

**Everything You Wanted to Know  
About an Academic Research Career  
but Were Afraid to Ask**

*Gopal Gupta*

# What's involved in an academic career

Jump through a number of hurdles:

- Get a Ph.D.

Take courses ; Pass the qualifying exam;  
Come up with a thesis topic; Perform re-  
search ; Write dissertation; Publish re-  
search; Defend

- Find an academic job

Apply to various Universities/Labs; Inter-  
view; Negotiate; Accept an offer

- Get tenured and promoted

Apply for grants; Recruit students; Pub-  
lish research; ....

# Questions

- What is involved in doing research?
  - Understand your area so well that you are practically living inside it.
  - internalize existing knowledge; build abstractions; develop ability to reason at a high level.  
(Suggested reading: Surely you must be joking Mr. Feynman)
  - Only then can one do research (discover new knowledge).

## Questions (*cont'd*)

- Can anyone do research?
  - YES (may have to limit the scope)
  - Research requires creativity;  
*Imagination is more important than Knowledge!*  
– *Einstein*
  - Ability to think creatively in an area is god given; E.g., Mozart (but see later).
- Can one's research ability be improved?
  - Atheletes can practice and improve
  - Can mental atheletes do the same?

## Questions (*cont'd*)

- Can ability to do research be acquired?
  - To an extent; Creativity is largely innate.
  - However, one may not be god-gifted, but can still have a successful career in research. (will have to work harder).
- Success  $\equiv$  Hard Work & Perseverance

*Big shots are little shots who keep shooting.*

*Genius is only the power of making continuous effort.*

*Genius is one percent inspiration, ninety-nine percent perspiration. (Edison)*

## How Is Research Done?

- Research is about generating new ideas.
- New ideas are generated from old ones. Need to know them first. So read a lot (hard work).
- Note: Do not fall into the trap of reading all the related literature first.
- Write a survey paper early in your research.

*This leads to the paradox that the more original a discovery the more obvious it seems afterwards. The creative act is not an act of creation in the sense of the Old Testament. It does not create something out of nothing; it uncovers, selects, re-shuffles, combines, synthesizes already existing facts, faculties, skills. The more familiar the parts, the more striking the new whole.*

— Koestler

*I could only see further because I stood on the shoulder of giants.*

— Newton

## Research (*Cont'd*)

- It is not enough to just have the idea, one should be willing to do all the hard work to demonstrate that they work.
- Can one learn the art of generating new ideas?
  - Study an idea, find it's deficiencies and try to fix them.
  - Jump into a completely new field; the most obvious ideas are novel.
  - When reading a paper or hearing a speaker, also pay attention to what was not said.
  - Seek your advisor's help.
- Finding a thesis topic is perhaps the hardest.
- A Ph.D. is all about learning to create new ideas/knowledge.

## Choosing a Topic/Area

- Things to watch for:
  - You should be genuinely interested in the area. You are going to spend at least next 10 years in this area.
  - Don't go by popularity of the area; the area may be out of fashion by the time you finish your Ph.D.

*If you can see the bandwagon, it's already too late.*

*Warren Buffet*

- The rest of the world should also be interested in it; otherwise you will not find a job. However, if you are genuinely interested in something, go for it.

*It is more important to paint than to eat.*

*Vincent Van Gogh*



# Thesis Proposal

- Pay careful attention to thesis proposal
  - states precisely what the problem is
  - states outline of your solution
  - states milestones (should plan to finish the research in 1 year)
  - contract between you and the dept.
  - Need to define the problem before you can solve it.

## Communication Skills

- Communication Skills (reading, writing, speaking) are very important for success in any career.
  - Writing is particularly important.
  - Learn to *read*: Reach a point where you can
    - glance through a paper and tell what it is about.
    - read the abstract and get a pretty good idea of what the paper is about.
    - read the title and guess what the paper is about.
- ⇒ broad knowledge of computing  
& good understanding of the area

## Communication Skills (*Cont'd*)

- Learn to write:
  - good writing is very important for an academic career
    - theses
    - papers
    - research proposals
    - books
  - learn to get the idea across
  - write to inform, not to impress
  - read books on writing (Strunk and White)
  - practice; observe other people's writing
  - takes time
  - While writing, be prepared to revise your document several times.
  - Writing is like programming: changes introduce “bugs”.

