How to get started on research in graduate school

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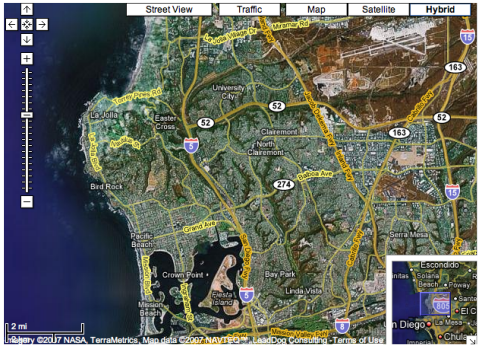
UCSDCSE
Computer Science and Engineering

computer audition laboratory

Welcome to UCSD!



UCSDCSE
Computer Science and Engineering

Things you have to do

- **High priority**
  - Find place to live.
  - Get driver's license.
  - Learn way to campus.
  - Do essential shopping.
- **Highest priority**
  - Find advisor.
  - Start research.

Why I volunteered for this job

- **Former Gradcom chair**

  From end-of-year interviews: finding an advisor is leading cause of stress.

- **Personal experience**

  Beginning students thrive on research.

  Possible to publish in 1st or 2nd year.

  Most failure modes are avoidable.

  Luck favors the well-prepared.

This talk

- **How to:**
  - Find and keep an advisor.
  - Choose and solve a problem.
  - Disseminate your results.
- **Themes**
  - Grad school is not (at all) like college.
  - Take initiative; be opportunistic.

How to find an advisor?

http://www.cseHarmony.com

Register to Begin

First Name:

I'm currently: Please select...

I'm a: Please select...

Postal Code:

Country: United States

Email:

Confirm Email:

Note: Your email is used to log back in

Password:

Must be at least 5 characters

How did you hear about us? Please select...

Submit

Already a Singles member? Log in here

FREE to review your matches!
Start now.

Rajesh
Professor, CSE

Experience the eHarmony Difference

- Now it's **FREE** to receive and review your matches!
- Each compatible match pre-screened for you across 29 Dimensions.
- Get started now. Simply register and take the questionnaire to receive your matches.

Student-advisor relationships

- **Last a long time**
  - Five years to PhD (and then beyond)
  - Breaking up is hard to do
- **Depend on trust**
  - Your careers are intertwined.
  - It helps to like the person.
- **Evolve with time**
  - Start as master and apprentice.
  - Mature into equals.

Roles and responsibilities

- **What advisors do for you**
  - Intellectual guidance
  - Moral and/or financial support
  - Professional advocacy
- **What students do for them**
  - Research engine
  - Source of novel ideas
  - Multi-faculty collaborations

Why and when it works

- **Mutual needs and commitments**
  - **Students need advisors and vice versa.**
  - **Both share time, energy, and ideas.**
  - **Advisors are a resource.**
  - **Students are an investment.**
- **Very different than:**
  - **Undergraduate advising**
  - **Humanities and social sciences**

Questions to ask yourself

- **Substance**
  - What areas of CS interest you most?
  - What type of work do you enjoy?
  - What are your strengths, weaknesses?
- **Style**
  - Which teachers do you like, and why?
  - Do you like to work alone?
  - Do you take direction well?

Approaching faculty

- **Common mistakes**
  - not approaching at all (!)
  - not providing context
  - approaching too late (without support)
  - gold-digging
- **Best practices**
  - take courses with potential advisors
  - use independent study as trial period
  - show flexibility in research interests
  - team with older students

Selling yourself

- **By email:**
  - broad areas of research interest
  - relevant undergraduate experience
  - graduate coursework (and grades)
  - interactions with other students
  - papers you have read
  - statement of current support
  - current course schedule
- **In person:**
  - keep appointments
  - lose the cell phone

Funding models

- **External fellowship**

  Ex: NSF, IGERT, industry, government.
  Very attractive to potential advisors.

- **Research stipend**

  Advisor pledges financial support.
  Very attractive to potential students.

- **Mixed support**

  From advisor, department, and teaching.
  Very common and workable.

A balanced course schedule

- **One breadth**

  Algorithms, complexity, architecture, operating sytems, etc.

- **One foundation course**

  Introductory course for graduate students in a particular research area.

- **Seminar or independent study**

  Vehicle for testing a potential advisor relationship.

