



## **Is work hell? Life in industrial research**

*John Wilkes*

Hewlett-Packard Laboratories, Palo Alto, CA

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*A presentation given at the CMU computer science department graduate student "emigration course". (Apologies to Matt Groening for the title.)*

CMU emigration course

# Is work hell? Life in industrial research

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## Why am I here?

- ✓ Because I've always wanted to visit Pittsburgh in January
- ✓ To ease your application to the competition
- ✓ To provide a totally unbiased perspective on working in industry
- ✓ The faculty know something about me that I'd rather you didn't

"A fine work, marred only by the author's flippancy and pomposity of tone" [Tom DeMarco]

## Why am I here?

Additional reading:

Robert Townsend. *Up the organization: how to stop the corporation from stifling people and strangling profits*. Alfred A. Knopf and Fawcett Publications, 1970.

Matt Groening. *Work is hell*. Pantheon Books, Random House, New York, 1985.

## Industrial research as a career

*What do you want to be when you grow up?*

There seem to be three kinds of technical people:

- Want to directly impact the real world
- Want to run their own world (entrepreneurs/faculty)
- The ones in between

## Industrial research as a career

*What do you want to be when you grow up?*

Some questions

- Is getting things into people's hands more important than asking questions/knowledge?
- Can you handle doing stuff one level removed?
- Do you enjoy/are you good at marketing/selling? managing?
- Why all these questions? Just decide something and get on with it!

Plus the folk motivated by money above all else.

## Industrial research as a career

### *Why would you want to?*

#### Technical gratification

- ✓ Helping advance the state of the art/knowledge
- ✓ Getting real-world things built
  - not just “toy” applications or systems
- ✓ A more challenging environment
  - technology plus realistic (“commercial”) concerns

#### Learning

- ✓ Competence at “realistic” things (e.g. system building)
- ✓ Good people to learn from

## Industrial research as a career

### *Why would you want to?*

Industrial research can combine the best of academia and industry — as a half-way house, it offers some of each. Access to “real systems” can be an exciting opportunity. It’s probably possible to build bigger, better, more robust, more interesting systems in industry than in academia.

“Realistic” or “commercial” world demands add additional constraints — sometimes good ones — that can prevent work being done on essentially useless avenues. Over-constraining can sometimes happen, too, of course!

From Chandu Thekkath (DEC SRC): “Although the research quality need not suffer, the quantity might [as measured in research papers produced, by comparison with an academic] — because work is done one project at a time, rather than in parallel, so it is not possible to multithread so easily.”

## Industrial research as a career

### *Why would you want to?*

#### Non-technical gratification

- ✓ products that help people
- ✓ more immediate gratification
  
- ✓ motivating people, not just manipulating things
- ✓ more comfortable organizational structures
  
- ✓ the fame, the fortune, the talk shows, ...

## Industrial research as a career

### *Why would you want to?*

How many people will read your thesis?:-)

By comparison to academia, there's more immediate chances of your work seeing the light of day in a real product — although you should be aware that product development cycles are not overnight things.

By comparison to pure product development, there's more of a need to motivate people, not just things.

The industrial research level may provide more of a supportive organization than a university, where a new professor is basically cast into the roles of entrepreneur, teacher, and researcher simultaneously.

Notice that money is not really the main issue: you can probably get paid as much at a top university if you are aggressive about consulting.

## Industrial research as a career

*Why would you want to?*

### Excellence.

If you don't do it excellently, don't do it at all. Because if it's not excellent it won't be profitable or fun, and if you're not in business for fun or profit, what the hell are you doing here?

— Townsend, p40

## Industrial research as a career

*Why would you want to?*

The journey is the reward.

# Industrial research as a career

## *HP corporate objectives*

### Profit

To achieve sufficient profit to finance our company growth and to provide the resources we need to achieve our other corporate objectives.

