

hints on research

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6898: Advanced Topics in Software Design

May 1, 2002

aims

how to succeed in research?

share some thoughts I have

- › extracts from some books I've liked
- › comments most relevant to CS
- › also a few observations of my own

caveat

- › a long list of aphorisms
- › not organized
- › but still fun and thought-provoking?

your ideas and experience?

SOURCES

Peter B. Medawar. *Advice to a Young Scientist*. Basic Books, 1979. *British Nobel Laureate in Medical Science*

Santiago Ramon y Cajal. *Advice for a Young Investigator*. Translated by Neely Swanson and Larry W. Swanson. MIT Press, 1999. *Neurobiologist. First edition 1897.*

Jack E. Oliver. *The Incomplete Guide to the Art of Discovery*. Columbia University Press 1991. *Geophysicist, major contributor to theory of tectonic plates.*

Baltasar Gracian. *The Art of Worldly Wisdom: A Pocket Oracle*. Translated by Christopher Maurer. Doubleday 1992. *Worldly Jesuit priest, Spain 1601-1658.*

medawar

am I brainy enough?

- › the El Greco test

what should I do research on?

- › to make important discovery, study important problem

scientific process: how to discover

- › fortune favors the prepared mind
- › to improve skills, repeat other's experiments

young scientists

- › “the old fashioned remedy for hubris was a sharp blow on the head with an inflated pig's bladder”
- › don't suck up

medawar

talks

- › use a blackboard, not ‘lantern slides’

language

- › “Mice, rats and other lab animals should never be injected...
Ah, but what into? the cry goes up.”
- › specifically...

study exemplars

- › any writer will do; essayists especially

audience

- › make up your mind whom you're addressing

cajal

beginner's traps

- › undue admiration of authority
- › ‘the most important problems are solved’
- › preoccupation with applied science
- › perceived lack of ability vs. power of determination
 - ‘discoveries are not the fruit of outstanding talent’ (p23)

passion for reputation

- › The die is cast and with this I finish my book, caring little whether it is read today or by posterity. Some day there will be readers. After all, did God not wait six thousand years to find in me a beholder and interpreter of his works? *Kepler*

cajal

intellectual qualities

- › independent judgment
- › concentration

diseases of the will

- › contemplators
 - “love the study ... only for its aesthetic qualities...”
- › bibliophiles and polyglots
- › megalomaniacs
 - want to start career with extraordinary achievement

theorists

- › “when faced with a difficult problem, they feel an irresistible urge to formulate a theory”

cajal

on women

- › not repeatable in 2002

on writing

- › “have something to say; say it; stop once it is said; and give the article a suitable title and order of presentation”

oliver: why he wrote the book

... I have grown more and more aware that success in science ... comes not so much to the most gifted, nor the most skillful, nor the most knowledgeable, but rather to the superior strategist and tactician.

... Consequently, I have long sought to observe the experiences and personal styles of successful scientists and to identify common traits that might be acquired and used profitably by others as they direct their careers...