Don’t be one of these!

- **Lone ranger**

  Student with external support who does not engage faculty.

- **Wishful thinker**

  Student who persists in area despite lack of space and/or funding.

- **Bookworm**

  Student who seeks comfort in classes, as opposed to research.

Keeping an advisor

- **Communicate**

  By email, instant messaging, in person, etc. Be available.

- **Set clear goals**

  Know what is expected of you from one meeting to the next.

- **Ask questions**

  Do not worry about seeming dense. Worry about seeming uninterested.

Become independently wealthy

- **Apply for fellowships**

  Government: NSF, DoD, DoE, etc.
  Industry: MSR, Google, Intel, AT&T.

- **Strategize early**

  Secure letters from UCSD professors.
  Work summers in industry.

- **Make an effort**

  Why should faculty try if you don't?
  Just as important as grad school apps!

CSE Fellowship Web Page

Application Deadline	Fellowship
October 9, 2007	Microsoft Graduate Fellowship [*][**]
November 2, 2007	Hertz Foundation
October 31, 2007	L'Oreal USA Fellowships for Women In Science (postdoctoral)
TBD Fall 2007	IBM Scholars Program [*][**]
November 1, 2007	National Consortium for Graduate Degrees for Minorities in Engineering Science GEM Fellowship
November 1, 2007	Paul and Daisy Soros Fellowships for New Americans
November 1, 2007	NSF Graduate Research Fellowship
November 5, 2007	National Physical Science Consortium
November 15, 2007	The American Association of University Women
Available September 2007	Ford Foundation
TBD Fall 2007	Graduate Assistance in Areas of National Need (GAANN) Fellowships[*]
December 11, 2007	NSF East Asia and Pacific Summer Institutes for U.S. Graduate Students (EAPSI)
January 7, 2008	National Defense Science and Engineering Graduate Fellowship (NDSEG)
Available October 16, 2007	Krell Institute Department of Energy Computational Science Graduate Fellowship
January 31, 2008	AT&T fellowships for women and underrepresented minorities[**]
TBD Winter 2008	Google Anita Borg Scholarship[**]
TBD Winter 2008	Interactive Graduate Education and Research Traineeship (IGERT)
TBD Winter 2008	Intel Scholarships Program [*]
TBD Winter 2008	Homeland Security Fellowships
TBD Winter 2008	Yahoo PhD Fellowship
March 31, 2008	Dan David Scholarships (not always for computer science)
TBD Summer 2008	CGS UMI Dissertation Award [*]
September 9, 2007	ACM Dissertation Award [*]

NSF deadline: Nov 13!

http://www-cse.ucsd.edu/node/201

Timeline

- **During fall quarter**

  Talk to all prospective advisors, and meet their students.

- **By end of winter quarter**

  Complete independent studies with one or more faculty members.

