provide you with a strong foundation for success in graduate school. You should learn at least one programming language and become familiar with software packages used in your field of interest.

While an undergraduate, you should explore membership in professional societies in your field as well as attend relevant local or regional meetings and conferences. This will help you stay current on recent developments as well as meet leaders in your discipline. Also, make it a habit to stay up-to-date by reading journal articles and on-line publications in your field.

Third, MSE graduate programs require students to research. Admissions committees consider prior research experiences when reviewing applications. Be sure to take advantage of research opportunities both on and off your campus so that you can gain research experience. Such research projects allow you to become familiar with experimental procedures in a variety of disciplines



and to identify the kind of research that interests you.

Summer research opportunities are offered in several settings, including:

- Institutions of higher education, including Research-intensive institutions
- Governmental agencies, Federal laboratories, and other research facilities
- Private non-profit organizations
- Corporations

Information about research opportunities offered by these organizations can be obtained from their websites, through written communication, by telephone, or by e-mail.

Fourth, most graduate programs require that applicants take and submit their scores for the General and Subject Tests of the Graduate Record Examination (GRE) administered by the Educational Testing Service (ETS). The General Test measures developed verbal, quantitative, and analytical abilities while the Subject Test measures achievement in various fields of study. Admissions committees will consider your GRE scores, along with your grade point average, letters of recommendation, and personal statement. Institutions vary with respect to the emphasis placed on the GRE.

The ETS website (www.ets.org) contains practice tests and helpful hints on taking the GRE. Also, the GRE Program at ETS offers a variety of publications that can assist you in making the transition from undergraduate to graduate education. The Princeton Review offers a GRE preparation course at its website (www.review.com)

(a private company unrelated to Princeton University).

Several other sites exist that can help you prepare for the test and help you assess your areas of strengths and weaknesses. Colleges, universities, and other groups also offer a number of courses that can help you prepare for the examination. Generally, university career centers and counseling services have a list of GRE preparation courses and can provide preparation materials.

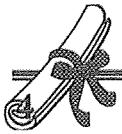
Take the GRE far enough in advance so that your scores can be included in your application packet. Also, allow enough time to re-take the test, if necessary, to improve your score.

The General Test is given through an electronic computerized system year-round by appointment at designated testing centers. To take the test in a paper-based format, you must check with ETS for the test dates. The Subject Test is offered only in paper format on specific dates. Information about the various dates and times can be found on the GRE web site (www.gre.org).

Choosing the Right Degree: Factors to Consider

Now that you have taken steps (course selection, enrichment opportunities, research experience, and the GRE) to help ensure your admission to graduate school, and to keep your career options open, you must decide what type of post-baccalaureate degree to pursue. Your earlier reflection on what you hope to gain from graduate school can help you decide on the type of degree to pursue.

The master's degree can provide you with the opportunity for career advancement or allow you to change fields completely. The Ph.D. is traditionally a research degree. Some Ph.D. programs do not offer master's degrees, and some programs require students to obtain a master's degree before they pursue the Ph.D. Having this



kind of information is critical as you decide where to apply and in which program to enroll. Keep in mind that once you have enrolled in a graduate department, it may be difficult to switch from one degree level program to another within the same department or at another university, without losing time or credits.

Interview students enrolled in both master's and doctoral programs to get an understanding of what is expected.

In some departments, students begin as master's degree candidates whether or not they intend to pursue the doctorate. Generally, in such departments, students must first pass the requirements for the master's degree before gaining admission into the doctoral program. This route may be advantageous because it allows you time to think about whether or not you want to pursue a doctoral degree. It may be disadvantageous in that once the master's is conferred, you may be tempted/encouraged not to continue with your doctoral studies.

Other considerations in choosing the type of degree to pursue include the following:

Availability of Financial Assistance

- Financial assistance is often more readily available for doctoral candidates than for master's degree students

Time Commitment

- A master's program may be more flexible and allow you to work while taking classes

- Some master's programs require only coursework for the receipt of the degree.

- Some universities offer different tracks for students pursuing a master's degree: one for students continuing in the same field of study they pursued at the undergraduate level and another for those switching to another field. The latter generally requires more time.

- After completing the required coursework for the doctoral degree, graduate students spend the majority of their time conducting research.

- A doctoral program can take several years to complete, in comparison to a master's program, because satisfying the Ph.D. requirements is heavily dependent upon original research that leads to a substantive contribution to the field.

Professional Requirements/Expectations

- Some people pursue master's degrees to upgrade their job status or to change professions. It can take from one to three years to obtain a master's degree, depending upon program requirements and enrollment status (full-time vs. part-time) of the student. Degree programs are usually very explicit in terms of courses that must be taken and other requirements.

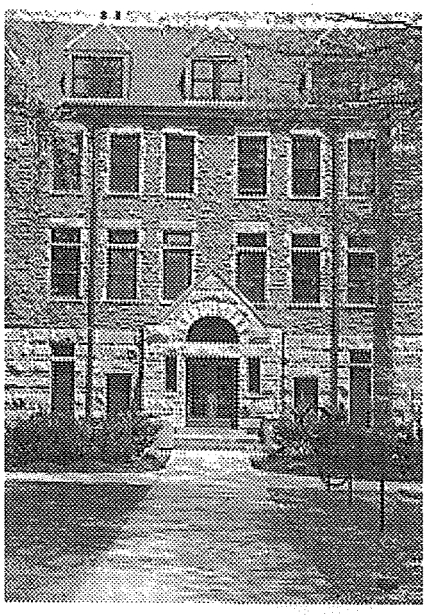
- To independently conduct scholarly and high-level research in most scientific fields, a Ph.D. is required/expected.

Thesis Requirements

- Some master's degree programs do not require candidates to complete a thesis.

- The doctoral thesis/dissertation must be based upon original research. A committee of scholars will critique your research methods as well as your findings and conclusions.

Talk to individuals already established in the field you plan to study. They can provide perspective on emerging research areas/directions in the field and offer advice on which degree might be best suited for your long-term career goals. Interview students enrolled in both master's and doctoral programs in your field. They can help you understand what is expected of graduate students in these programs in terms of background, independence, and time commitment. Carefully research the programs of interest to you. Consider applying to different types of programs so that you will have options as you make your final decision.



Section 2: IDENTIFYING THE RIGHT GRADUATE SCHOOL AND PROGRAM

IDENTIFYING THE RIGHT GRADUATE SCHOOL AND PROGRAM

Finding the Best Match

Visiting prospective schools; seeking advice from professionals, faculty, and current graduate students; and using various publications, the Internet, and other resources are excellent ways to learn about graduate schools and programs. One of your best resources may be the career services office on your campus. Generally, career centers have catalogues and bulletins from several graduate and professional schools. Other resources include:

- The US News and World Report's annual report on the best graduate programs. The website for US News and World Report, www.usnews.com, provides a ranking of several graduate and professional programs as well as a list of the criteria used in the ranking.

- The ETS website (www.est.org) provides an overview of various graduate programs. Some schools have applications on-line that can be down-loaded and used for electronic submissions. You can download information about different schools and their admission criteria for comparison purposes.

- The GradAdvantage, found at www.gradadvantage.org, provides useful information about hundreds of graduate programs, including information on what factors to consider when applying to a particular program.

Factors you should consider in deciding on which graduate school/program to apply include the following:

- Degrees/special programs offered in your field of interest
- Research interests of the faculty in the department you are considering
- Size of the department
- Admissions requirements
- Financial assistance available
- Demographics of the department
- Graduation and attrition rates

To learn more about the universities and departments to which you are applying, visit their websites. Furthermore, a book by Richard Jerrard and Margot Jerrard entitled, *The Graduate Student Handbook,* can help provide insight into graduate school decisions.

Graduation rates (average time to degree) and attrition rates are important factors to consider when deciding on which programs to apply. Try to find out the average time it takes for students in these programs to obtain graduate degrees. If possible, find out the national average for time to graduation and the graduation rates for your particular field of study so that you can compare rates/ averages in the programs of interest to you with national data.

You may want to inquire about attrition rates by contacting the graduate admissions office at each of the institutions you are considering. If the number of students who leave the program is quite high, you should try to ascertain the reasons. Attrition and graduation rates will vary among disciplines, departments, and faculty advisors. It may be helpful to contact the professional societies in your discipline to see if they have information on

national averages for graduation rates and time to graduation for various graduate departments.

Also, it may be helpful to know what students in particular programs do after graduation. What percentages pursue careers discipline related in academe? in governmental agencies? In the corporate world? What percentage leaves the field altogether? This kind of information also may help in your decision about where to attend graduate school.