### Customers

### Fields of Interest

### Growth

### Our People

### Management

### Citizenship

## Industrial research as a career

### *HP Corporate objectives*

Why this “crass commercialism”? Because profit makes other goals possible. The full HP set is as follows:

- Profit - To achieve sufficient profit to finance our company growth and to provide the resources we need to achieve our other corporate objectives.
- Customers - To provide products and services of the highest quality and the greatest possible value to our customers, thereby gaining and holding their respect and loyalty.
- Fields of Interest - To participate in those fields of interest that build upon our technology and customer base, that offer opportunities for continuing growth, and that enable us to make a needed and profitable contribution.
- Growth - To let our growth be limited only by our profits and our ability to develop and produce innovative products that satisfy real customer needs.
- Our People - To help HP people share in the company's success which they make possible; to provide employment security based on their performance; to ensure them a safe and pleasant work environment; to recognize their individual achievements; and to help them gain a sense of satisfaction and accomplishment from their work.
- Management - To foster initiative and creativity by allowing the individual great freedom of action in attaining well-defined objectives.
- Citizenship - To honor our obligations to society by being an economic, intellectual and social asset to each nation and each community in which we operate.



## Industrial research as a career

### *Corporate objectives*

#### □ HP

The achievements of an organization are the result of the combined efforts of each individual in the organization working toward common objectives. These objectives should be realistic, should be clearly understood by everyone in the organization and should reflect the organization's basic character and personality.

— *P corporate objective*

#### □ IBM

Last year I told you that, as we worked to transform IBM and return it fully to industry leadership, we had four clear priorities: to be profitable; to become more competitive; to increase shareholder value; to grow.

— *1994 annual report*

## Industrial research as a career

### *Corporate objectives*

Goals tend to indicate the tenor of an organization rather than make the day-to-day business choices easier. I certainly make few decisions on a day-to-day basis by looking at the HP corporate objectives. But their spirit pervades things like the management structure, the devolution of decisions to the lowest possible level, and the emphasis on guidelines (which can be broken) over rules (which cannot).

If the corporate goals aren't articulated, what are you getting in to?

It's a good idea to look for the same clarity from a work group you may be talking to.

## Getting in

### *Why do companies hire people?*

#### Hiring

To keep an organization young and fit, don't hire anyone until everybody's so overworked they'll be glad to see the newcomer no matter where he sits.

— Townsend, p108

#### Growth

into new area, or of existing area

#### Turnover

desirable or undesirable

## Getting in

### *Why do companies hire people?*

Simple growth is less common nowadays than it used to be.

Turnover can be desirable or undesirable—the desirable sort is allowing growth in a new area, and may be being deliberately managed. (Hopefully with humanity.) It's worth finding out why it is happening.

How long have they been looking? Who have they hired recently? How do they get rid of dead wood?

## Getting in *Applications*

### Whether to apply

- ✓ required requirements
- ✓ optional “requirements”

### Some common courtesies

- ✓ ask what form input is wanted (if you can)
- ✓ ask who to send to (if you can)
- ✓ if you apply to more than one group in a company, tell them all

## Getting in *Applications*

Look over the job description, if you can get it. Is it what you want to do? (If not, why not? If so, why?) Could you do the job today? Could you do it tomorrow?

Women in particular seem to care overly much about “desired” qualifications. Remember: if you don’t apply, you can’t possibly get the job. If in doubt — ask. Or ask a colleague.

Multi-body problems are real. Don’t be shy about mentioning this, but don’t expect too much help from a company in solving it for you — they’ll do what they can, but it’s probably a bad idea to go around working as a pair anyway(!)

You’d be amazed how little effect even huge amounts of internal communication can have inside a large company: don’t assume that any 90,000-person organization can speak with one voice, or that one half knows what is going on elsewhere!

## Getting in *Applications*

### Who to apply to?

- ✓ personal contacts
- ✓ campus recruiting teams
- ✓ on-line submissions
- ✓ personnel departments (sometimes)

## Getting in *Applications*

It seems that personal contacts are the ways that most good applicants get to companies, especially at the PhD level.