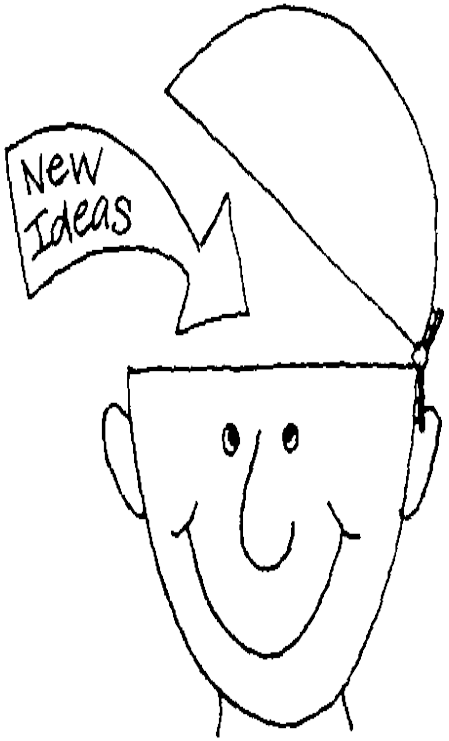
- **By end of spring quarter**

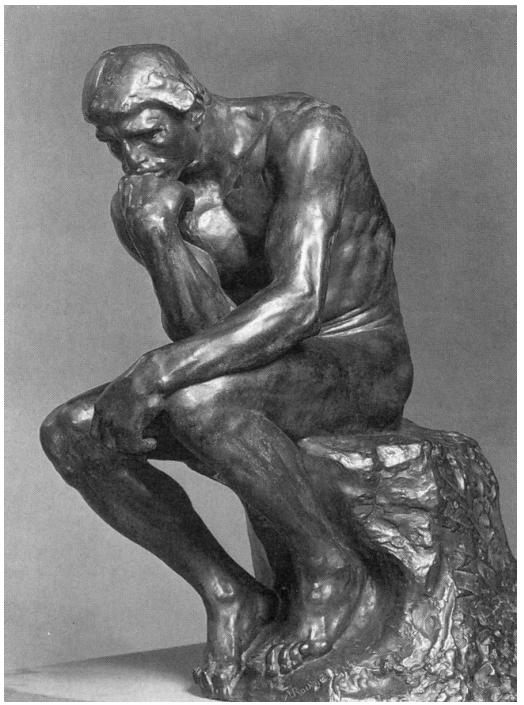
  Match and bind with faculty advisor, even if you have your own support.

Themes

- **Grad school is not like college.**
  - More like an apprenticeship.
  - Coursework is only a means to an end.
  - Expectations are very different.
- **Take initiative; be opportunistic.**
  - Position and sell yourself.
  - Seek out faculty with shared interests.
  - Seek out external fellowships.

Choose and solve a problem.





Start small

- **Find a well-defined problem**

  Ex: re-[derive/implement] a previous result, then extend it in some way.

- **Impress your advisor**

  Work habits, clarity of thought, ability to work alone, background reading.

- **Build confidence**

  Not only for yourself, but also for your (potential) advisor.

Work habits

- **Schedule for research**

  You needn't do research every day: just on the days that you eat.

- **Balance with coursework**

  Courses have constant deadlines. Set deadlines for your research, too.

- **Vary your research diet**

  Reading, writing, problem-solving, programming, brainstorming, etc.

Clarity of thought

- **Prepare for meetings**

  Be able to summarize one week's work in 10-15 minutes.

- **Keep a log/blog/wiki**

  Be able to recall the results of last month's experiments.

- **Write up intermediate work**

  Proofs, calculations, etc: whatever overflows your advisor's whiteboard.

Working independently

- **Read, read, read**

  You will read many, many papers for every one you write yourself.

- **Learn the subfield**

  Your project is a vehicle to master a small but technical body of knowledge.

- **Fill in gaps**

  You will learn more through (self-directed) research than courses.

FAQs

- **How often to meet?**

  Depends on advisor, problem, and frequency of other communication.

- **How to entice your advisor?**

  Report a preliminary demo, draft, or experimental result.

- **What if you get stuck?**

  It happens to everyone. Use your advisor as a resource.

Take ownership.

- **Pre-empt your advisor**

  Suggest your own directions, as well as asking for guidance.

- **Have internal goals**

  Monitor calls-for-papers of upcoming workshops and conferences.

- **Branch out**

  Look for connections to other work in the department and the field.

Mix with the upper classes.

- **Seek advice from n-years**
  - teachers and courses
  - tutorials and references
- **Collaborate**
  - build on earlier work in lab
  - provide manpower