Factors That Can Help You Decide Where to Apply:

- Degrees/special programs offered
- Research interests of the faculty in the department
- Size of the department
- Admissions requirements
- Financial Aid Programs
- Demographics
- Graduation and attrition rates

As a minority student preparing to enter a field in which minorities are underrepresented, you will want to be aware of the retention and graduation rates of minority students at the universities and within the departments you are considering. In February 2000, the QEM Network released a report entitled *Leading Producers of Minority Doctoral Degree Recipients in Mathematics, the Physical Sciences, and Engineering 1990-1997*. The report provided information on 27 institutions that were leading producers of minority MSE doctoral degrees recipients during that time period.

Assessing Institutional and Departmental Climate

Unlike most undergraduate programs, graduate students are admitted into particular departments. Be sure that you take the time to research a department and its faculty thoroughly. Since graduate programs generally have fewer students than undergraduate programs, more opportunities exist for graduate students to develop close relationships with each other as well as with faculty and staff in the department. Graduate students are sometimes

treated as "aspiring faculty." In many ways, this could be considered ideal but it also may lead to students becoming "entrenched" in their departments.

At the February 2000 QEM/MSE Network Conference, graduate student participants were asked to complete a questionnaire about their experiences in graduate school. When asked about the climate at their institutions, several students responded that their institutions had been quite supportive. A few students indicated that the environments on their campuses were not as helpful as they might have been. For example, one student felt that racial tensions in the surrounding community had an effect on the climate on campus. Several students identified ways in which the climate on campus as well as in departments could have been improved. Their observations suggest several questions for you to consider as you try to assess institutional/departmental climate at the institutions to which you are applying:

- Are there ample opportunities for students to meet with faculty and administrators? Do current students feel that the department's administration and faculty are willing to listen to their problems and concerns?

- How culturally diverse are the institution and the department? How sensitive are the faculty and staff to differences that may exist among its students (e.g., differences that may be due to religion or to the nature of their undergraduate experiences)?

- Are academic and professional enrichment opportunities available to students on- and off-campus? Are funds available to support student attendance at professional meetings? Are student chapters on campus of professional societies in your discipline available on the campus?

- ❑ Are there institutionally/departmentally sponsored opportunities for graduate students to interact and provide each other with academic and personal support?

A lack of institutional support identified by several graduate students as one of the main barriers to their obtaining a graduate degree. A lack of support at the institutional level can create an inhospitable climate that may spill over into the departments.

To better understand an institution's environment, you should visit the campus. If you are invited for an interview, take advantage of the opportunity to learn about the campus and the department. If your initial impressions are good, you may want to make a second visit on so that you can interact with students on a more informal basis. Campus climate also can be affected by geographic location of the campus, availability of housing for graduate students, size of the student body, and social activities.

Researching Faculty Interests

Graduate students have indicated that the composition of the faculty played a large part in their decision to attend a particular institution. Faculty members' research areas and publication records; tenure status; and level of external research support are important to examine. Also significant are the number of students who have graduated under individual faculty members; their time to graduation; and conditions for graduate students in various research laboratories.

Faculty members attending a QEM Network *Scholarly Productivity Seminar* at Tennessee State University in March 2000 offered the following advice to prospective graduate students as strategies for

identifying faculty interests and evaluating graduate departments and programs:

- Spend time finding out about the department and the faculty. Almost all institutions/departments have websites, and this is an excellent place to begin. Faculty often list their research interests and publications at the websites. Read a few of their publications to get a sense of their research activities. E-mail also is a great way to contact faculty, ask questions, and/or arrange meetings.

- Talk to departmental faculty at your undergraduate institution to get an idea of the academic reputation of graduate institutions you're considering as well as that of faculty at these institutions. Some of your college professors may know the graduate faculty through various professional activities. If so, they may be able to offer additional insight about the faculty and the graduate institution, beyond research accomplishments and academic reputation.

- Visit the departments and meet with faculty conducting research in areas of interest to you. Such face-to-face meetings will provide an additional opportunity for assessing departmental climate as well as faculty availability to and interest in students. Graduate programs usually have their own admissions office. Make an appointment with someone in the admissions office, arrange a tour, and schedule a meeting with graduate students in the program. Appointments can be arranged by that office with faculty who are doing research in areas of interest to you.

Finding Financial Support for Graduate Education

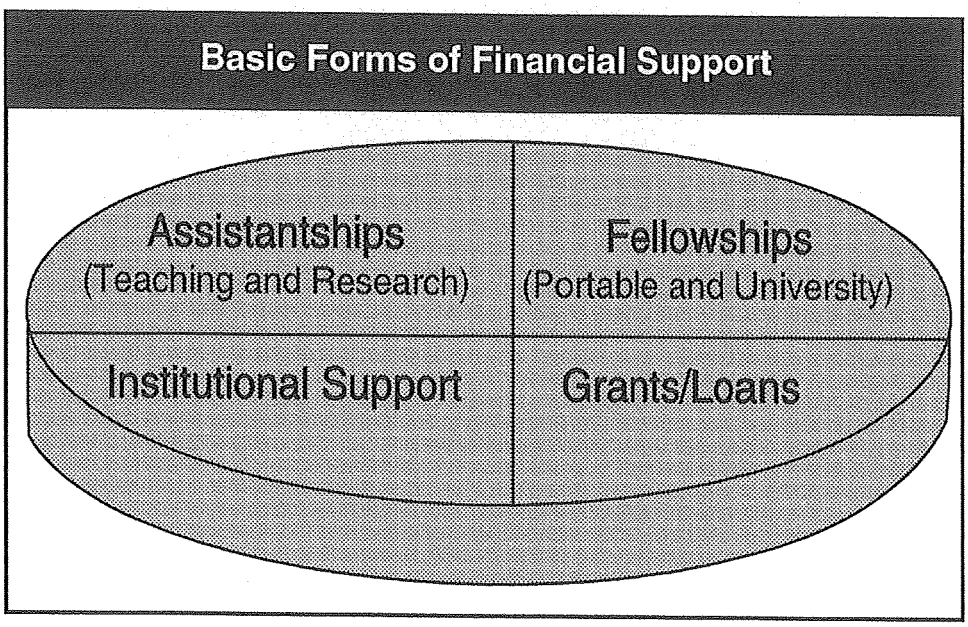
Four basic types of financial support exist for graduate students, beyond personal or family savings:

Assistantships (Teaching and Research)

Fellowships (Portable and University)

Institutional Support

Grants/Loans



Assistantships

Assistantships, generally teaching or research, require students to provide a particular service in return for financial support. Teaching assistantships require students to carry out classroom-related responsibilities such as teaching undergraduate students, grading papers or problem sets, and meeting with students.

The amount of work required during a teaching assistantship will vary depending on the assignment. For example, laboratory courses, generally, require more teaching time than lectures. When graduate students are teaching, they have less time to spend on research. Students often find they are less productive in the laboratory during the semesters/quarters they have teaching duties.

Some balance is necessary during such periods so that the time dedicated to research can be maximized. Although productivity may be reduced during these times, teaching provides opportunities to improve communication skills (oral and written), develop curricula, and mentor others. Such skills and experiences are important and can enhance your success as a graduate student and a professional.

Research assistantships require students to assist faculty in the conduct of research. The duties of a research assistant vary among disciplines. Research assistantships are designed to facilitate faculty members' research and for students to gain research experience. Graduate research assistants often decide to work on a thesis project tied to the research in which they are engaged as a research assistant.

Fellowships

Fellowships are scholarships for graduate students that may be portable or university-based. **Portable fellowships** are offered by agencies or organizations outside the university and, generally, can be used at any accredited institution chosen by the recipient. **University fellowships** are offered by specific institutions and must be utilized by recipients at those institutions. Fellowships have specific time limits and may or may not be renewable. The awards may include support for tuition, living expenses, and travel funds for meetings and conferences.

Students who obtain fellowships before entering graduate school are viewed as very desirable candidates. Numerous fellowships are available and students should explore fellowship opportunities for which they are eligible. Even if you do not receive a fellowship, the process of applying for a fellowship will be worth the effort.

What if you have a portable fellowship and decide to change institutions after beginning your graduate studies? This is a topic that must be taken up with the funding agency. Funding agencies often have very specific requirements/expectations attached to their fellowships. If this is the case, transferring your funds from one place to another may be difficult.

Some fellowships and assistantships are accompanied by payback agreements. Usually such payback agreements require that an individual work in a specific field for the same length of time that support was provided. Assistantships and fellowships are taxable.

