Peter J. Feibelman: A PhD Is Not Enough

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- 1967 PhD in Physics, University of California, San Diego (Calif.).
- 1968 – 1969 National Science Foundation (NSF) Fellow/Attaché de recherches, Centre d'Études Nucléaires de Saclay, France.
- 1969 – 1971 Research Assistant Professor of Physics, University of Illinois, Urbana-Champaign.
- 1971 – 1974 Assistant Professor of Physics, State University of New York, Stony Brook.

Source: https://history.aip.org/phin/11508026.html
Sandia National Laboratories

- Website: [www.sandia.gov](http://www.sandia.gov)
- Established: 1949
- Research type: **National security, nuclear science**
- Budget: US$ 3.1 billion
- Staff: 10,652, students: 738
- Location: Albuquerque, New Mexico; Livermore, California.
- Campus: 8,699 acres (35.20 km²)
- Operating agency (since 2017): National Technology and Engineering Solutions of Sandia, under the direction of **Honeywell International**

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No verified email

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**Ion desorption by core-hole Auger decay**
ML Knotek, PJ Feibelman
Physical Review Letters 40 (14), 964

**Surface electromagnetic fields**
PJ Feibelman
Progress in Surface Science 12 (4), 207-407

**The CO/ Pt (111) puzzle**
PJ Feibelman, B Hammer, JK Narskov, F Wagner, M Scheffler, R Stumpf, ...
The Journal of Physical Chemistry B 105 (18), 4018-4025

**Photoemission spectroscopy—correspondence between quantum theory and experimental phenomenology**
PJ Feibelman, DE Eastman
Physical Review B 10 (12), 4932

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A PhD Is Not Enough


What is Science? (1)

Science = scientific knowledge

Science = The Scientific Community

Theory of Science

Theory of Sociology of Science

Example for Science = scientific knowledge:
The question „How should the (individual) scientist behave within the scientific community?“ does not belong to Theory of Science.
What is Science? (2)

Science = 
„scientia perennis“
(永恒科学)

Science = 
evolving through history

= There is one science from Aristotle to now.
= The science of Aristotle, Galilei, Newton is not our current science.

→ Scientia perennis takes from Aristotle, Galilei etc. **what fits to current science** and ignores the rest.
→ History of science is **retrospective opportunistic story-telling**.
Case: The PhD Technician (p. 11)

- L. spent 2 years as PhD in a prestigious lab
- He had been hired because of his technical know-how
- His task was to build a piece of equipment
- At the end of the 2 years the desired instrument was in place
- L. did not receive a permanent job position because he had not learned the basics of his new field

= L. has done everything his employer asked for – the result is fatal for his career.
= L. has done everything Theory of Science asks for – it’s not enough to survive in science.
Feibelman‘s Advice

• „…you will greatly improve your chances for long-term productivity and survival in science if you can teach yourself to be problem-rather than technique oriented. […]“ (p. 122)

• What it means to be a scientist: making my work meaningful to others (p. 6)

• Asking questions about the direction of one‘s scientific field, reading as widely as possible in its literature, and formulating a research program of one‘s own. (p. 12)
The concept of the „publon“

„Even though you are working toward a long-term goal, you report each project as an independent piece of work that has produced an new kernel of knowledge (only half jokingly a „publon,“ a quantum of publication*). (p. 55)

*The concept of the „publon“ emerged from the graduate student minds of M. J. Weber, now at the University of Virginia, and W. Eckhart, now at the Salk Institute.“ (footnote, p. 55)
Publication Strategy

Advantages of publishing a series of short articles

• Address the problem of writer’s block (p. 57)
• Reviewers are busy, prefer to review short papers (p. 57)
• Numerous articles keep your name in the spotlight (p. 56)
• Managers & funding agencies need evidence that they have spent money wisely (p. 55)
• Kernels of knowledge will give confidence that you are a person who completes projects (p. 128)
• The length of your publication list reduces the risk of employing you in your potential employers eyes (p. 128)
• You win no brownie points for writing long, multifaceted papers (p. 129)
Publication Strategy

Requirements for publishing a series of short articles

- You need to develop an appreciation for when a piece of work is complete enough to be written up. (p. 57)
„In the „good old days“, prior to World War II, scientists did not apply for, nor did they receive, research grants from funding agencies.“ (p. 107)

• In the latter part of the 20th century societies realized that the products of hard sciences can improve life (p. 108)
• Government and industry learned that investing in scientific leadership is necessary for prosperity (p. 108)
• Universities discovered the blessings of receiving government and other outside funds (p. 108)
• Student’s fees do not cover universities‘ costs (p. 108)
• „If you examine the science world around you, you will see that he who spends most money has the most influence.“ (p. 102)
Timing

• „Once you leave graduate school, the clock is ticking.” (p. 1)