So make some: at conferences, during informal visits — in both directions — offer to give a talk if you are passing through (try to make it low overhead; try not to ask for funding). Cultivate these contacts assiduously. Exploit them. when the time comes. if you're good, they'll welcome it — and you've got to be good to be here!

## Getting in

### *Campus recruiting*

#### Recruiting:

Send the people who can't go.

To convert a corporate liability into an asset overnight, fire the recruiters and put together a group of the most active, enthusiastic and successful people at work in your company, at all levels. Make them the campus recruiters. Their job: to be honest, not to sell or persuade.

— Townsend, p188

## Getting in

### *Campus recruiters*

They're often evaluated on how well they bring in good people. They're on your side. Use them!

Find out how (and when) the company does its on-campus recruiting. Participate. It gives you another avenue into the company, with a person who understands the corporate culture offering an opinion of you that the company hiring managers will often value more than a "walk-in" resume. It can help connect you to parts of the company that you never thought existed.

Don't use it as the only path. (But if the company uses a "mentor" model — keep them informed of what you're up to, and contacts you get.)

## Getting in *Applications - what to include (1)*

### Cover letter

- What are you applying for?
- Why are you applying?
- What makes you different and a good match?

### The resume

- Emphasize skills, not accomplishments
- Don't hide things

## Getting in *Applications - what to include (1)*

First impressions take about 30 seconds. Q: How many applications do you think we get? A: HP got about 300,000 via the personnel people in 1995-6.

Common courtesies really matter: put yourself in the hiring person's shoes.

Don't say: I'm great; you'll find my resume at URL ... (Why should we bother?)

It's our job to decide if you're great — not yours. Your goal is to prove us with the information we need to make the decision as accurately and quickly as possible.

Compare:

- “Designed and built worlds' first mumblefrotz — the best thing since sliced bread.”
- “Walking-toaster design project (Mumblefrotz product). Provides fresh, warm bread products to bed-ridden users. Came up with original concept; developed firmware architecture and implemented it with my colleagues as a 3-person team; ran customer trials in local hospital (added third leg for additional stability in power outages as a result). Acquired skills in real-time robotics control in Java and product marketing survey techniques.”

## Getting in

### *Applications - what to include (2)*

#### References

- Never:** “to be supplied”!
- What those references should know about you
- How they should say it

#### Other stuff

- Selected (best) papers
- Pointers to them

## Getting in

### *Applications - what to include (2)*

References: why make us ask?

They need to be calibrated, though — you’d be amazed how many “90th percentile” applicants we get (about 90% of the applicants, in fact).

Reference writers for industry should be encouraged to say not only the good stuff I require that they tell me a little “here’s where X isn’t perfect” before I’ll believe anything they say. (Caution: academic references don’t do this — instead, they seem to go in for a particularly tricky form of unguided tea-leaf reading.)

We can forgive — but won’t forget letters that say “I think X would be a particularly fine addition to your university department” — just how well do you think this reference thought about our requirements?

It’s ok to provide copies of a couple of your outstanding papers. Also, include in your resume pointers to where they can be obtained.

Have a personal web page listing your publications — and keep it up to date!

## Getting in

### *Interviewing - What to expect*

#### Format

early on: a talk — how long?

1-on-1 sessions

meals — *everything* is a test

length: 1–2 days

#### Dress code

conservative

## Getting in

### *Interviewing*

The interview is a period of mutual admiration and assessment. Your future career rides on how well you do. Take it seriously — companies spend a lot of their energies doing an interview well.

The talk: How long? - ask, don't assume. Whatever you do, don't overrun. Expect questions. Part of your job is to manage the audience. The other is to be impressive. Cast things in ways that your audience wants, not you.

**Everything** is a test. People care about how you behave when you're not "performing", too.

Personnel or not? Probably irrelevant, but could indicate bureaucracy. ("Don't be frightened about work schedule...")

Dress: conservative; in general, expect to dress up — probably more than your interviewer. (Possible counter-example: Wall Street., where you couldn't afford it!)