Institutional Support

In addition to University fellowships, institutions often offer support through externally-funded training grants that have been awarded to specific departments. These departmental training grants provide support for tuition and a monthly stipend. This kind of support for students in mathematics, science, and engineering is quite common. It is very rare that training grant recipients have to supplement the financial support provided. As noted, institutions also offer fellowships that must be used within the institution and are non-transferable. These fellowships generally are merit-based and competitively awarded.

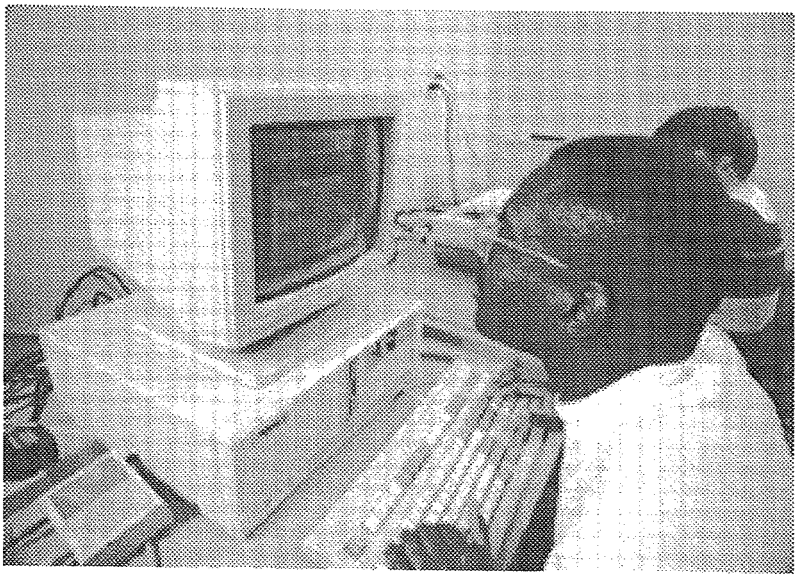
Grants/Loans

Graduate students may receive loans and federal work study support, but are ineligible for Federal Pell Grants or Federal

Supplemental Educational Opportunity Grants. When applying for and/or receiving financial support, make sure you understand all of the eligibility requirements. If you have loans from your undergraduate education, check the requirements for payment of those loans. Payment on educational loans often can be deferred until after graduate school.

Comparison of Financial Support

Type of Support	Assistantships	Fellowships	Institutional Support (fellowships and training grants)	Grants/Loans
Source of Support	Institution	Government agencies or private foundations/ organizations	Institution	Government agencies or private organizations
Requirements for Obtaining This Type of Support	Graduate students enrolled at granting institution and meeting other institutional requirements	Applicants must apply for and meet requirements stipulated by granting agency/ organization	Requirements are established by the granting institution	Applicant must be enrolled as graduate student Applicant may be required to demonstrate financial need
What to Know About This Type of Support	Teaching or research expected in order to receive assistance Possible payback requirements Taxable	Portable or Institutional Time limitations Possible payback requirements Taxable	Support can only be applied for at granting institution Possible payback requirements Taxable	Loans must be paid back with interest



SECTION 3:
APPLYING TO GRADUATE SCHOOL

APPLYING TO GRADUATE SCHOOL

Voices of Experience

Two papers follow that focus on effective preparation for and application to graduate school. They have been prepared by individuals who have been through the application process and/or are currently advising doctoral students in the sciences and engineering. The first is a treatise entitled *Effective Preparation for Graduate School: A Timeline and Guide for Successful Results*, that was prepared in Spring 2000 by Packard Scholar Tasha Innis who, at the time, was a Ph.D. candidate in Applied Mathematics at the University of Maryland College Park. In December 2000, Ms. Innis was one of three African-American women to receive the Ph.D. degree in mathematics from the University of Maryland College Park. Dr. Innis is now Clare Boothe Luce Professor of Mathematics at Trinity College.

The second paper, entitled *Developing a Competitive Graduate School Application,* was prepared by Dr. Cynthia Winston, Howard University, Program Coordinator, NSF/Alliance for Graduate Education and the Professoriate (AGEP) and Ms. Melissa Wynn, Assistant AGEP Program Coordinator.

Effective Preparation for Graduate School: A Timeline and Guide for Successful Results

by
Tasha R. Inniss
Ph.D. Recipient, Applied Mathematics
University of Maryland College Park
December 2000

It is becoming increasingly vital that students pursue graduate or professional degrees to make themselves more marketable and competitive in our society. Choosing the graduate school that is most compatible with you, your goals, and your mission is a very important issue that should be given a great deal of thought. I chose the University of Maryland College Park because of the flexibility in choosing qualifying exams, the supportive environment, the diverse range of faculty research, and the presence of other African-American students pursuing doctorates in mathematics. (Currently, we have the largest number in the country.)

To the students who have decided to pursue a graduate education, I applaud you. This is a choice that you will not regret!

Preparation for graduate school begins during your freshman year of college.

Preparation for Graduate School

Graduate schools give serious consideration to candidates who appear to be academically sound and well-rounded. With this in mind, the following is a list of suggestions to help you make yourself more attractive to graduate schools.

1) Study Hard and make the best possible grades! This will determine how much funding you are offered to attend graduate school and how many graduate schools accept you.

There is no reason that any student should have to take out a loan to go to graduate school to pursue an MSE doctorate.

2) Participate in Summer and On-Campus Research Programs. This will allow you to gain exposure to interesting areas in your major field. Talk to your advisor, professors, or other students to find out about research opportunities. One example of a summer research program, Research Experiences for Undergraduates (REU), is supported by the National Science Foundation (NSF). REUs are offered in various science fields and at different universities. Visit (www.nsf.gov/home/crssprgm/reu/start.htm)

3) Get Involved in Extracurricular Activities such as community service projects, clubs in your major fields, student government, or class boards.

4) Go to Conferences and Seminars related to your major to learn about the most recent and exciting developments in your field.

5) Attend Graduate Recruitment Fairs to gather information about graduate schools and their programs in your major or the field in which you are interested in getting a graduate education.

6) Learn at Least One Programming Language and the software that is used in your field of interest. This is particularly important for mathematics and science majors.

7) Keep a Portfolio listing of all the activities in which you have participated, honors and awards you have received, and presentations you have given. This information will ultimately go on your résumé or curriculum vita.

Applying to Graduate Schools

The graduate school application process can be tedious, cumbersome, and somewhat overwhelming. The following is a suggested timeline to follow that will allow you to bite off one piece at a time to ensure your overall success and happiness with the outcome of the process. Prior to your junior year, focus on the tips in the previous section on Preparation for Graduate School.

Summer before Junior Year:

- ❑ Create a list of potential schools and find out more information about these schools using the Peterson's Guide to Graduate and Professional Programs, at the website www.graduateschool.net/, or in the Educational Testing Services GRE/CGS Directory of Graduate Programs. To discover which schools have potential, you might want to consider your preferences about the location of the school, the professor/student ratio, the research of the faculty, level of support for students of color, and facilities/laboratories.

- ❑ Explore research funding opportunities. The following websites are examples of ones that may be of use to mathematics and science majors:

  Fastweb: www.fastweb.com

  National Science Foundation: www.nsf.gov/ehr/dge/grf.htm

  Ford Foundation: www4.nas.edu/osep/fo.nsf/web/fordpredoc

  David and Lucile Packard Foundation: www.packfound.org/html/graduate_scholars.html

  National Physical Science Consortium: www.npsc.org

- ❑ Write a first draft of Statement of Purpose that also is known as your Personal Statement. According to Dr. Dereck Rovaris,

Director of Xavier University of Louisiana's Graduate Placement Office, your statement should be concise, organized, clear, honest, and positive. See his article at http://www.blackcollegian.com/graduateschool/future sucess1999-1st.shtml for a sample Statement of Purpose.

- ❑ Send cover letters to graduate and funding institutions requesting more information and applications. You also can get the email address of a contact person and request materials via email.

- ❑ Register for the GRE. Participate in a GRE preparatory course. You can take a free practice test online at www.graduateschool.net/

First Semester Junior Year:

- ❑ Take the GRE General Test. Aim for a 1200 total on verbal and quantitative sections.

- ❑ Refine Statement of Purpose and have others read/critique it.

- ❑ Respectfully ask professors (with whom you have taken classes) if they would be willing to write a favorable recommendation for you. Give a folder to each professor that contains a recommendation form, your résumé, your Statement of Purpose and a pre-addressed, stamped envelope. Ask the professors to sign their names on the seal of the envelopes.

- ❑ Gather official transcripts. It is a good idea to have copies of official transcripts handy from all schools you have attended.