• PhD T. was not able to finish his PhD work (programming a computer program) within time: “At least he would have reserved time each day or week to establish contact with other researchers at the lab and involved himself in one or two short-term projects with a clear chance for success.” (p. 9)

• „A problem that will take two years to finish must not be the main focus of your activities“ (p. 123)
The Employer’s viewpoint (1)

The PhD

• „For a typical employer, a postdoc is cheap labor.“ (p. 32)
• „A postdoc will also be gone in two to four years.“ (p. 32)
• „…a postdoc is a trained researcher who can be expected to be reasonably competent and not terribly demanding of supervision“ (p. 32)
• „Acquiring a postdoc […] is much like buying a piece of laboratory equipment.“
The Employer’s viewpoint (2)

A Permanent Position

• „…to hire you is a big risk.“ (p. 95)

• „If you turn out to be directionless, if you are noninteractive, if you are unproductive, your will represent a huge waste of time and resources…“ (p. 95)

• „If you are one of ten staffers […] and you fail, then the department is only 90 percent productive at best.“ (p. 95)

• „If you are simply going to be another pair of hands, a technician is a lot cheaper…“ (p. 96)
Managed vs Unmanaged Environment

Universities – unmanaged environments („academic freedom“)

- „A professorship is effectively several jobs rolled into one.“ (=teaching, writing grant proposals, reviewing, being an active academic citizen) (p. 74)
- Assistant professors – „suffer most of the disadvantages and have few of the benefits of a tenured academic position.“ (p. 77)
- Professors tend to work independently (there is no particular reward for collaboration) (p. 76)

Industrial and governmental labs – managed environments

- „Your job description is relatively simple“ (=being a scientific leader) (p. 80)
- The „management monitors the functioning of the lab.“ (p. 82)
- „…your lab will want to provide you with the necessary hardware.“ (p. 80)
- Cooperation of employees is rewarded. (p. 82-83)
Risk

• A young scientist who has **not yet completed a project** is „a pig in a poke“ for his potential employer (p. 8)

• „Employers generally feel that a **postdoctoral employee is not a big risk.**“ (p. 32)

• The **length of your publication list reduces the risk** of employing you in your potential employers eyes (p. 128)

• „….to hire you [for a permanent position] **is a big risk.**“ for the research lab. (p. 95)

• „Are you a **self-starter** or a **drone who always needs to be told what to do** next? Are you a leader or a follower? Will you take an interest in your colleagues‘ **work**, or will you **shut the door to your lab office**…?“
Credit (or: Confidence)

- **Credit for the lab**: „If the word gets round that postdocs […] end up with permanent positions […], then the best PhD‘s will want to apply to the lab…“ (p. 96)
- Kernels of knowledge will give confidence that you are **a person who completes projects** (p. 128) (→ publications)
- **Managers & funding agencies** need evidence that they have spent money wisely (p. 55) (→ publications)
- The ability to formulate a research program – will give confidence that you do not need supervision.
Synopsis (1)

The perfect scientist

- Is a „self-starter“ (=does not need supervision)
- Is a person who completes projects
- Knows his field
- Is able to formulate a research program
- Knows what motivates a particular scientific question
- Is able to communicate to others what makes his research important
- Sees the big picture
- Is problem- not technique-oriented

= is somebody who fits into an unmanaged environment!
The Scientific Community (SC)

• „To win a permanent research position is to seal a contract with the scientific community“ (p. 137) = participation in science starts with permanent research position

• **Products of the SC:** (1.) publons, (2.) good scientists, (3.) good labs

• **Risk reduction strategies in the SC:** (1.) requirement of finishing projects, (2.) job positions and grants for 2-4 years, (3.) continuous publication of publons, (4.) (long) publication list, (5.) others (e.g. personal networks)
Mining of Knowledge
Discussion

• **What we are told:** Everybody who is rational and willing to conform to scientific methodology may participate in science.

• Problems that may arise from the organisation of knowledge in the form of publons? (Are publons the adequate form for knowledge?)

• Scientific career as scientific entrepreneurship (=surviving in an unmanaged environment): „…remember that you are responsible for your success or failure as a scientist“ (p. 124) – acceptable?

• Science as an economy driven by venture capital rewarded with publons as cryptocurrency, and scientists/labs accumulating credit – a possible bubble?

• Why are the skills for survival in science not officially taught to young scientists? **Which rules can you believe, anyway?**
Two Sets of Interacting Rules

Time Constraint (1): 2 years for a project

- Understand that you are alone: that you are responsible for your scientific career!
- Show that you can finish projects!

Time Constraint (2): Try to get a permanent position as quickly as possible!

- Show that you can formulate a research program!
- Interact with your colleagues in your lab!

Knowledge takes on the form of publons.

The industry of science strives to reduce risk and rewards credit.