## Getting in *Interviewing - What to expect*

### Adminitrivia

- ❑ “surprises”:
  - drug testing
  - NDAs
- ❑ who pays for what
- ❑ making arrangements

### When to interview

## Getting in *Interviewing*

### Adminitrivia

- drug testing — grrr ... but it happens. It's not your host's fault.
- Non-disclosure agreements (NDA): unlikely, but possible; ask for a copy ahead of time if you care
- who pays: they do; but you don't make *any* money on this—bend over backwards to be frugal/fair with their money if you can; dividing up costs between companies is fine; eat at the level you've become accustomed to, not way better (some people will have a per-diem instead); keep your receipts, and send them in with your expenses.
- who does the arrangements? ask; if you have a preference, say so

### When to interview:

- these things take time ... but not all year
- if you have deadlines, say so up front; if they arrive during the process, communicate them; if you are feeling ignored, provide a gentle prod (but if they tell you to leave them alone - do so!)

## Getting in

### *Interviewing - What to do*

#### Do your homework!

- the company: technology, financials, customer perspectives, ...
- the group: web pages, published papers
- sources: your colleagues, friends, faculty, ...

#### Who is interviewing who?

- decide what points you want to get across
- decide what you want to learn

#### Be yourself

## Getting in

### *Interviewing - What to do*

Find out everything you can about the company and the prospective work group(s).

How else will you know what you are getting into? (If nothing else, it leaves a favorable impression - as well as save time.)

Be as thorough about them as they are about you.

Q: Who is interviewing who?

A: you are both are interviewing each other.

Be yourself ... or prepare to be acting for the rest of your life!

## Getting in

### *Behavioral interviewing*

#### Concrete examples, not general trends

- ❑ “I usually get in on time”
- ✓ “Last week, I arrived before noon on 4 of 5 days - the only exception was Thursday, when I had a doctor’s appointment.”

#### Inappropriate questions

anything that is not directly job-related — politely refuse to answer

you may volunteer information, of course

## Getting in

### *Behavioral interviewing*

Getting across explicit examples rather than vague statements. make concrete what you mean by “good”. Indicate how you handle situations by using a concrete instance: “the last time that I had to handle that kind of thing, the following happened. ...”

Expect questions about more than just technical things.

Feel free to guide the interview **a little** to get across what you want to say.

**But:** inappropriate questions are those that could be used for discrimination under the civil rights laws’ Title XIII (basically: gender, age, national origin, marital status) plus - these days - sexual preference.

## Getting in

### *Interviewing - What are **we** looking for?*

#### Technical stuff

- ✓ do you know more about some thing than any of us?
- ✓ can you explain it properly?
- ✓ do you understand how to put it in context?
- ✓ do you know enough about the competition?
- ✓ can you separate “I did lots of work” from “the contribution here is ...”?
- ✓ is your evaluation technically sound?

## Getting in

### *Interviewing - What are **we** looking for?*

Expect us to be interested in more than just technical skills - working in a team often matters, too.

## Getting in

### *Interviewing - What are **we** looking for?*

#### Non-technical stuff

- ✓ maturity of self-description, grounded in common sense
  - accuracy: don't over/under sell
  - know what you don't know
  - confidence, not arrogance
  - humility, not deference
- ✓ compatibility of work style
- ✓ decent people skills
- ✓ vision of yourself in the future
- ✓ having a life

## Getting in

### *Interviewing - What are **we** looking for?*

Work out ahead of time what you care about. Be expected to be asked about this - and to be able to articulate it.

If you get turned off by something - say so. (You may save everybody a lot of time; you may simply be mistaken.)

When should you expect a decision? (Ask!)

Expect us to be interested in more than just technical skills - working in a team often matters, too.

## Getting in

### *Interviewing - What are **you** looking for?*

- What are you looking for?
- How will you know when you find it?
- Are you allergic to:  
cubicles/windowless offices/smoking/winter/...?

Beware the boss who walks on water and never makes a mistake. Save yourself a lot of grief and seek employment elsewhere.