- ❑ Contact graduate schools you are seriously considering to inquire about visitation programs (or funds for campus visits) and to request contact information for students

currently in their program. It is a good idea to talk with students in the program you are considering to get an open and honest perspective of the department.

- ❑ Contact graduate students at the schools you are seriously considering. Ask them about their progress, their satisfaction with the program, the undergraduate courses they found most useful for the graduate courses, the average completion time of the degree (Master's or Ph.D.), teaching and course loads, and funding/support of students of color.

Second Semester Junior Year:

- ❑ Make personal campus visits to graduate schools. Meet with the Graduate Director and graduate students; inquire about an application fee waiver; obtain information on first year course requirements with syllabi and names/authors of required texts; and request copies of sample qualifying/comprehensive examinations.

- ❑ Retake GRE General Test (if needed).

First Semester Senior Year:

- ❑ Take the GRE Subject Test even if the schools you are seriously considering do not require it. Most funding agencies DO require the GRE Subject Test.

- ❑ Mail ALL fellowship (funding) and graduate school applications. Note: Fellowship application deadlines can be as early as October.

- ❑ At the end of the semester, contact schools to make sure your application files are complete.

Second Semester Senior Year:

- ❑ Make final decisions about your choice for graduate school and for funding. If you are offered a fellowship by the school you would like to attend and one from an outside agency, find out if you can accept both. (Most federal fellowships require that you only accept one means of funding.) If you cannot accept both, accept the outside funding and request that the university funding be deferred until the outside funding terminates. This is an acceptable and legitimate request!

- ❑ Send acceptance and rejection letters to all schools and fellowships that made offers.

- ❑ Give thank-you notes to all the professors who wrote recommendations for you and notify them of your choice of graduate school.

Summer before Graduate School:

- ❑ Read required texts for first year courses to refresh your memory and to get a head start.

- ❑ Take one summer class at your graduate school of choice, if desired or required.

REST, TRAVEL, and HAVE FUN!!!!!!
You are about to embark on a challenging, yet exciting journey.

Developing a Competitive Graduate School Application

by
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PART I: The Application Process

Reading is Fundamental

After you have researched several institutions, you should obtain application materials from those in which you are interested. This should be done early because there are many requirements. It is important to read through everything very carefully to make certain that you identify all of the requirements. Some institutions may ask a specific question or require you to focus your statement in a particular direction. If you have a pre-written statement, it may need to be tailored to fit each institution.

Organization of Application Materials

Organization is key to the pursuit of the Ph.D., so develop good habits early. It is likely that you will be applying to several schools with different application requirements. Therefore, it is important to keep all of this information well-organized. You should create a separate folder for each institution to which you wish to apply. In the folder you should keep the information you have gathered on the school, the application materials, and any other pertinent information. It is a good idea to print a few sets of address labels to assist you in mailing all of your correspondence.

Also, create an application checklist for each institution (sometimes the institution will provide one with the application). Note all deadlines on the checklist. It also is a good idea to create a master

calendar with all of the deadlines as you receive the materials. This will assist you in determining how to strategically approach the entire process.

Communication

Effective communication can mean the difference between getting accepted and getting rejected. You have completed the written application, your transcript is stellar, your GRE scores are impeccable, but why did you get rejected while another individual at your institution with a lower GPA was accepted? The answer may lie in your communication skills (or lack thereof). Written and verbal communication are crucial in the entire application process. Any time you pick up the phone to call the institution or actually set foot on the campus, you should view it as an informal interview. You always want to put your best foot forward. The old phrase "you catch more flies with honey than vinegar" is a good one to keep in the back of your mind at all times.

Essential Parts of Your Application:

- Application Form
- Transcripts (*from any post secondary institution*)
- Letters of Reference
- Required Exam(s)
- Personal Statement
- Interview (if applicable)
- FOLLOW-UP!!

Admissions officers and departmental secretaries can be great advocates for you during the follow-up stage. They can make certain a specific professor is aware that your file is complete and that he or she sees it. Although an interview is usually not required, you may wish to visit the campus and meet the department chair or a faculty member to narrow your institutional choices or to gain additional information on the institution. Treat this as a formal interview. Much can be interpreted from what you say as well as from what you do.

Application Tips

- ✔ Make sure you research institutions carefully and realistically.
- ✔ In gathering graduate catalogs and departmental information, always keep your goals in mind.
- ✔ Obtain your application materials early.
- ✔ Reading is Fundamental! Be sure to read the materials thoroughly so that you are aware of all admissions requirements, and prepare accordingly.
- ✔ Do an application checklist for each institution to make sure that you know what the requirements are and note their deadlines. Develop a targeted deadline date and note the date you actually mailed the materials. It also is a good idea to create a master calendar of these deadlines.
- ✔ Photocopy all applications and fill them out in draft form first. Once an application is completed to your satisfaction, type it.
- ✔ Make sure everything is typed and be sure to always include your name and social security number on every page that you submit. Things do get separated.
- ✔ Complete all application requirements in a timely manner. Do not wait until the deadline.
- ✔ Strategically determine the individuals who will write your letters of reference. Request them early and provide the recommenders with any required forms. It also is a good idea to provide them with pre-addressed, stamped envelopes. Make the process as easy for them as possible.

- ✔ Request official transcripts early. If it is permissible to submit transcripts with your application materials, then have them released directly to you.

- ✔ Get a copy of your last Federal Income Tax Return. It is necessary for most need-based financial aid applications.

- ✔ FOLLOW UP!!! You are your strongest advocate. This may prove to be the most time consuming part of the application process.

- ✔ "You catch more flies with honey than vinegar" - communication is key. Treat verbal and written communication as interviews and put your best foot forward.

- ✔ When calling an institution, make a note of the person(s) with whom you speak. You may want to call those individuals again or make reference to them when speaking to others at the institution.

- ✔ You should consider sending materials with a returned receipt requested. This minor cost far outweighs the headache of a lost application.

- ✔ MAKE AND RETAIN COPIES OF EVERYTHING!!!

PART II: Writing an Effective Personal Statement

Be clear about why you are writing the statement. The purpose of your personal statement should be to persuade members of the admissions committee that you are an exceptional candidate for their doctoral program. You want to demonstrate to the committee that you have the ability, motivation, and experience to succeed in your field. An effective personal statement requires you to communicate your unique characteristics and experiences in a way that will distinguish you from the rest of the applicant pool. This can be a challenge, and you may need to do the following:

- ❑ Analyze your personality and personal history.
- ❑ Prioritize and analyze your experiences, accomplishments, and personal traits, keeping in mind the departmental admissions criteria and requirements.
- ❑ Arrange all this prioritized information into narrative form.
- ❑ Craft an organized essay from this information into a persuasive statement.
- ❑ Do all of this within the narrow or specific constraints of the personal statement question.
- ❑ Focus on substantive strategies and concerns so that you stand apart from others who may have the same GPA as well as comparable accomplishments, awards, and experiences. This requires you to be creative, innovative, and engaging.
- ❑ Understand the meaning and scope of the questions being asked.

- ❑ Isolate and focus on the central theme of each question. Most schools provide guidelines for answering their questions. Follow these guidelines carefully. Analyze the questions and/or guidelines for the personal essay. List each question on a separate page. Answer each question in a short paragraph before attempting to write the entire statement.

- ❑ Formulate the structure and content of your statement. Determine the structure that will be most efficient and responsive to the question(s) posed.

Introduction

Your introductory paragraph is extremely important. Use it to grab the reader's attention and to persuade him/her to read your essay intently. Take some time to think through possible alternative approaches for presenting information. For example, you may use an opening quote, anecdote, or narrative passage. Be very careful if you employ one of these strategies to ensure it is well thought-out and that you are strategic about what you decide to use. Select a quotation only if it is linked to the focus of your statement, as the committee may come to identify you with this quotation.

An effective opening line engages the reader and draws him/her into your essay, compelling him/her to continue reading. The rest of your introduction should be a short summary of what is to come. Thus, it should serve as an advanced organizer or preview of what follows.

Body

Graduate school admissions committees are most likely to be concerned with the following questions:

Why you are pursuing graduate study?

What are your long and short-term goals?

What is the area in which you wish to specialize?

How do you plan to use your graduate study experiences in the future?

What is your academic and research preparation?

Are there problems or inconsistencies in your record or scores?

Are there special problems revealed elsewhere?

