Al-Mustaqbal University

College of Science

Scientific Thinking and Research Skills

Third Year Students / 1st Semester

Research skills

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Biochemistry Department

By

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Research

- The process of searching
  - carefully
  - with a method

to answer a question

Skills - Wikipedia

- A skill is the learned capacity or talent to carry out pre-determined results often with the minimum outlay of time, energy, or both.
- Talent or learned capacity?

Talent or learned capacity?

- Most of the skills can be learnt or improved over time, if one wants
- Some talent is needed, but alone it is not enough
  - People with great talent and no skills obtain much less than what they could do
- Not only technical skills

Many types of research

- Theoretical
  - Theorems and proofs
- Experimental
  - Algorithm development, experimental results
- System development
  - Coding, testing, engineering, …

- Basic research skills don’t differ much

Clear about our goal

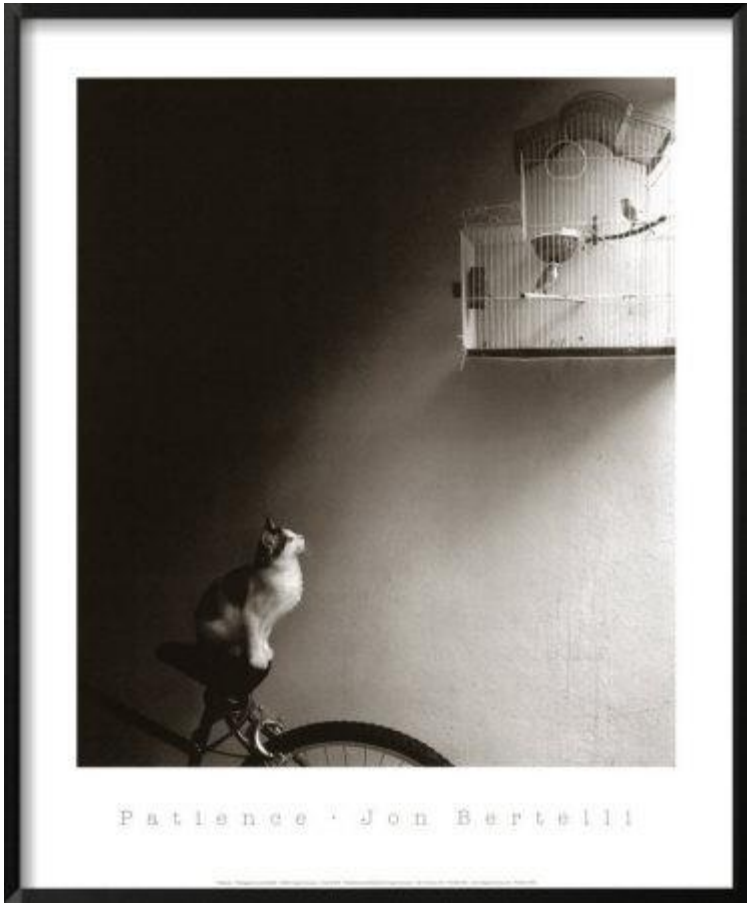
- Our goal is to produce good research results, to make advancements in science and technology
- NOT to get a job, or to make more money, …
- If we do good research, these things will come, but they are not the goal, they are a side effect
- If we go for the wrong goal, good research will probably not come, and not even the goal

Skill 1: Curiosity

- Intellectual curiosity
- How does it work? What if you change this? Why did you do this? …
- Ask questions to everybody (and to yourself) and in all circumstances
- Look at what others do
- Can be very helpful in learning how to recognize the interesting questions

Skill 2: Patience

- Good research needs time
- Don’t expect great results immediately
  - Theorems may be hard to prove
  - Coding may take more time that initially thought to be bug-free
  - Experiments need to be tuned to show interesting results and lessons
- Allow ample time to do either theoretical or empirical research



Skill 3: Enjoyment

- Research has to be something you like to do
- Don’t do it for some other reason (money, recognition, fame, jobs, etc.)
- If you enjoy it, more chances that the results will be interesting, and all the other things will come
- Just relax and have fun
- Think carefully if this is what you like
  - If you can imagine a better life, you should go and take that life

Skill 4: Problem formulation

- A problem should be formulated in a simple and crisp way
- Everybody, even non-expert people, should be able to understand it
- An unnecessary complex formulation may hide the essence of the problem and also its solution
- Talk to others, define your problem to them, get feedback

Skill 5: Look for important problems

- Working only on the details of your latest propagator or theorem can be useful for the next paper
- But devote some time also to think about the larger picture
- What are the important problems in my field?
- Read what others work on
- Discuss with other students, your supervisor, anybody you meet at the conferences

Skill 6: Review existing work

- Being able to find and evaluate previous work
- Look for what others have done **before** starting your research project
- It helps defining and tuning your problem
- May give you ideas on how to solve it
- Avoids reinventing the wheel and wasting time