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

oliver: strategy

don't follow the crowd

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

strive to enhance serendipity

taste in research

- › avoid science eddies
- › avoid side tracking to trivia
- › go with intuition

argue by analogy

- › eg, earth's interior as pot of soup

oliver: tactics

skim the cream

minimize jargon

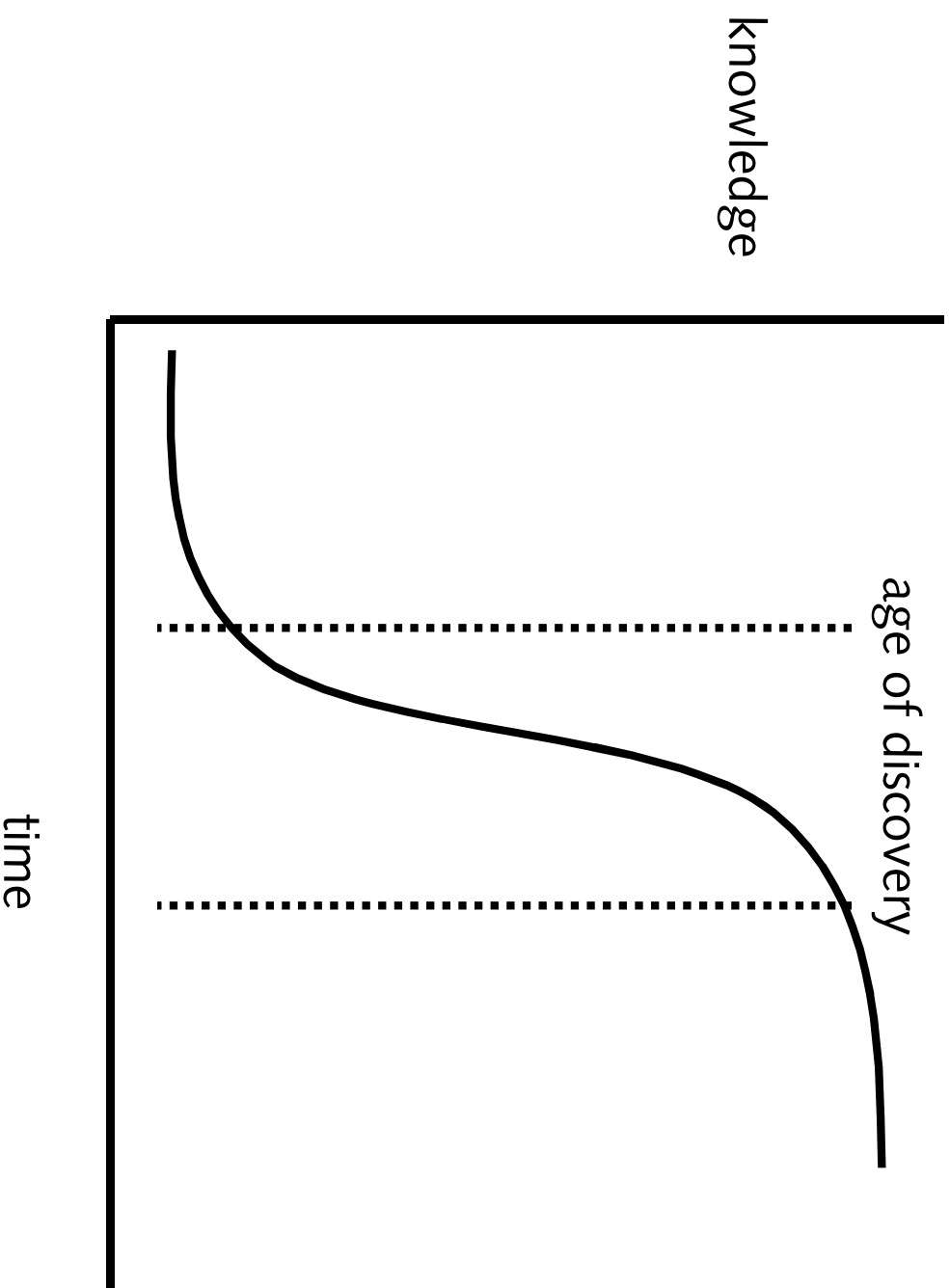
skim the rest of the volume, any volume

do it yourself

choose your problem very carefully

oliver: curve of discovery

know where you are on the discovery curve



oliver: personality traits

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

gracian: relationships

- › know yourself
 - › plumb your depths, weigh your resources
 - › know what piece you are missing
 - › know your best quality
 - › avoid the defects of your country
-
- › associate with those you can learn from
 - › find something to praise
 - › know the great men of your age

gracian: decisions

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

gracian: temperament

- › don't be tiresome. don't have one theme, one obsession
- › know your unlucky days, for they exist
- › in all matters keep something in reserve
- › don't live in a hurry
- › when you start something, don't raise other people's expectations
- › make people depend on you
- › make others understand
- › express yourself clearly
 - how will others understand what they are hearing if we have no idea what we are saying?

gracian

don't outshine your boss

- › “When you counsel someone, appear to be reminding him of something he's forgotten, not of the light he's unable to see”

some thoughts of my own...

find exemplars

- › in any field, in any aspect of work
- › figure out why they are successful
- › study how they write and present
- › spend most of your time on the best material

other people's work

- › analyze the paradigm
- › deconstruct the style & structure
- › if you don't understand, figure out why

listen carefully, understand deeply

- › a good argument: when you can reformulate your opponent's viewpoint to their satisfaction

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

examples

- › 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
- › recognize & conquer research avoidance
- › record your ideas in a bound notebook

presentations

- › it's never too simple
- › write the abstract at least twice
- › take slide titles very seriously (hmm...)

disappointments

- › “never attribute to malice that which can be explained by sheer incompetence”
- › analyze what went wrong, keep trying

but ultimately ...
› find your own way