Guiding Questions in preparing your personal statement:

- ✔ What is most unusual, distinctive, unique, and impressive about me?
- ✔ Do I have special qualities or skills that might set me apart from others and make me a successful graduate school candidate?
- ✔ When did I originally become interested in my field of study, and what have I learned about my field?
- ✔ What skills (e.g., research, analytical, communication, and leadership) do I possess?
- ✔ What are the most compelling reasons for the committee to be interested in me?

Conclusion

In the conclusion, you should emphasize the point you made at the beginning of the statement. Do not merely re-state your introduction. While it is acceptable to re-state your goals and reasons for wanting to attend graduate school, you should do so in a manner that leaves a lasting impression with the reader. End with a statement about the characteristics and/or experiences that make you an outstanding candidate for the doctoral program.

Form and Revision

Your statement should be objective, yet self-revealing. Write in a direct and straightforward manner about your experience and what it means to you. Do not use jargon. Your statement should form conclusions that explain the value and meaning of your experiences. It should be specific. Document your conclusions with specific instances or base them on individual experiences. Your statement should be an example of good persuasive writing.

Form

- Type your statement and use name and page number headers or footers.

- Keep within the page number limit. Remember reviewers often have many statements to read.

- Use at least a 12-point font.

- If you do not use the form provided to write your personal statement, you should type "please see the attached" on the form.

Revision

This may be one of the most important essays you will ever have to write. Therefore, do not submit your first draft.

Read your personal statement aloud; have a friend read it; and then revise, revise, and revise! Next, have at least two professors and one other individual read and critique your statement. Most schools do not conduct personal interviews. Therefore, the personal statement is your only chance to personally connect with the people who hold the admissions decision-making power.

Do not hesitate to analyze your essay line by line. Question whether each line fits and connects with other statements. Ask whether each line is concise and effective. Does it illuminate the general theme or support an assertion? Make sure that all sentences follow the preceding ones in logical order. If something is not absolutely clear to you, it certainly will not be clear to the reader who knows nothing about you.

Questions to ask after you have written your first draft:

1) Does my statement accurately answer the question(s)?

2) Does my opening paragraph capture the reader's attention? On the whole, is my statement interesting?

3) Does my statement distinguish me from others?

4) Is my statement positive, upbeat, and confident?

5) Have I expressed myself clearly and concisely?

6) Is my statement well-written and in standard essay format? Is it a complete essay with an introduction, body, and conclusion?

Do I have smooth transition sentences that link my paragraphs together?

7) Do I have any spelling or grammatical errors?

8) Have I supported all assertions?

9) Do I have any redundancies?

The revision process is very important, so take your time.

Personal Statement Tips

- ✔ Concentrate on your opening paragraph; make sure you stress compelling reasons for the admissions committee to be interested in you.

- ✔ Treat your personal statement like a job interview. You have five minutes to impress.

- ✔ Find an angle, tell a story, and set yourself apart from others.

- ✔ Balance personal and analytical thoughts in your statement. Catch the reader's attention in your first paragraph with personal information, but remember to sell yourself through analysis and reflection of your skills, strengths, and assets throughout your essay.

- ✔ Be selective. Write clearly and concisely.

- ✔ Adhere to word and page limits.

- ✔ Proofread every draft.

✔ Use positive language. "I am productive with my time" versus "I do not waste time."

✔ Learn about the capabilities of the faculty at the institutions to which you are applying and make an informed decision about whether or not to mention these faculty by name in your personal statement. "Goodness of fit" is critical at many institutions.

✔ Avoid redundancies among the differing parts of your application package (e.g., do not just recite your GPA and courses in your personal statement).

Your personal statement is your chance to shine. Plan it accordingly. Discuss accomplishments, not failures; valuable experiences, not defeats. Emphasize the positive and empowering, do not bore or depress the reader. Make sure your personal statement is engaging.

Remember everyone is in the same boat. You have special qualities that distinguish you from everyone else; if you didn't, you would not be you. So tell the committee who you are and why you are a strong candidate for graduate school.

GOOD LUCK!

SECTION 4:
THE EARLY YEARS:
SUCCEEDING IN GRADUATE SCHOOL

THE EARLY YEARS: SUCCEEDING IN GRADUATE SCHOOL

Developing an Individual Graduate Plan

While each graduate program is different, requirements for a doctoral degree generally include the following:

1) A set of required courses
2) A qualifying examination
3) A thesis/dissertation proposal and the conduct of original research
4) A written thesis/dissertation and an oral defense

You should develop a graduate plan based on the various requirements for receipt of the degree you are pursuing. Read the school catalog to be certain you understand the requirements for your degree program and seek advice from your research advisor about the development of a graduate plan. A plan should include regular meetings with your advisor, a schedule for taking required courses, a projected date for taking the qualifying/comprehensive examination, and a proposed research area. Depending upon the discipline, your plan also may include the selection of a thesis committee and regular meetings with this committee.

Preparing for Courses and Examinations

Most graduate programs have a core set of courses that all students must take as well as other offerings that may be taken as electives. Required courses are usually taken during the first two years of graduate school. These courses must all be passed with a grade of "B" or better to remain in good standing in the department. Core courses can help students decide where their research interests lie.

Lanette Roybal, a mechanical engineering graduate student at the University of New Mexico, suggests that entering students meet with their faculty advisor to lay out a plan for the first three semesters of coursework. She also advises that this plan take into consideration courses that are offered only at specific times of the year. She suggests that an extensive literature search be conducted during the first semester. She offers the following advice: "review about 50 to 75 papers, decide on a topic on which you want to focus, and narrow your literature search to 20 to 30 papers. Understand those papers well. Write summaries of all of them because these papers can serve as the basis for your research proposal and become part of the thesis."

Graduate programs generally require students to maintain at least a 3.00 grade point average (GPA). If your grades fall below that level, you should immediately seek help and advice from faculty or departmental administrators. Improving your GPA may require enrolling in additional courses, participating in tutorial sessions, or doing extra class work. A graduate department makes a significant investment in its students and wants to see them leave with degrees. However, it is each student's responsibility to remain in good standing in the department.

Courses at the graduate level are quite different from those at the undergraduate level. Be aware of these differences before starting your graduate studies. The level of detailed knowledge expected is generally much greater in graduate level courses. Participation in study groups enables students to help each other acquire the knowledge and understanding expected.

The courses you take will help with your research. You will be gaining new knowledge, learning how to critically review the literature in your discipline, and developing new research techniques. The required courses also will provide you the opportunity to learn about different subfields/branches within your

discipline. You will find that graduate education becomes very specialized following these initial courses. Most of what you will be doing afterwards will be research focused on one area or subfield.

Choosing a Thesis/Research Advisor

Although the terms "advisor" and "mentor" are often used interchangeably, the roles of individuals serving in these capacities are quite different. Your research advisor will be the individual who will help you in formulating and answering research questions that will lead ultimately to your earning a doctoral degree. A mentor is a guide, cheerleader, resource, and advocate on your behalf. If you are fortunate, your research advisor also will be your mentor. If not, you may have to find someone else within or outside your department to serve as your mentor.

Students in the physical and life sciences often do rotations with various principal investigators during their initial year(s) rather than seeking out a single research advisor upon entering the program. Such rotations can last from a few weeks to a few months. Rotations allow you to find out what a laboratory environment is like as well as about the research being conducted by the principal investigator. Although a research project may look great on paper, it is important to have support and comfort coming from within the research group and the project leader. Otherwise, you may have difficulty completing your research and dissertation in a timely manner.

The existence of an esprit de corps within a group/laboratory is of critical importance. You must be able to survive and thrive in this environment. Each principal investigator sets the tone and climate for his/her research group. Don't ignore this environment when seeking/choosing a research advisor because it is very difficult to switch advisors. The research laboratory you choose will be your home for the next several years.

Rotations generally occur during the time that students are taking classes. Maria Maynes-Nolen, a second year graduate student in the School of Medicine at Washington University, suggests that students have a clear understanding about how much will be expected of them during rotations and that they make sure the goals are reasonable. The purpose of a rotation is to enable you to become familiar with each laboratory.

Kathy Eggleson, a recent doctoral recipient, offers this advice on choosing an advisor: Choose your thesis advisor very carefully. It is important to consider his/her publication record, tenure status, funding, collaborations, reputation in the department, number of students previously trained, and average length of student training. It is equally important to consider the kind of person he/she is. Emotional stability, even-temperedness, kindness, understanding, and a genuine will to teach and nurture on the part of your advisor will facilitate your development as a scientist. Living in fear or under oppression can stifle creativity and limit your accomplishments.

Choosing a research/thesis advisor is perhaps the most important decision you will make in graduate school. You may find that once you have joined a particular laboratory, it is not what you had anticipated. Don't be afraid to discuss your concerns early on with your advisor. If the situation is not correctable, you should seek another advisor immediately to avoid losing significant time.