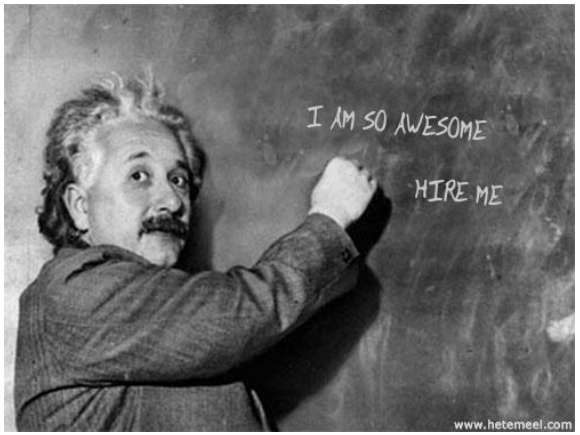
Time management

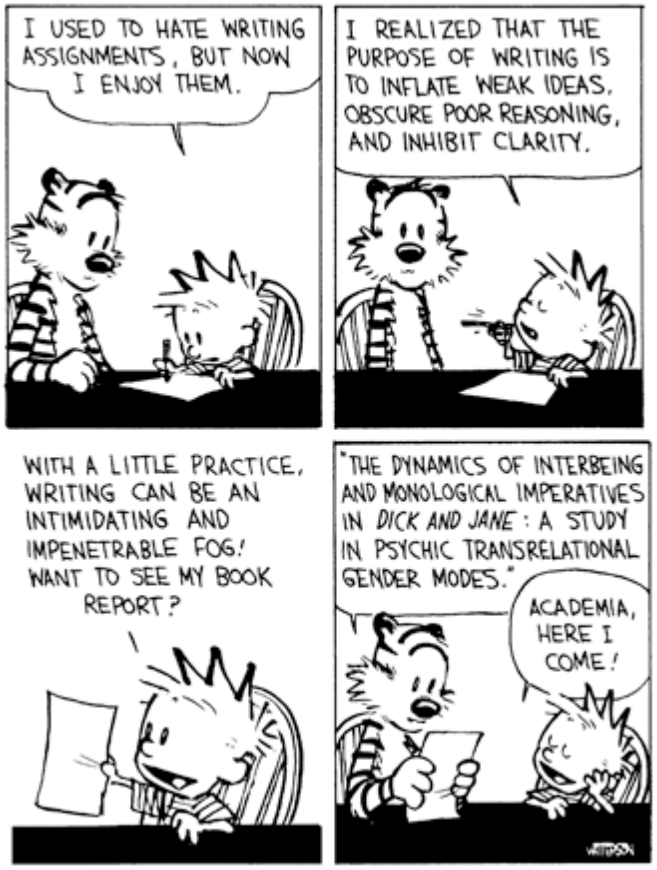
- **As an undergraduate**
  - Follow the academic calendar.
  - Relax over academic holidays.
- **As a graduate student**
  - Follow the conference calendar.
  - Relax after conference deadlines.
- **Make the shift**
  - Missed opportunities are costly.
  - Setbacks are measured in months.

Themes

- **Grad school is not like college.**
  - More open-ended and self-directed.
  - Learn more by doing, not studying.
  - Conference vs academic calendar.
- **Take initiative; be opportunistic.**
  - Own your research projects.
  - Fill in your own gaps: read!
  - Monitor and document your progress.

Disseminating your results





Phases of research

- **Discovery is:**
  - unbridled fun
  - full of creative “eureka” moments
- **Speaking and writing are:**
  - eating your vegetables
  - reviewing and rehashing old thoughts
- **Some overlap:**
  - fun when others appreciate your work
  - to explain is to understand

Speaking and writing

- **Challenges**
  - clarity of technical exposition
  - time and/or page limits
  - absolute deadlines
  - high (professional) standards
- **How to improve**
  - practice, practice, practice
  - accept weakness; embrace criticism
  - multiple rehearsals and drafts
  - read voraciously (not just papers)

Spreading the word

- **Writing**
  - technical reports
  - workshop & conference submissions
  - journal papers
- **Speaking**
  - weekly lab meetings
  - area seminar
  - conference oral presentation

Venues

- **Conferences**
  - non-iterative peer review
  - page limits, strict deadlines
  - poster or oral presentation
- **Journals**
  - iterative peer review
  - no page limits
  - no deadlines (except special issues)

Venues

- **Workshops**
  - **invited abstracts**
  - **oral presentations**
- **Technical report**
  - **self-publishing on web page**
  - **no page limit, no deadlines**

You are …

- Not to blame for writing poorly now
  - CS majors do not write much
  - technical writing is not emphasized
  - you cannot improve without feedback
- In deep trouble if you do not improve
  - poorly written papers get rejected
  - you are mainly known by your papers
  - this is your last chance to learn

