

Applying to Graduate School in STEM

A Practical Guide for Undergraduates and REU Students

Workshop Outline

- 1 Why Graduate School?
- 2 The Application Timeline
- 3 Components of a Strong Application
- 4 Letters of Recommendation
- 5 The Personal Statement
- 6 What Graduate Schools Are Looking For
- 7 Funding and the Interview

Why Pursue a Graduate Degree?

Professional Benefits

- Deeper expertise in your field
- Access to faculty-level research positions
- Competitive salaries in industry & academia
- Leadership roles labs, tech
- Credential required for many careers

Personal & Intellectual Benefits

- Become an expert and *creator* of knowledge
- Work on problems that matter to you
- Build a professional network
- Collaborate with world-class researchers
- Funded travel to conferences

Ask yourself

What do I want to **do** with my degree, and does graduate school move me toward that?

M.S. vs. Ph.D. — Which Is Right for You?

	Master's (M.S.)	Doctorate (Ph.D.)
Duration	1.5 – 2 years	4 – 6+ years
Goal	Applied expertise	Original research
Thesis	Optional / required	Required
Funding	Often self-funded	Usually fully funded
Output	Professional skills	New knowledge
Typical path	Industry, government	Academia, R&D, national labs

Important note for STEM students

Many STEM Ph.D. programs are **fully funded** (tuition waiver + stipend). A terminal M.S. in STEM often is **not**. Know the difference before you apply.

When to Start — Work Backwards from Deadlines



- **USRA/REU students:** Your experience is a launching pad — use it!
- Most Ph.D. deadlines fall between **December 1 and January 15**
- NSF GRFP deadline is typically **mid-October** — apply early in your Ph.D. or senior year

Building Your List of Programs

How many programs?

- Aim for **8–15 programs**
- Balanced across reach, match, and safety
- Do not apply to programs you would not attend

How to find programs:

- Ask your research mentor(s)
- Check faculty pages of researchers you admire
- AMS, SIAM, SACNAS, ABRCMS program directories
- NSF, NIH, DOE funded research groups

Program Fit Checklist

- ✓ Faculty working in *your* area?
- ✓ Are those faculty taking students?
- ✓ Funding guaranteed?
- ✓ Current students happy?
- ✓ Location / cost of living workable?
- ✓ Track record of student placement?

What Goes Into a Graduate Application?

- 1 **Transcripts** (unofficial first, then official)
- 2 **Letters of Recommendation** (usually 3)
- 3 **Personal Statement / Statement of Purpose**
- 4 **CV or Résumé**
- 5 **Test Scores** (GRE — many programs now optional)
- 6 **Writing Sample** (some programs)
- 7 **Application fee** (\$50–\$120 per program)

Where is the weight?

In STEM, programs typically weight:

- 1 Research experience
- 2 Letters of recommendation
- 3 Personal statement
- 4 GPA & transcripts

The GRE is rarely the deciding factor.

Transcripts and GPA

- Most programs list a **minimum GPA** (often 3.0), but the *average* for admitted students is typically **3.5+**
- An upward trend matters — a difficult freshman year followed by strong later performance tells a good story
- Difficult coursework (real analysis, abstract algebra, graduate-level classes) signals preparation
- A “W” or a single bad grade is not fatal — **context in your personal statement** can address it

Pro tip

If your GPA dipped due to a documented hardship, address it **briefly and factually** in your personal statement or the optional “additional information” section. Do not over-explain.

The GRE — Do I Need It?

Current landscape (2025–2026):

- Most Ph.D. programs in math, stats, biology, and engineering have made the GRE **optional or eliminated it**
- Subject GRE (e.g., Math Subject Test) still valued at some top-10 programs
- Always check each program's policy

If you do submit scores:

- Strong quant score (>160) is helpful in STEM
- Weak scores can hurt more than strong scores help
- Prepare using **ETS official materials** (free)
- Consider submitting only if above program average

Rule of thumb

If a program is GRE optional and your score is below the admitted student average, **do not submit it.**

Letters of Recommendation — The Most Important Piece

Why letters matter so much

A strong letter says what transcripts and test scores cannot: *“I have seen this person do research, and they have the potential to become an independent scientist.”*

Who to ask:

- Research supervisors (most important!)
- REU faculty mentors
- Professors who know your work deeply
- Ideally 2–3 research-based letters

Who not to ask:

- A professor who only knows you from a large lecture
- Someone who will write a generic letter
- A family friend or community leader (unless specifically asked)
- Anyone who seems reluctant

How to Request a Strong Letter

- ▶ **Ask early** — at least 6 weeks before the earliest deadline
- ▶ **Ask in person or by email** — briefly explain your goals and target programs
- ▶ **Provide a packet:**
 - ▶ Your CV or résumé
 - ▶ Draft personal statement
 - ▶ List of programs with deadlines (sorted!)
 - ▶ A reminder of projects you worked on together
- ?? **Ask directly:** “Do you feel you know my work well enough to write a **strong** letter?” Give them the option to decline gracefully.
- ▶ **Send polite reminders** one week before each deadline
- ▶ **Send a thank-you** after letters are submitted

The Personal Statement — Your Most Controllable Asset

What is a personal statement?

A 1–2 page (sometimes 500-word) essay that answers: **Who are you as a researcher?**
Where are you going? Why here?

What it IS:

- A research narrative
- Evidence of intellectual maturity
- Fit with the program/faculty
- Your voice and your goals

What it is NOT:

- An autobiography
- A transcript summary
- A list of accomplishments
- Filler or generic platitudes

Most common mistake

Beginning with *“Ever since I was a child I have been fascinated by. . .”* This wastes your most valuable real estate — the first sentence.

Structure of a Strong Personal Statement

- 1 **Hook (1–2 sentences)** — Open with a specific research question, moment, or finding that drew you in. Be concrete.
- 2 **Research experience** — Describe 1–2 key research experiences. What did *you* do? What did you discover or contribute? What did you learn?
- 3 **Skills and preparation** — Highlight relevant technical skills, methods, and coursework. Show you are ready.
- 4 **Research goals** — What question(s) do you want to pursue in graduate school? Be specific; broad vague goals are forgettable.
- 5 **Fit** — Name 2–3 specific faculty and explain *why* their work aligns with yours. Show you did your homework. **Customize Every Application**
- 6 **Closing** — Briefly restate your commitment and long-term vision.

Writing Tips for the Personal Statement

✓ Do:

- Use specific, concrete language
- Focus on *your* contributions, not just the lab's work
- Use active voice: "I developed a model. . ." not "A model was developed. . ."
- Read it aloud — it should sound like *you*
- Revise it: Have a faculty mentor, writing center, and a peer review it

✗ Avoid:

- Listing every course you took
- Excessive jargon without context
- Apologizing for weaknesses
- Clichés ("passion," "team player," "from a young age")
- Exceeding the page limit

Sample sentence structure to model

"During my REU at [University], I [specific action: derived, coded, analyzed], which led to [specific outcome]. This experience revealed [specific insight], which motivates my interest in [specific research direction]."

Addressing Weaknesses in Your Application

- **Low GPA in one semester:** Briefly explain (illness, family hardship, difficult transition) and emphasize recovery
- **Limited research experience:** Emphasize coursework, independent projects, or technical skills; explain plans to continue
- **No publications:** This is *normal* for undergraduates; conference posters and REU presentations still count
- **Switching fields:** Articulate clearly *why* and how your background is a strength in the new field
- **Non-traditional background:** Reframe as diversity of perspective — it often is a genuine asset

Do not over-explain

One to two sentences of context is sufficient. Do not let weakness dominate your statement. Acknowledge, contextualize, move on.

Inside the Admissions Committee

Committees are usually composed of **faculty** reviewing files for potential fit with their research group. They ask:

- 1 **Can this student do research?** (Evidence from letters, REU experience, publications/presentations)
- 2 **Are they prepared?** (Relevant coursework, GPA, technical skills)
- 3 **Do they know what they want?** (Clarity in the personal statement)
- 4 **Is there a faculty match?** (Named specific faculty, understands the field)
- 5 **Will they finish?** (Persistence, resilience, evidence of grit)

Research Experience — The Game-Changer

Why it matters so much:

- Ph.D. programs admit you to *do* research
- Prior experience is the **best predictor**
- REUs are specifically designed to build this credential
- Faculty write the most compelling letters about research they saw firsthand

How to maximize USRA/REU impact:

- Ask deep questions; show curiosity
- Produce a deliverable (poster, report, draft manuscript)
- Maintain the relationship with your mentor

Experience That Counts

- NSF REU programs
- On-campus research (any year!)
- Independent study / senior thesis
- Industry internships with R&D
- National lab internships (DOE, NIH, NASA)
- Publications, preprints, conference presentations

Contacting Faculty Before You Apply

Should you email potential advisors?