During the 2000 QEM/MSE Network Conference, several graduate students in attendance were asked to list the characteristics of a good advisor. The two attributes mentioned most frequently were availability and dependability. These students felt that an advisor should be able to support his or her students throughout the graduate process. Although the students said that research funding, publications, and research experiences of advisors were important considerations, they felt being able to "trust" an advisor and to feel as though the advisor would remain supportive beyond their

graduate years were extremely important.

Finding/choosing an advisor can be challenging if your graduate program does not include rotations. If you must find an advisor without the benefit of working with him/her first, you should be sure to talk to as many people as possible who have worked with this individual. Talking with students who are already working with this advisor can be helpful. How do they find working with the advisor? Is the climate in the laboratory conducive to carrying out research? How long has it taken for students to complete their research projects in the laboratory?

Additional questions to consider when choosing a thesis advisor include:

> How many students have completed their dissertations under this advisor?
>
> Are there students currently in the laboratory and, if so, what type of relationship do they have with the advisor?
>
> How available is the advisor? Is he/she easy to approach?
>
> Are the laboratory's "standard operating procedures" ones that you can accept or do you sense that they may impede your productivity?
>
> Will there be ample resources (e.g., equipment, supplies, journals, and personnel in the laboratory) available to you if you choose this advisor?

One of the most important aspects of a successful relationship with your advisor is regular communication. Be confident in your ability to discuss your ideas with your advisor and be able to accept criticism as well. Receiving and addressing criticism will be part of your graduate school experience. You may find your advisor to be the most critical. This will probably be the case because he or she

is most familiar with you and your project. Your advisor is a guide who will lead you through the difficult times but also will let you make your own decisions. Open and regular communication with your advisor will help ensure that the two of you have the same ideas about how your project is going. Remember, your advisor wants you to succeed as much as you do. He or she has a vested interest in you and your work because you are helping to further his or her research at the same time you are finishing your project.

Finding a Mentor

"Mentoring is distinct from advising because it becomes a personal relationship. It involves professors acting as close, trusted, and experienced colleagues and guides... It transforms the students into a colleague." (Council of Graduate Schools position paper developed by Arizona State University). Mentors may come from within or outside of your department and institution. They may have various backgrounds and experiences, and having more than one is recommended. However, you should be clear about what you expect from each mentor.

Mentors can assist you in understanding the "written" and "unwritten" rules of your department, institution, and discipline. For many students, especially minority students, it isn't always the academic program in graduate school that causes difficulty. Understanding the nuances in your academic environment is very important. Mentors will help you to develop the skills needed to successfully navigate through your graduate program. Their influence will likely continue through your professional career.

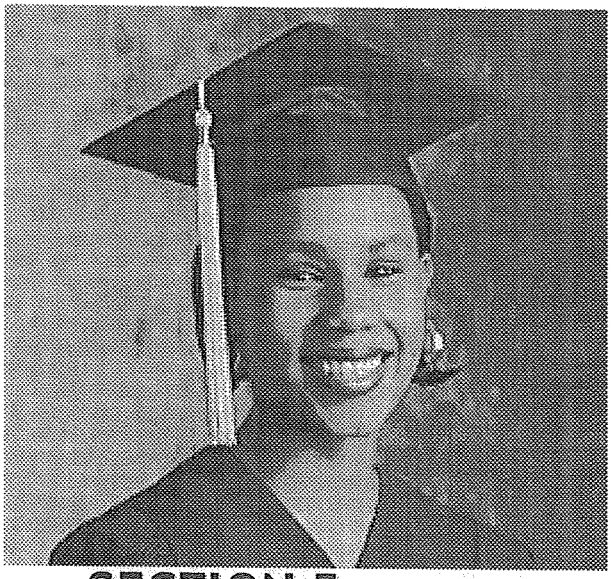
Dr. Rosalie Troung, a recent doctoral recipient from Washington University School of Medicine, Department of Molecular Microbiology, says, " ....finding a mentor is not too different from finding a spouse. You must have common interests and you must get along."

Mentors are often found informally. You may meet a future mentor at a professional meeting, departmental seminar, during a class, in a dean's office, at a banquet, or in any number of non-academic settings since mentors do not have to be professors or administrators.

To find and keep a mentor you must be pro-active. Mentoring relationships develop over time and must be cultivated. You will need to help mentors understand your situation and needs while not overburdening them with your problems. Stay in contact with mentors you had during your undergraduate years and keep them informed of your progress. They may be able to help you understand some of the issues that arise during graduate school and beyond.

Peers, including fellow students, also can serve as mentors. Forming (or joining) support groups can help you meet individuals who understand what you are experiencing. Such groups can be helpful in developing relationships with peers outside your department; in serving as a forum for discussing issues not related to your research; and in providing opportunities to seek advice in any number of areas.

Joining campus student organizations also can assist you in building a support network. Minority- and non-minority-focused student groups and associations can assist you in meeting students with similar interests. You may be able to serve these organizations by becoming an advisor/mentor to an undergraduate member. Serving as a mentor can be as valuable as having one because it can give you a different perspective on how relationships develop between mentors and students. Being active in student chapters of professional organizations, especially those in your field, is another way to meet potential mentors as well as to build a professional network.



SECTION 5: COMPLETING YOUR GRADUATE PROGRAM

COMPLETING YOUR GRADUATE PROGRAM

Choosing a Thesis/Dissertation Project

Choosing a thesis project is a process that is completed during the early years of your program in consultation with your advisor. This usually occurs by the third year, although it can take longer to find a project on which you want to work.

Deciding on a thesis topic is an involved process. It requires a lot of background reading because you want to know a considerable amount about the topic and the latest techniques and methods related to it. Your advisor or professors in the areas of interest to you can recommend appropriate journals and articles for you to review. Also, you should read the dissertations of graduate students who completed their work in your area of interest. This will familiarize you with work that has already been done as well as give you some idea of the direction in which the research is headed. Use this time to read, critique, and evaluate what has been done. This will help you to formulate your own research ideas and will make writing up your own research easier. Share what you learn with your advisor and with the principal investigators carrying out research that interests you. Choose a topic you enjoy and find interesting because you probably will be working on it for a long time!

Once you have decided on a topic and have been invited to join a research group, devise a research plan. This plan should outline the focus of the project, the questions to be asked, and the process to be followed in answering these questions. This plan will likely change several times over the course of your research and, as a result, the initial research focus of your project may change. Also, the interest of your research advisor may shift, affecting the direction of your

project. Be flexible and understand that the length and the depth of a project will be shaped by numerous factors. A thesis project is generally the result of several smaller projects. Focus first on completing smaller projects that make up the larger questions you're trying to address. This will allow you to maintain some sense of control and keep the overall project from overwhelming you.

You and your research advisor will work very closely during this period. Be sure that you schedule regular (weekly, if possible) meetings with him/her. At some point, you will notice that your advisor is making fewer and fewer suggestions and you are making more and more decisions about steps to take. Eventually, your project will begin to take form and you will become the "expert." As you get closer to finishing your project, you will recognize your growing independence and ability to make decisions on what the next steps should be.

Choosing a Thesis Committee

In consultation with and guidance from your research advisor, you will need to choose a thesis committee. This committee will assist you in developing your research/thesis project and will eventually decide if and when you receive a degree. Although your defense of your thesis may be an open event that can be attended by friends and colleagues, it is the committee that must be present and give final approval of your work. Throughout your research, you will come to depend a great deal on members of your committee. Departments may have specific guidelines for choosing a committee and you should discuss these guidelines with your research advisor before asking any individuals to serve on your committee. The process of choosing a committee is usually very informal. It may be as simple as e-mailing a faculty member and asking if he or she will agree to be on your committee.

What are some of the characteristics of a good committee?

- ➔ The committee should be as supportive as possible. Talk with other students and your advisor before asking individuals to serve on your committee.

- ➔ The committee should be well-informed and familiar with your area of research. Members should challenge your ideas and stimulate your thinking and be able to provide you with helpful suggestions.

- ➔ The committee should provide both professional and personal advice.

Get to know the members of your committee well and develop a professional relationship with each of them.

Publishing and Presenting Research

Publications are important for success in academe. Once you have obtained your degree and are looking for a position, one of the first questions that many prospective employers will ask will be about your publications. Some programs require at least one publication before a doctoral degree is awarded. In such cases, manuscripts should be accepted by a peer-reviewed journal.