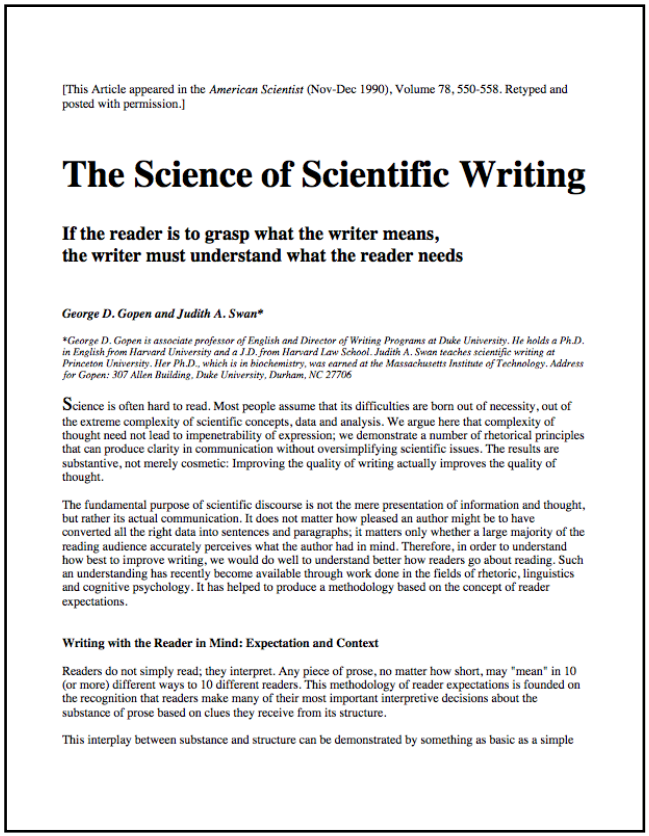
You can learn to write well.

- **Just like programming:**
  - Style is substance.
  - There are rules and conventions.
  - You can develop good taste.
  - There is no substitute for practice.
- **Raise your standards:**
  - Commit to writing clearly.
  - Bad prose is as unacceptable as 2+2=5.

Common practices

- **The good:**
  - Asking colleagues for feedback.
  - Allowing time for multiple revisions.
- **The bad:**
  - Writing up to the deadline.
  - Under-estimating the reader's pain.
- **And the ugly:**
  - Using your advisor for clean-up.
  - Blaming the reviewers.

CSE 291. Scientific writing



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The Science of Scientific Writing

If the reader is to grasp what the writer means, the writer must understand what the reader needs

George D. Gopen and Judith A. Swan*

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Science is often hard to read. Most people assume that its difficulties are born out of necessity, out of the extreme complexity of scientific concepts, data and analysis. We argue here that complexity of thought need not lead to impenetrability of expression; we demonstrate a number of rhetorical principles that can produce clarity in communication without oversimplifying scientific issues. The results are substantive, not merely cosmetic: Improving the quality of writing actually improves the quality of thought.

The fundamental purpose of scientific discourse is not the mere presentation of information and thought, but rather its actual communication. It does not matter how pleased an author might be to have converted all the right data into sentences and paragraphs; it matters only whether a large majority of the reading audience accurately perceives what the author had in mind. Therefore, in order to understand how best to improve writing, we would do well to understand better how readers go about reading. Such an understanding has recently become available through work done in the fields of rhetoric, linguistics and cognitive psychology. It has helped to produce a methodology based on the concept of reader expectations.

Writing with the Reader in Mind: Expectation and Context

Readers do not simply read; they interpret. Any piece of prose, no matter how short, may "mean" in 10 (or more) different ways to 10 different readers. This methodology of reader expectations is founded on the recognition that readers make many of their most important interpretive decisions about the substance of prose based on clues they receive from its structure.

