

Research: HOWTO

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What is Research?!

- Exploration & Investigation of a topic/problem/phenomenon in a deliberate, scientific manner
- Discovery of knowledge that advances the “state of the art”

Why Do It?

- Research Scientists usually given more autonomy
 - Rewarding career in academia
 - Make lots o' money @ research labs
- It's fun to explore, play, learn
- Stay abreast of cutting/bleeding edge technologies
- Contribute to society
- People call you "Doctor"

So How Do It?!?

- Has to be "experienced" not "learned"
- A Process that combines the following
 - Inquisitiveness
 - Self Discipline
 - Organization
 - Experimentation
 - Ability to apply prior knowledge/experience to new situations
 - Ability to see things (problems) from multiple perspectives
- Often involves trial & error!!
- Can experience periods of frustration

How do I find what to research?

- The hardest problem
 - Dead-ends most PhD's
- Think Big - "I can change the world!"
- Find something that
 - Excites you
 - Interests you
 - Suits your thought process (Theory vs. Practice)

Finding a Topic

- Flash of Brilliance: "Divine intervention"
 - Pro: Instant topic
 - Con: Not likely to happen
- Given out by Advisor: Advisor gives you a topic
 - Pro: Start working right away
 - Con: Shortcut on research experience, topic might not suit you
- Sweat & Tears: Through work on other projects, find key insight to a related problem
 - Pro: Topic comes from your work
 - Con: Can take a while to find a topic

Finding a Topic (cont)

- Piecemeal: Combining many smaller projects into topic
 - Pro: Puts lots of previous work to use
 - Con: Can be difficult to find thread of continuity for all work
- Search & Destroy: Read papers to find open issues
 - Pro: Learn whole research process
 - Con: Could read papers forever!

How do I know what intererst me?

- Take courses in many areas
- Work on small projects for many faculty
- Talk to professors
- Attend talks, colloquia, conferences
- Think about what you like
- Solve small research problems

Have Topic, What next?

- Clearly define the problem
 - Set realistic bounds (not too big, not too small, just right...)
 - An ambiguous problem is more difficult to solve than a clearly defined problem
 - Don't try to "save the world"
- Clearly plan out your path to solution
 - Know when to say "no" to your advisor
 - Know when you better say "yes" to your advisor
 - Realize that my may have to redefine your problem

How do I start, what if I get stuck?!

- Take Baby steps
 - Don't tackle everything at once
 - Learn about/understand, solve little pieces at a time
- Always make progress
 - Set realistic goals for EACH DAY
 - Reward yourself for achieving daily goals
- Plan First, then execute, then refine ...

Along the way...

- Publish Papers...
- Give Conference Talks...
- Network...

FINALLY

- GRADUATE!
- Before Graduation:
 - Think about where you want to end up
 - Academia
 - Industry
 - Government Labs
 - Start-ups
 - Position your work & networking efforts towards where you want to work

References

- Jeff Chase, Duke University
- Mary Jean Harrold, Georgia Institute of Technology
- Janie Irwin, Penn State
- Elena Jakubiak, Tufts University
- Lori Pollock, University of Delaware