Writing an acceptable manuscript is not easy and will take several "re-writes," in collaboration with your advisor. If your advisor takes the lead in preparing the manuscript for publication, make sure you are heavily involved in producing papers that use your data and findings.

Ask your peers to proofread and edit your work. What you put into print will be read by many in your field, including potential collab-

orators and competitors. Be sure that what you write reflects your best effort. For further assistance with publications, consult your department and your career services center. They often offer seminars and resources on publishing.

While publications are important, you also must take advantage of all opportunities you have to make presentations on your work. Informal settings such as laboratory meetings or study groups as well as formal settings such as professional meetings or departmental seminars are excellent ways to share your work and to hone your presentation skills. Simple settings are means for you to receive constructive criticism from others on your work. "You are required to think on your feet. You can learn from the comments of others when giving a presentation," said a student attending the Ninth Annual QEM/MSE Network Conference.

Dr. James Stith, Director of Physics Programs at the American Institute of Physics, offered the following hints for making an effective presentation:

1) Think carefully about what you wish to accomplish during your presentation and identify one or two main points to be communicated to the audience.

2) Do not put too much information on a vu-graph or slide.

3) Be sure that visuals can be seen from the last row in the room and be sure to choose the colors of visuals carefully.

4) Never give an unrehearsed presentation.

5) Use poster sessions to get your "feet wet."

Poster sessions allow you to interact one-on-one with individuals. People are more likely to ask questions about your research during a poster session than during a formal presentation.

Presentations are designed to exchange ideas. Your success at doing so is highly dependent upon your ability to communicate your findings. Publishing and presenting are ways to convey your contributions to your field to others. To make others aware of those contributions, you must actively disseminate your work. So, while you are in graduate school, take every opportunity to strengthen your written and oral communication skills. These skills will serve you well in the future.

Building Networks

Networking can take many forms. Socializing with peers is an important networking tool. Joining various professional societies and attending meetings also can help you to build a support network and to identify employment opportunities. Most societies offer some form of career counseling and provide information and advice on professional development, grant writing, fellowships, and postdoctoral opportunities. Becoming active in these societies also can prove beneficial.

Many professional societies offer grants for students to travel to meetings; some fellowships include travel funds; and departments sometimes provide funding for travel to meetings, especially if you are presenting your research.

Graduate students responding to the QEM Network Graduate Student Survey felt that professional meetings were one of the best ways to develop a network. At a meeting, you have the chance to share your findings with colleagues working on similar research questions. Many problems have been solved through informal conversations at meetings. Attend meetings as both a presenter and an

observer. Although presenting your work will make it easier for you to meet people, just attending as an observer will allow you to explore different opportunities in your field and to strengthen your network.

Advisors and committee members also are excellent sources/bases for building a network. Most of these individuals will have been in the field for several years and will have established relationships with colleagues at other institutions. They can provide names and possible introductions to others in your field. Eventually, you will be out of graduate school and may need to use their network as you explore future options.

E-mail and the Internet have made networking much easier. Be sure to exchange e-mail addresses with individuals in your field and write them occasionally to keep them informed of what you are doing. Also, it is very easy to find out what others are doing by visiting various websites. Eventually, you may decide to develop your own website where you can include a short biography and describe your research.

Writing and Defending the Thesis/Dissertation

Your thesis or dissertation is the culmination of your research. It must be a unique body of work that contributes new findings to your research area. Writing a thesis and defending it are the final steps in attaining a doctoral degree. Your advisor and committee will decide when you are ready to defend your thesis. After you have developed a research plan and received confirmation from the committee on your research proposal, it may take two or three years to complete your research, write your dissertation, and prepare to defend it.

The Council of Graduate Schools' publication, *The Role and Nature of the Doctoral Dissertation*, describes the various roles the dissertation serves:

- It reveals the student's ability to analyze, interpret, and synthesize information
- It demonstrates the student's knowledge of the literature relating to the project or at least acknowledges prior scholarship on which the dissertation was built
- It describes the methods and procedures used
- It presents the results in a sequential and logical manner
- It displays the student's ability to discuss the meaning of the results fully and coherently

A dissertation thesis represents an original body of work. You should read the theses of other students in your department and in your laboratory to get an idea of how they should be written. During the time you are writing your thesis, you will have little time to do other things so forewarn friends and family about the importance of the task you are undertaking.

Departments have very specific guidelines about how a thesis should be written and when it must be completed. These guidelines must be closely followed.

Distribute the final draft of your thesis to your advisor and committee at least two weeks before your thesis defense so that they can provide feedback. Make sure that several people read over each section for clarity and grammatical errors.

Talk to students and faculty in your department about the thesis defense. The protocol for a thesis defense varies across disciplines and departments so attend as many defense presentations in your field/department as possible. Your defense will be open to others and will be advertise by your department. Practice your presentation often and well in advance of the defense. Follow guidelines for effective presentations, such as those cited earlier.

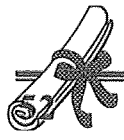
After you have finished the presentation and answered questions from the audience, committee members will often stay behind after the others have left to continue the discussion of your thesis project. Your committee will use this opportunity to ask questions about any aspect of your classwork, discipline, or thesis project. If your committee is satisfied with your responses, and you have completed all departmental requirements, the remaining tasks before you receive your degree should be relatively few.

You will need to make changes to your thesis suggested by your committee and have the thesis bound and placed in your department's library. Take time at this point to copyright your thesis. Your department can assist you with this process.

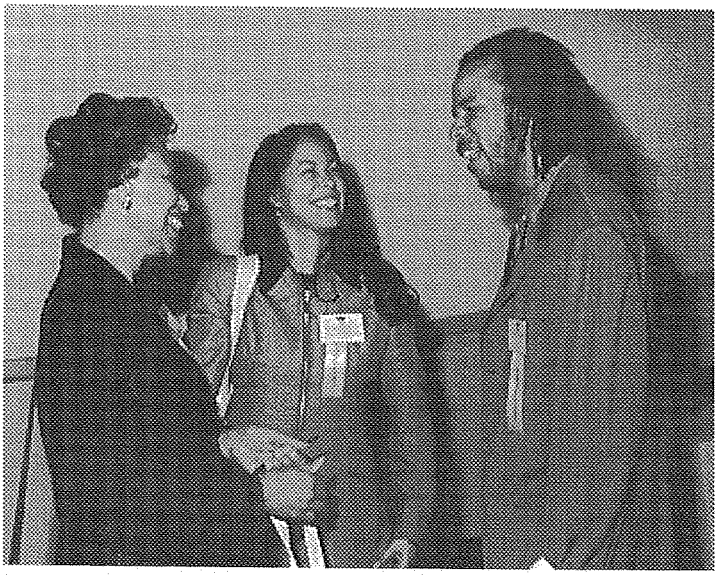
Peter J. Feibelman's book, entitled *A Ph.D. Is Not Enough*, provides helpful suggestions on choosing a mentor, publishing one's work, and choosing a career after completing a doctoral program. The Council of Graduate Schools' publication, *The Role and Nature of the Doctoral Dissertation*, cited earlier also is helpful when writing a thesis.

Striking a Balance

In developing your graduate school plan, try to strike a balance between your studies and your private life. Graduate school can be frustrating and difficult at times. Experiments may not go well, classwork may be demanding, and you may feel overwhelmed.



This may be the time to step away and, if possible, to change your surroundings, if only for a weekend. Pursue activities outside of your research that can help you through the down times. Athletics, dance, art, writing, and other activities can serve as wonderful outlets. Spend time cultivating both personal and professional relationships. Most importantly, take time for yourself!



SECTION 6: EXPLORING PATHWAYS IN THE PUBLIC AND PRIVATE SECTORS

EXPLORING PATHWAYS IN THE PUBLIC AND PRIVATE SECTORS

Exploring Career Options

Throughout graduate school, you should be thinking about what you will do in the future. What you decide to do may depend upon the experiences you have as a student. After so many years of pursuing a degree, you may want to do something completely different. Whether you have a master's or a doctoral degree, you will have several options. Now that you have your degree, it is the time to act on those options.

Mentors and other students can be of great assistance. The networks you have developed over the years will be especially useful at this point. Conferring with recent graduates also can help you avoid certain pitfalls.

Career services at your university will have several job postings and will be able to assist you in developing your curriculum vitae or résumé. Some offices hold workshops that focus on various aspects of career development. Some hold job fairs that can be great opportunities for networking and establishing contacts. Consult with advisors and committee members while you are looking for a position. They can inquire about possible positions, utilizing their contacts.

Several sources are available for learning about employment opportunities (e.g., journals, newspapers, company and university websites, and personal contacts). Many universities have future faculty programs that provide opportunities for graduate students to develop research, teaching, and service skills in preparation for academic positions.