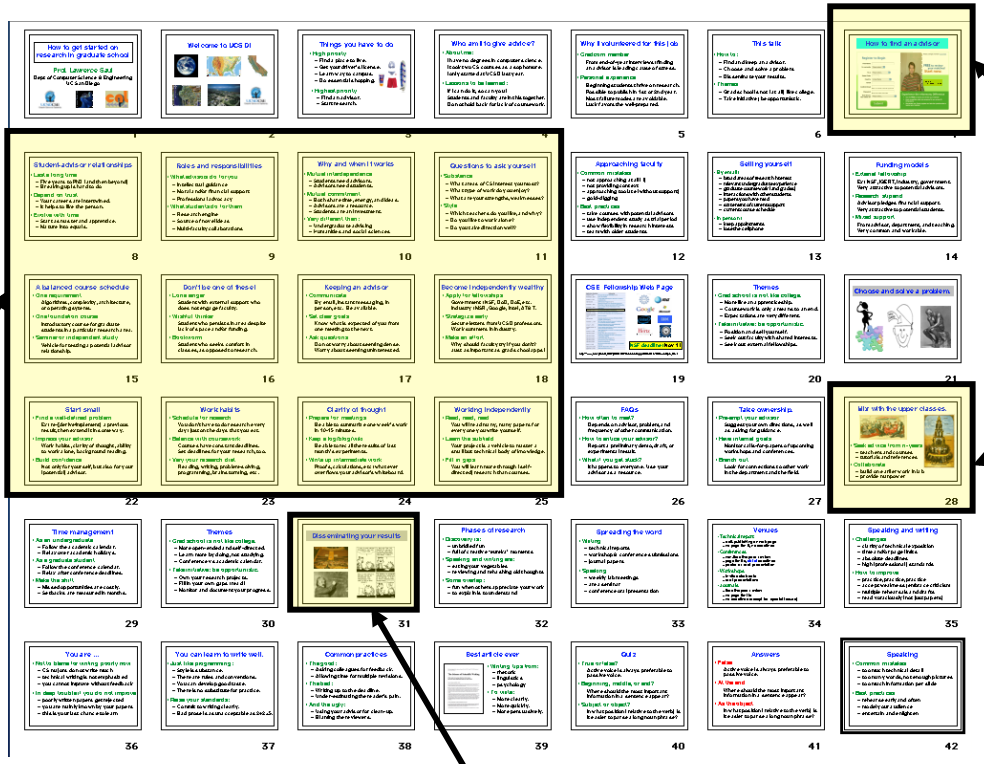
This interplay between substance and structure can be demonstrated by something as basic as a simple

- **Writing tips from:**
  - **rhetoric**
  - **linguistics**
  - **psychology**
- **To write:**
  - **More clearly.**
  - **More quickly.**
  - **More persuasively.**

Speaking

- Common mistakes
  - too much technical detail
  - too many words, not enough pictures
  - too much information per slide
  - running overtime
- Best practices
  - rehearse early and often
  - model your audience

Do as I say, not as I do ...



Bad jokes.

Not enough visuals.

Tiny, unreadable print.

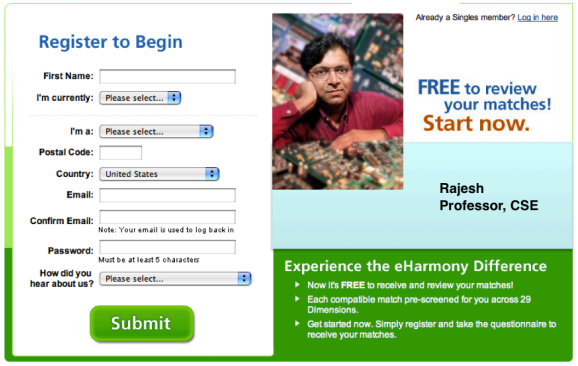
Plagiarism

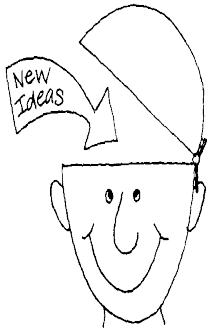
- **Know the definition**
  - intentional or unintentional use of other work without sufficient credit
  - citation may be insufficient
  - ask if you have questions
- **Consequences**
  - dismissal from the program
  - the end of your research career
  - bad karma

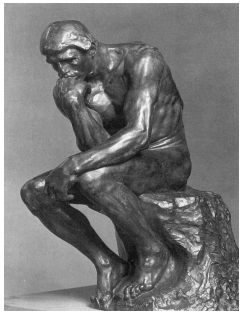
Conclusion

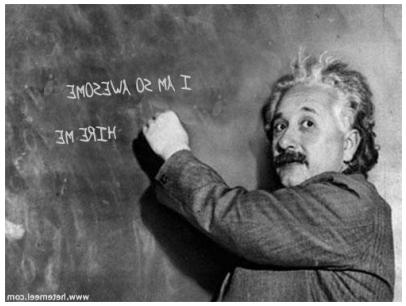
- **Goals**
  - find an advisor
  - for (n=0; n<MAXINT; n++) {
    solve some problem;
    publish your results;
    present your work;
    }
- **Target timelines**
  - one year to find an advisor
  - two years for first research “cycle”

Good luck!









Remember: luck favors the well-prepared.
Also: your current profs can help.