Yes, in many cases — especially in smaller programs, a faculty member's interest can significantly boost your application.

A good cold email to a potential advisor:

- 1 Open with **who you are** (name, institution, year, advisor)
- 2 Mention **one specific paper** of theirs you read and found compelling — say why
- 3 Describe your **research background** in 2–3 sentences
- 4 Ask if they are **accepting students** for the upcoming cycle
- 5 Attach your **CV**, keep whole email under **200 words**

What not to do

Do not send mass generic emails. Do not ask questions whose answers are on their website.
Do not follow up more than once.

Diversity, Equity, and Inclusion Statements

- Many programs now request a **Diversity Statement** (sometimes called a “Personal History Statement”)
- This is *separate* from the Statement of Purpose
- It asks: How has your background shaped your perspective? How will you contribute to an inclusive research community?

Strong diversity statements:

- Are specific and personal
- Connect experience to future mentoring or outreach
- Show awareness of systemic context
- Demonstrate reflection, not victimhood

Weak diversity statements:

- Define diversity only by ethnicity or gender
- List accomplishments with no reflection
- Use vague platitudes (“I believe in diversity”)
- Are clearly repurposed from the SOP

Understanding Graduate Funding

How STEM Ph.D. funding works:

- **Tuition waiver:** Program pays your tuition
- **Stipend:** \$18,000 – \$40,000/yr (varies by program, location, and field)
- **Health insurance:** Usually included
- **Source:** Teaching assistantship (TA), Research assistantship (RA), or fellowship

Do not pay for a STEM Ph.D.

If a STEM Ph.D. program does not offer funding, look elsewhere. This is rare and a red flag.

External Fellowship Opportunities

- NSF Graduate Research Fellowship (GRFP)
- DOE CSGF
- NDSEG Fellowship
- NIH F31 (predoctoral)
- Ford Foundation Fellowship
- Hertz Fellowship
- State-level and university fellowships

The Interview — Campus Visits and Virtual Meetings

What to expect:

- Invited to **visit days** (typically Feb–March)
- Meet with multiple faculty for 20–30 min each
- Informal meals and social events with current students
- Sometimes a short research presentation (5–10 min)

How to prepare:

- Read recent papers of each faculty you will meet
- Prepare a 2-minute summary of your research
- Prepare thoughtful questions
- Talk to current students honestly
- Evaluate **mentorship style**, not just prestige

Questions to ask current students (privately)

How is the advisor's mentoring style? How long are students taking to finish? Do students get opportunities? Is the stipend livable? Would you choose this program again?

Making Your Decision

- You typically have until **April 15** to decide (Council of Graduate Schools agreement)
- Do not feel pressured to decide before this date
- Weigh:
 - ▷ Advisor fit and mentoring style (most important!)
 - ▷ Research opportunities and lab resources
 - ▷ Stipend and cost of living
 - ▷ Program culture and cohort
- It is **acceptable** to negotiate: ask if additional funding, fellowship nomination, or earlier start is possible
- A **program rank** matters far less than a **good advisor match**

Most important factor

Your advisor will shape your research, your skills, your mental health, and your career more than any other single factor. Choose wisely.

Building a Competitive Application — Summary

Academic Foundation

- Strong GPA (especially in major)
- Rigorous coursework
- GRE if it helps (skip if it doesn't)

Strong Written Materials

- Tailored, specific personal statement
- Faculty contact and fit
- Polished, error-free writing

Research Experience

- REUs and on-campus research
- Deliverables: poster, paper, presentation
- Relationships with mentors

Letters of Recommendation

- From research mentors who know you well
- Ask early; provide a complete packet
- At least 2 research-based letters

Top 10 Pieces of Advice

- 1 **Start early.** Deadlines sneak up on you.
- 2 **Get research experience.** Even one semester matters.
- 3 **Choose your recommenders strategically.** Quality beats quantity.
- 4 **Tailor every statement.** Generic applications fail.
- 5 **Contact faculty before applying.** Build a connection.
- 6 **Don't let the GRE stop you.** Many programs don't require it.
- 7 **Apply to a balanced list.** 8–15 programs, varied tiers.
- 8 **Ask for help.** Mentors, writing centers, peers — use them.
- 9 **Negotiate your offer.** It is expected.
- 10 **Prioritize advisor fit over prestige.** Every time.