The Princeton Review website (www.review.com) offers helpful suggestions to graduates entering the job market and job listings are posted at the Educational Testing Service's website (www.ets.com).

Choosing the Right Position

You may decide to seek a teaching position or a position with a non-academic agency or corporation. During your graduate training, you may have found that you truly enjoyed teaching. Many opportunities are available for individuals who love to teach.

Choosing between academe and positions in industry can be very difficult. A recent graduate is accustomed to an academic environment and may choose to remain in the same place or at another academic institution. Positions in industry may pay more money but often offer employees less freedom and flexibility than is present in an academic environment.

Many doctoral recipients choose academic careers. The initial step towards an academic career at a research university may be post-doctoral training. However, increased employment opportunities are causing many degree recipients to consider alternative careers. As graduates begin to focus on their impending entry into the workforce, they are finding that many opportunities are available to them. Graduate programs also are recognizing this and are beginning to provide more career support, often in the form of career seminars and career fairs.

Many students who have been doing research in MSE fields choose to pursue a post-doctoral training position at a research university or in an industrial setting. Post-doctoral training is intended to prepare an individual for an independent research position. For example, in the life sciences, post-doctoral training helps in the transition from being a graduate student in a research group whose

research was directed by a principal investigator to an independent researcher. However, a "post-doc" is still working under the guidance of a research group director.

An important advantage of a post-doctoral appointment is the opportunity to publish. Post-docs must publish and demonstrate their ability to be successful outside of graduate school. They also can apply for fellowships and help to prepare grant proposals.

The duration of post-doctoral training can vary significantly. Often, post-docs remain in their positions until they can find more permanent employment (e.g., as a tenure track faculty member, a research associate, or the leader of an industrial research group). The electronic journal Next Wave (www.nextwave.org), published by the American Association for the Advancement of Science, often features articles on post-doctoral training.

Whatever career path you choose, the skills obtained and developed during your time as a graduate student will be well-used. Consider what you enjoy, dislike, and tolerate. For instance, if you dislike teaching, then a position at a small liberal arts college would probably not be suitable. On the other hand, a position with a large pharmaceutical company may be ideal.

It is not uncommon for people to switch careers more than once in their lives, so you should not feel that the initial path you choose is the one on which you must remain the rest of your life. Advisors, committee members, and peers can all help you assess your strengths and weaknesses, and assist you in looking for suitable positions. Possible career paths are given in the chart below:

Some Positions in Academe	**Non-tenure/Tenure Track Faculty** **Research Scientist** **Academic Administrator** **Adjunct Faculty**
Some Career Options in the Private Sector	**Scientific Research** **Curriculum Design** **Human Resource Development in Science and Technology** **Patent Law** **Technical Writing/Scientific Editing** **Science/Technology Consulting** **Marketing of Scientific Products** **Technical Training**

Helpful websites:

www.jobsonline.com
vault.com www.
careers.yahoo.com
chronicle.com
blackissues.com

The following paper by Dr. Lesley Brown, Visiting Assistant Professor in the Chemistry Department at Goucher College, offers advice as a recent MSE doctoral degree recipient who has decided to pursue an academic career.

I am currently a visiting assistant professor at Goucher College in Baltimore, Maryland. Goucher is a small liberal arts college with strengths in the sciences and performing arts and an enrollment of approximately 1,700 undergraduates. As you can guess, my primary duties are teaching, but I do research that involves undergraduates; advise students; and provide service to the college by sitting on various committees. The committees on which I serve have responsibilities that range from recruiting students to hiring faculty to evaluating degree programs. My path to this position has neither been straight nor perfectly laid out; there have certainly been forks in the road. My most careful plans were those that took me to graduate school. I knew that I wanted to go to graduate school because I enjoy the intellectual challenge of figuring out a puzzle, especially one that has biomedical relevance.

Graduate school has an entirely different environment than an undergraduate institution. Here are some recommendations that I think will serve you well as you make the adjustment: It is important that you have a very good background and/or experience in your field before you enter graduate school. Graduate school builds upon knowledge that you already have. It is not the time to try to learn something completely new. Teaching assistantships are often a part of graduate education; take advantage of such an opportunity, especially if you think that you may want to teach.

Choose a research project that you find interesting because it has to hold your interest for several years. You also will have to make presentations about your research and if you are enthusiastic, you will make a better impression. Develop good time management skills and improve your oral presentation skills. Most importantly,

Final Questions to Consider

Here are a few questions you may want to ask yourself before accepting a position or choosing a career

What strengths and weaknesses do I have that might affect my work as a professional?

Am I creative?

Do I pay close attention to details?

Am I a good listener?

Do I enjoy solving problems?

Do I enjoy learning new things?

Am I able to accept and act upon constructive criticism?

What sorts of tasks do I enjoy (e.g., writing, teaching, designing, or programming)?

Am I a good organizer?

Do I enjoy working with a variety of people?

Do I possess good management skills?

Is the amount of money I earn important?

Will I be able to re-locate?

What sort of employment setting am I looking for (office, laboratory, field, in home)?

What type of work schedule best suits me (nine to five, flexible, evenings, weekends)?

Do I enjoy traveling?

Do I work better in groups, or alone, or equally as well in both?

Do I work well under pressure?

Would I prefer a dynamic or static work environment?

Some Additional Resources

FinAid
http://www.finaid.com

Fastweb
http://www.studentservices.com/fastweb

The Student Guide: Financial Aid from the U.S. Department of Education
A free booklet from the Department of Education.
Write to:
Student Aid Information Center
P.O. Box 84
Washington, DC 20044
1-800-433-3243
http://www.ed.gov

Gradschool.com
http://www.gradschool.com

Peterson's Guide to Graduate Schools in the United States
http://www.petersons.com/graduate

Fastweb: (supported by Student Services, Inc.) provides information on scholarships and other financial aid programs: http://www.studentservices.com/fastweb

Minority On-Line Information Service (MOLIS)
Source for minority applicants seeking information on financial aid. http://www.sciencewise.com/molis

National Consortium for Graduate Degrees for Minorities in Engineering and Sciences (GEM)
A resource for students interested in obtaining graduate degrees in engineering.
GEM Center
P.O. Box 537
Notre Dame, IN 46556
http://www.nd.edu/~gem

National Institutes of General Medical Sciences
Fellowship Awards for Minority Students and MARC (Minority Access to Research Careers) Pre-doctoral Fellowships:
Dr. Adolphus Toliver
Chief, MARC Branch
National Institutes of General Medical Sciences
45 Center Drive
MSC 6200
Rm 2AS.43
Bethesda, MD 20892-6200
301-594-3900
http://www.nih.gov/nigms

Financing Graduate School: How to Get the Money You Need for Your Graduate School Education
Patricia McWade
Peterson's Guides
202 Carnegie Center
P.O. Box 2123
Princeton, NJ 08543-2123

The Graduate School Funding Handbook
April Vahle Hamel, et. al
University of Pennsylvania Press

The Grad School Handbook
Richard Jerrard and Margot Jerrard
Berkeley Publishing Company
Making the Grade in Graduate School: Survival Strategies 101
Howard G. Adams, Ph.D.
National Consortium for Graduate Degrees for Minorities in Engineering and Sciences

Scholarly Guideposts for Junior Faculty
Quality Education for Minorities Network
http://qemnetwork.qem.org

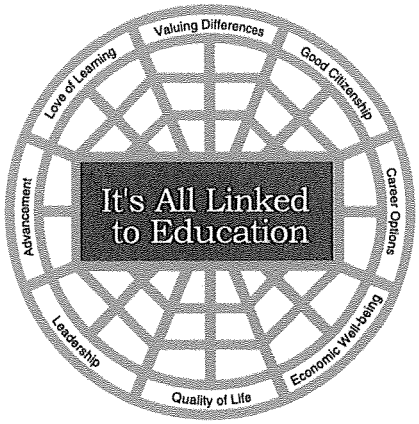
Careers in Science and Engineering: A Student Planning Guide to Grad School and Beyond.
Committee on Science, Engineering, and Public Policy
National Academy of Sciences, National Academy of Engineering, and Institutes of Medicine

Careers in Science and Technology: An International Perspective
Advisory Committee, Office of International Organizations and Programs
Office of Scientific and Engineering Personnel
National Research Council

Careers in Science and Engineering: A Student Planning Guide to Grad School and Beyond

Careers in Science and Technology: An International Perspective

A PhD is not Enough: A Guide to Survival in Science



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E-mail: qemnetwork@qem.org
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