**Chapter 4**

**4.1 Choose Research Topics**

* Demand from social and economic development.
* Curiosity and personal interests.
* Combining social requirements with personal interests.
* **Deep impact on one’s career.**

**Importance of interdisciplinary Research**

* Tendency of modern science and technology and possible drive of discipline change and development.
* 40% of the work winning the Nobel Prize is in the areas no one claim to be in.
* The concepts and knowledge in one area may change the course of another area.
* New areas may come out as the inter-disciplinary research.

**Form of interdisciplinary research**

* Researches from different fields collaborate to work on some particular problems.
* Researches mutually work on the problem of other fields.
  + One from field A work on the problem of field B
  + One from field B works on the problem of field A
* Researchers from different fields propose a new field
  + Bio informatics, system biology.
  + Network science and data science
  + Energy informatics (cyber-physical-energy-system)

**Historical perspective on systems and control areas- an example**

* The fundamental role of probability and stochastic process in system work.
  + Knowledge from outside the field influenced our research.
* The concept of what constitutes a solution to a problem routinely solvable
  + Practices in science and mathematics are changed by computer technology.
* The notion of dynamics and feed back in all their ramifications.
* Specific concepts the system field contributed to other fields.

**Approach to choosing a research topic**

* Comprehensive understanding of the state of art in well established areas.
* Demand oriented versus methodology oriented approach.
* Spend time in understanding the background and issues of unfamiliar areas.
* Prepare to work in a new area without many references.
* Prepare to work on difficult problems.

**Observations on the new frontiers of science and technology in the 21 century**

* **INFORMATION SCIENCE AND TECHNOLOGY , ESPECIAL INTERNET TECHNOLOGY**
* **LIFE SCIENCE AND BIOLOGICAL TECHNOLOGY**
* **ENERGY , ESPECIALLY NEW ENERGY**
* **ENVIRONMENT**

**4.2 APPYING RESEARCH FUNDING AND WRITE PROPOSALS**

* Applying funding in one of the lifelong tasks of a researcher.
* One of the most important standards or criteria for performance evaluation.
* Writing a good proposal is a necessity to get research funding.

**Assumptions when writing proposals**

* The reviewers are statistically unbiased and intelligent.
* The reviewers are smart but very busy.
* There are many smart researchers out there competing on the same subject and proposing similar or better ideas.

**Strategies when writing proposals**

* Concentrate on our side
* Present the key ideas clearly and convincingly in first two pages.
* Be creative and try very hard to set up new problems and propose new approaches unlikely to be thought about by others.

**Emphases on different categories of Chinese proposals**

* Basic and applied basic research - NSFC, 973 , etc.
  + Originality of ideas and academic impact.
* Technology development - 863, S&T Support, etc
  + Technological innovation , applicability and commercial impact.
* One or both of the above plus HR, equipment , environment plus the above - 985, 211, etc.

**CONTENTS OF A PROPOSAL**

* Project descriptions
* References cited
* Biographical sketches.
* Budget
* Current and pending support
* Facilities , equipment, and other resources.

**Project descriptions**

* Introduction
  + Motivations
  + Basis for proposing the project
  + Current status( literature reviews)

**Research contents**

* Goals
* Proposed tasks
* The key issues to be resolved

**Technical approaches**

* Solution methodologies
* Experiment designs
* Key techniques.

**Innovations or salient features**

* Expected deliverables and milestones
* Current achievements related to the proposed project
  + Related projects completed
  + Related publications
  + Related duties

**Biographical Sketches**

* Key investigators in the team
* Educational background
* Academic duties
* Experiences
* Related publications

**Budget**

* Reasonable amount
* Follow the rules

**Related Support**

* Good summary of the past support and the achievements.
* Current support-report as needed
* Pending Support- report as needed

**Defense for a key project**

* Give PPT presentation on the project proposal usually 15-20 minutes.
* Apply all the principles and skills discussed in Lecture 2.
* THE GOAL - Convince the previewing panel!

**Progress Report**

* Background information: a good summary of project descriptions.
* A description of current status: results , methodologies, etc
* Conclusions
* Achievements so far: paper published and accepted, awards , patents.
* A good progress report may lead to a scientific paper.

**Mid term field review**

* PPT presentation on the progress.
* Demos on the achievements so far.

**Final report and panel review**

* Report on the overall progress and achievements
* PPT presentation on the overall achievements
* Demos on the achievements and applications
* Facilities, environment, etc.
* A good review ranking on the project helps the next project