Finding Programs:

- mathprograms.org (math/stats)
- gradschools.com
- NSF REU site finder
- SIAM, AMS, ASA program listings
- Professional conference networking

Application Support:

- Your institution's graduate school office
- Writing center
- Faculty research mentors
- GradCafe (thegradcafe.com) for

Fellowships & Funding:

- nsfgrfp.org (NSF GRFP)
- krellinst.org (DOE CSGF)
- fordscholarships.org
- ndseg.sysplus.com
- Your institution's fellowship office

Books and Guides:

- *Getting What You Came For* — R. Peters
- *A PhD Is Not Enough!* — P. Feibelman
- NSF GRFP applicant resources

Overview of GRFP

What is the NSF GRFP?

What is the program?

Why is it prestigious? Recent winners who have gone on to successful scientific careers

Funding rates (12000 applications, 2000 awards) and Benefits to award winners

Dr. Ryan workshop each September at CSU with Office of Research!

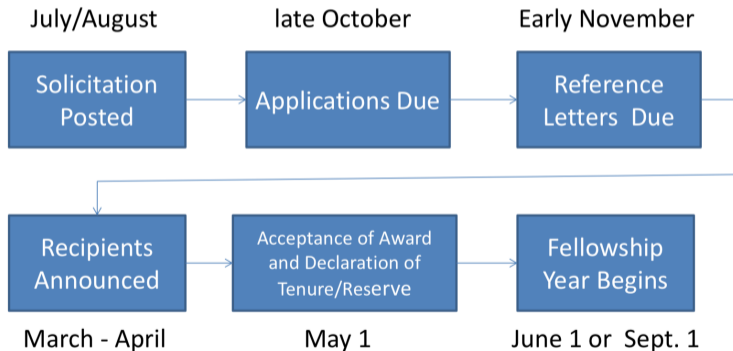
GRFP Fields of Study

- Chemistry
- Computer & Information Systems
Science/Engineering
- Engineering
- Geosciences
- Life Sciences (includes Biological Sciences)
- Materials Research
- Mathematical Sciences
- Physics and Astronomy
- Psychology
- Social Sciences (includes Economics)
- STEM Education

Sub-Fields of Study found at: www.nsfgrfp.org ; Applicants; Application Components; Choosing Primary Fields (see link below)

https://www.nsfgrfp.org/applicants/application_components/choosing_primary_field

GRFP Application Timeline





GRFP Complete Application

Complete Application Package: *Due in late October*

- 1) Personal Information, Education, Work/Research Experience, Proposed Field of Study, Academic honors, Publications
- 2) **Personal**, Relevant Background and Future Goals **Statement** (3 pages)
- 3) Graduate **Research Statement** (2 pages)
- 4) **Transcripts** (uploaded electronically)
- 5) Three **letters of reference**



Please see the most recent Solicitation (NSF 18-573) for application details and requirements.



NSF Review Criteria

Two National Science Board-approved review criteria:



- **Intellectual Merit**

How important is the proposed activity to advancing knowledge within its own field or across different fields?

- **Broader Impacts**

How well does the proposed activity benefit society or advance desired societal outcomes?

??

Questions & Discussion

Thank you for your time!

Contact

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Appendix: Sample Application Timeline Checklist

Month	Task
June – August	Finalize program list; email potential advisors
September	Request letters of recommendation
September – Oct	Draft personal statement; gather transcripts
October	NSF GRFP submission (if applicable)
October – Nov	Revise personal statement with feedback
November	Create accounts on all application portals
December – Jan	Submit applications; waive fee waivers where available
January – Feb	Follow up on missing letters; confirm receipt
February – March	Attend campus visit days / virtual interviews
April 15	Accept offer (CGS national deadline)

Appendix: Personal Statement Paragraph Outline

Paragraph 1 — Hook & Motivation

One specific research moment, question, or finding. Why does this matter to you?

Paragraph 2 — Research Experience #1

What did you do? What skills did you use? What did you discover? What did you learn about how research works?

Paragraph 3 — Research Experience #2 (if applicable)

Same structure. Show progression or breadth.

Paragraph 4 — Future Research Goals

What specific questions will you pursue? Why now, why this field?

Paragraph 5 — Fit