Research

Hints on

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6898: Advanced Topics in Software Design
MIT Lab for Computer Science
Daniel Jackson
Aims

Your ideas and experience?

But still fun and thought-provoking?

Not organized

A long list of aphorisms

Caveat

Also a few observations of my own

Comments most relevant to CS

Extracts from some books I've liked

Share some thoughts I have

How to succeed in research?
Worlly Jesuit priest, Spain 1601-1658.
Baltasar Gracian. The Art of Worldly Wisdom: A Pocket
contributor to theory of tectonic plates.
Jack E. Oliver. The Incomplete Guide to the Art of Discovery.
Translated by Neely Swanson and Larry W. Swanson. MIT
Santiago Ramon y Cajal. Advice for a Young Investigator.
1979. British Nobel Laureate in Medical Science
Peter B. Medawar. Advice to a Young Scientist. Basic Books.

Sources
medawar

"don’t suck up"

the head with an inflated pig’s bladder

"the old fashioned remedy for hubris was a sharp blow on
young scientists

to improve skills, repeat others’ experiments
fortune favors the prepared mind

scientific process: how to discover

what should I do research on?

the El Greco test

am I brainy enough?
medawar

make up your mind whom you're addressing

audience

any writer will do; essays especially

study exemplars

... specifically...

Ah, but what into? the cry goes up: „Mice, rats and other lab animals should never be injected...

language

use a blackboard, not lantern slides,

talks
find in me a beholder and interpreter of his works? Kepler

After all, did God not wait six thousand years to be readers. After all, did God not wait six thousand years to whether it is read today or by posterity. Some day there will The die is cast and with this I finish my book, caring little passion for reputation discoveries are not the fruit of outstanding talent (p.23) perceived lack of ability vs. power of determination preoccupation with applied science the most important problems are solved undue admiration of authority beginners’ traps

cajäl
When faced with a difficult problem, they feel an irresistible urge to formulate a theory. "Love the study ... only for its aesthetic qualities..." Contemplators and philosophers want to start career with extraordinary achievement. Diseases of the will: megalomanias, intellectual qualities, independent judgment, concentration.
on writing

not repeatable in 2002

on women

cajal
What makes discovery precious is not recognition, honor or advancement but unparalleled private joy.

...others as they direct their careers. Common traits that might be acquired and used profitably by personal styles of successful scientists and to identity... Consequently, I have long sought to observe the experiences... strategist and tactician. Nor the most knowledgeable, but rather to the superior... comes not so much to the most gifted, nor the most skillful,... I have grown more and more aware that success in science...

Oliver: why he wrote the book
oliver: strategy

— earth's interior as pot of soup
argue by analogy

— go with intuition

— avoid side tracking to trivia
avoid science eddies
taste in research

strive to enhance serendipity

— rebel but wisely: don’t jump to every radical cause
seek the non-questions, questions ignored or forgotten
see your era in long term perspective
what is everyone else doing collectively?
don’t follow the crowd

oliver: strategy
Choose your problem very carefully.

Do it yourself.

Skim the rest of the volume, any volume.

Minimize jargon. Skim the cream.

Oliver Tactics
Know where you are on the discovery curve

Oliver: curve of discovery
oliver: personality traits

- beware of Occam's razor
- occasionally think like a child
- remember scientists debt to society
- avoid all pretence
- be optimistic, at least secretly
- respect not reverence
- never fully accept any theory, hypothesis, law or doctrine
- enjoy the struggle, not the spoils
Gracian: Relationships

- Know the great men of your age
- Know the defects of your country
- Know your best quality
- Know what piece you are missing
- Plumb your depths, weigh your resources
- Know yourself
- Associate with those you can learn from
- Find something to praise
- Plumb your depths, weigh your resources
- Know yourself
Gracian: Decisions

- Don't be overly clever; common sense is safer.
- Don't surrender to first impressions.
- Don't be the only one to condemn what is popular.
- Free yourself from common foolishness.
- Don't be obsessed with the latest.
- Don't persist in folly.
- Know when to put something aside.
- Matter most.
- Weight matters carefully and think hardest about those that matter most.
- How to take advantage of them.
- Know when things are at their acme, when they are ripe, and know how to choose.

Gracian: Decisions
· There are no ideas what we are saying?
· How will others understand what they are hearing if we
  express yourself clearly
· Make others understand

· Make people depend on you
· Expectations

· When you start something, don’t raise other people’s
don’t live in a hurry
· in all matters keep something in reserve
· Know your unlucky days, for they exist
· don’t be tiresome, don’t have one theme, one obsession

Gracian: temperament
Gracian

When you counsel someone, appear to be reminding him of something he’s forgotten, not of the light he’s unable to see:

Don’t outshine your boss.
some thoughts of my own…

Listen carefully; understand deeply

- If you don’t understand, figure out why
- Deconstruct the style & structure
- Analyze the paradigm
- Other people’s work

- Spend most of your time on the best material
- Study how they write and present
- Figure out why they are successful
- In any field, in any aspect of work

Find exemplars

…
explain your ideas
› to yourself, to others whenever you can
› polish your elevator pitch

teach!
› a privilege, not a burden
› few ideas are as simple as they seem

eamples
› work hard on generating good examples
› very difficult, very productive
› convey essence of a real problem
› don’t wait until you write the paper
    construct examples as you go along
strategize, often

evaluate progress

learn to recognize progress

evaluate progress

analyze what went wrong, keep trying

never attribute to malice that which can be explained by sheer incompetence

"never attribute to malice that which can be explained by disappointments"

take slide titles very seriously (hmm…)

write the abstract at least twice

It's never too simple

presentations

record your ideas in a bound notebook

recognize & conquer research avoidance

strategize, often
but ultimately ... find your own way