

## Advice for Scientists

Adapted from Dr Tanner (University of MO at Columbia), modified by T. Flatt

*"You can spot the ones who are going to be academics fairly quickly, just by the way they do science: the passion, the curiosity, the intensity, the intelligence, the work at nights and the weekends - there are so many qualities they combine, and you just know this someone who just wants to do science."*

(Graham Warren, Director of the Max F. Perutz Laboratories, Vienna)

### To succeed in scientific research, you must:

- **Work Hard**

Work 60-80 hours per week. Plan to do this through graduate school, postdoctoral study, and at least your first ten years in a permanent position. The American people have invested large amounts of money (State and Federal funds) in our laboratory. To not work hard is theft of service, and it undermines the confidence of Americans in scientific research.

- **Write many high quality papers, and thereby publish in mainstream journals**

Start to practice writing early. You need to write at least two really good papers per year, starting in the latter part of your graduate work. Learn how to write well. Use an outline and be complete but concise in planning the introduction to a paper. It helps to imagine that you are presenting the material in a lecture. For style questions, consult Strunk & White.

- **Read incessantly and widely**

Half of your reading should be immediately related to your current research (journals and books); the other half should be potentially related to your current or future research. You should always be reading one textbook or monograph, and you should look at each issue of key journals and serials. Know how to read journals to extract the most useful information in the least time. Search Medline weekly. Use these resources

- o Online journals
- o Health Sciences library
- o Ellis library

- **Manage Your Time**

Two-thirds of your time (40-50 hours/week) should be spent conducting research. One third of your time (20-30 hours/week) should be spent reading. Set daily, weekly and long-term goals. Review your goals and progress frequently. If you are consistently falling short of your goals, try keeping track of how you actually spend your time for a few days. Use this inventory to help plan adjustments. Know when to be meticulous and when you can be sloppier. Be efficient and learn to multi-task. Do not postpone important things. Prioritize.

- **Be the expert regarding your project**

- a. I (your advisor) cannot and should not be the expert on each scientist's project.
- b. To be the expert, you must read incessantly and widely.

c. You must visit the library (real or online) twice per week to identify new pertinent literature.

d. You must do electronic literature searches weekly - use Medline via Netscape.

e. You must search the Protein Data Bank weekly to see if your protein or a related one has been deposited.

f. You must live in abject fear that you have missed a pertinent paper, and will thereby be embarrassed in a public forum.

g. Fulfillment of a. to f. is part of scholarship.

- **Present solid, clear seminars**

Take advantage of opportunities to give lectures about your research. Preparing a talk helps you to review what you are doing, why you are doing it, and what you still need to do. In lecturing, look at the audience, not at the board or screen. Pretend you are talking to someone in the back row - that will help you speak loudly enough. Don't fumble with the keys or change in your pants pocket. Don't read from your slides.

- **Be able to accept frequent and sometimes harsh criticism and overcome adversity.**

- **Master at least one widely-applicable technique and preferably two different techniques**

- **Be first**

Nobody cites second references and nobody remembers the confirming paper.

- **Be Intensely Interested in Your Work**

If you're not consumed by interest in your research project, pick another project. If you're not consumed by interest in some project, pick another career.

- **Write superb grant or fellowship applications**

Current funding levels are 10-15% at most agencies and decreasing.

- **Be Ambitious and Reasonably Aggressive**

- **Be Persistent**

Be resilient. Science is a tough business so it is important to have a firm psychological stance.

- **Conduct your research with a sense of urgency**

Someone, somewhere, is working on your crystal structure.

- **Pick Interesting Research Topics**

They should be something that any other scientist would be interested in.

- **Work on Something that You can Do**

Your main project at any given time should be one that is well-defined and that is solvable within 6-12 months. Break projects up into 3 month steps.

- **Network**

To succeed in science you must network. A lot. You must know your senior and junior colleagues and they must get to know you. Attend seminars, conferences, and symposia whenever you can. Give talks or posters. Talk to senior, fellow, or junior colleagues and build up a network of colleagues and collaborators. Networking is also important to get a job. It helps if the job search committee knows already who you are.

**To write many high quality papers, you must:**

1. First and foremost, be a scholar.

2. Ask yourself:

What is new? What have I discovered?

What is the message? 1 to 2 messages per paper.

What is not known?

What will the figures look like?

Who am I trying to reach?

Which journal is appropriate?

3. Write your papers as the research is conducted. It is illogical, inefficient, foolish, and counterproductive to wait until your work is completed to write the manuscript. You will fail if you take this approach.

4. Write the Material and Methods section first - it's simply a story about what you actually did in the lab. Then proceed to Results, Conclusions, Introduction, and Abstract.

5. Live the following concept: Always have at least one paper in press, one manuscript submitted for review, and one paper that you are writing.

**Additional Noteworthy Points**

- Gather ideas and techniques from widespread sources  
Advances are made by people who have insights and lead the charge.

- Consult Other Experts

When you run into a technical problem that's peripheral to your main research goal, consult someone who's an expert in that area instead of spending weeks trying to find and absorb all the relevant literature.

- Work on Two Different Projects at the Same Time  
99% of the experiments fail, so you must have backup plans!

- Hoard Ideas

Whenever you have an idea for a possible research project, write it down immediately and save it in your Ideas Notebook. Review your ideas occasionally. Move the best ones to the front of your notebook and keep developing them.

### **Why do people fail?**

1. They are lazy.
2. They are stupid (in the broadest sense of the word).
3. They do not perform research better and faster than the competition.
4. They do not have pride in their work.
5. They do not write papers.
6. They exercise immense self delusion by saying,  
"If I only had time to write up my exciting data."  
"I was unlucky."  
"I will write the paper tomorrow."  
"I work harder than anyone else."  
Etc.

### **You will fail if:**

You do not embrace what I have told you. I guarantee it.

You may succeed if :

You embrace the strategies I have outlined.

### **Some of my responsibilities:**

1. Provide resources to do the job.
  - a. supplies.
  - b. equipment.
  - c. personnel/technical support.
2. Provide a scholarly environment.
3. Provide ideas and act as a critic.

4. Assist in manuscript preparation.
5. Career counseling.
6. Staff psychiatrist
7. Assist your success: If you succeed, I succeed. If you fail, I fail. I do not like to fail.
8. Acts as spokesman for the laboratory regionally, nationally, and internationally.
9. Set standards for the lab, set overall direction, decide where resources will be spent.