*Excellent work is the product of excessive revision*

## Communication Skills (*Cont'd*)

- Learn to speak effectively:
  - learn to get the main idea across
  - practice

*Excellent work is the product of excessive revision*

- make sure that at least 20% of the talk is accessible to everybody.
- good speaking is all about confidence

## Academic Job Hunting

- Typical people Start looking for jobs in the last year of their Ph.D.
- If you plan to start in Fall of 2004, you'll apply around Dec of 2003.
- Ads appear in CRA.org, ACM.org and in journals/magazine (CACM, IEEE Computer).
- Apply to as many places as you can;
  - detailed vita
  - statement of teaching
  - statement of research
  - references
- The job market can vary; depends on:
  - the state of the economy
  - supply and demand
- Wait for interview calls
  - (held around Feb/March/April)

# The Interview

- What matters most:
  - your area (e.g., security; software engg)
  - quality of your research
  - your publication record
  - contacts may also get you an interview
    - \* tell people about your work in conf.
    - \* collaborate (perhaps through your advisor with other people in your area)
    - \* participate in organization of workshops/conferences
    - \* project the image of hard working, ambitious, congenial person
    - \* get to know the people in your area and get them to know you

## Interview (Cont'd)

- interview consists of:
  - a 1 hour talk (w/ questions)
  - 30 min. meeting with faculty members
  - 30 min. meeting with the Dean
  - maybe tour of the city/campus
  - lasts 1-2 days
- Interview talk the most important item: people will judge how good a teacher you are, etc., based on your talk.
- Exude confidence while giving your talk; you are the expert in that area, so speak with confidence.

## Interview (Cont'd)

- Practice summarizing your research in 5 minutes or less. Lot of people will ask you to describe your research, if they've not been to your talk.
- interview is for both parties to “discover” and assess each other.
- Your goal is to convince them that they should hire you.
- Their goal is to convince you that they should be your #1 choice.
- Terms are not negotiated during the interview;
- Offer is made later; you negotiate then



## Interview (Cont'd)

- Ask questions during meetings with individual and dept head:
  - How do you like this place?
  - Where do you see the department going in 5 years?
  - How much time are you supposed to spend on research?
  - What are the general requirements for obtaining tenure?
  - What is the cost of living?
  - How are the benefits?
  - Who can you collaborate with?
  - Do the faculty members get along?
  - What are the expectations w.r.t. getting research grants?
  - Ask people about *their* research.

## **The Academic Jungle**

- Finally you get the job and you'll face the challenges of:
  - teaching (perhaps for the first time)
  - defining your research agenda
  - recruiting students
  - raising money for your research from national funding agencies, state funding agencies, private industry or even your own University.
  - performing departmental service (various committees)
  - still need to continue doing good research, publishing, knowing your research community, making yourself known in your research community etc.
  - plus balance a family

## **The Academic Jungle** (*Cont'd*)

- An academic job is quite challenging, and not for everyone.
- However, there are many advantages:
  - Freedom to pursue what you like to do
  - Flexible schedule
  - Teaching/interaction can be quite rewarding
  - You are around smart people
  - You get to keep the glory, not your company

## Strategies That Work

- Dream big: Embark on solving a very difficult problem; the first small step can be your Ph.D. thesis; the rest can provide you a lifetime of research problems.
- Don't get enmeshed in mediocre research; keep your conscience clean.

*For every paper, no matter how bad, there is a journal that is of low enough quality, that will publish the paper.*

Don't fall into this trap; only do worthwhile research.

- Quality over quantity: Don't publish for the sake of publishing; generally, people will recognize bad research. This will negatively impact your reputation.

## Strategies That Work (*cont'd*)

- Be honest with yourself; Are you happy with what you are doing?

*The bigger the real-life problems, the greater the tendency for the discipline to retreat into a reassuring fantasy-land of abstract theory and technical manipulation.*

*-Tom Naylor*

- Collaborate with a large team.
- Hire smart students :-)
- Pick a role model (dead or alive) from your research community; try to follow their example or emulate their career.
- Read biographies of famous researchers: for inspiration as well as to find out that they are just as human as you are.
- Research is done by people; understand the process and the psychology of people involved; always helps.

## Summary

- A faculty member is half a businessman.
  - Hard work
  - Creative Thinking
  - Good Communication Skills
  - Involvement in the research community
  - Ambition: Dream big
  - Publicize your work
  - Understand the process/psychology