— Townsend, p97

## Getting in

### *Interviewing - What are **you** looking for*

Work out ahead of time what you care about. Expect to be asked about this — and to be able to articulate it.

If you get turned off by something - say so. (You may save everybody a lot of time; you may simply be mistaken.)

When should you expect a decision? (Ask!)

## Wheeeee! — an offer

### (1) *The money*

#### Setting the amount

- expect to exchange (rough) info about your offers
- don't forget to include the benefits — are they guaranteed?
- one** round of negotiation is probably ok

#### Don'ts:

- don't play games
- don't try to wring out the last cent
- don't expect a raise like this every year

## Wheeeee! — an offer

### (1) *The money*

Your goal: more moolah than you know how to spend.

#### Their goals:

- not overbidding in the marketplace
- salary equity for people already on board
- room for salary growth for you once you are inside
- inadequate information about other offers
- benefits cost a company \$\$, too

My own goal: make money not the issue in the decision.

## Wheeeee! — an offer

### *(2) Benefits and bonuses*

**“Total compensation” — in addition to salary:**

- one-time sign-on bonus; relocation costs/benefits
- stock options /grants
- stock purchase plan (matching funds?)
- retirement schemes (matching funds?)
- incentive bonuses (are they guaranteed?)
- vacation time (and the rate it grows)
- health insurance
- other goodies (conference travel, company yacht, ...)

## Wheeeee! — an offer

### *(2) Benefits and bonuses*

Salary is not the only component of what you get paid. Companies go to great lengths to structure what they think are important benefits for a range of employees. As a result, the offers are often difficult to compare on salary alone.

What motivates you anyway?



## Wheeeee! — an offer

### *(3) The process*

#### Offer contingencies

- time-outs/decision dates
- background checks
- joint offers

#### Obligations

- say what else is going on
- delaying decisions: why should they? (but often done)
- verbal statements are legally binding

Take some time off **before** you start work

## Wheeeee — an offer

### *(3) The process*

Contingencies: have you ever bought a house?

Why do they impose decision dates? These people are not out to gouge you (if they are, your interviewing failed). When they make an offer, they have tied up a valuable resource - so don't tie it up for longer than needed.

Don't ever burn bridges!

If in doubt — ask!

Take a vacation. You've earned it. You'll likely not have as much time available to you in one lump for quite some time.

## Once you are in

### *What's it like to work here? - Start-up phase*

#### Getting up to speed

- expect to be in heavy learning mode at first  
expect your colleagues to know more than you do
- consider a start-up project

#### Say if you have a preferred learning/working mode

#### Get feedback on your performance

#### Find a mentor

## Once you are in

### *What's it like to work here? - Start-up*

Expect a transition: technical, cultural, and social. Many people find this harder than they expect.

Start-up projects may be a good way to get acclimated easily/quickly.

If you prefer to work a particular way (tossed in at the deep end; guided introduction; freedom from distraction; multiple concurrent projects) - say so, early.

Provide (constructive) feedback as soon as you can - don't assume the worst. Limit your criticisms of the project - try to start by assuming that they are right after all.

Seek out a transition mentor, if you can — somebody who can treat you as a peer rather than a boss, and guide you through the intricacies, act as a sounding board, and interpret the corporate entrails.

## Once you are in *Common misconceptions*

### I get told what to do [yet academics have complete freedom to do what they want]

- don't expect to be given the company jewels on day 1
- do expect to be able to earn freedom to make choices do so by demonstrating the value of giving it to you
- don't wait to be told

### The organization hierarchy is everything

- who can you approach ("open door" policies)?
- peers matter more than bosses (usually)

## Once you are in *Common misconceptions*

Academics pay a high price for their "freedom" — they've got a lot of people to keep happy ...

HP often institutionalizes promotion behavior as "we'll think about promoting somebody once they are already doing [most of] the job".

Try to think/act like you are your boss - what would they want done here?

Organizational imperatives do matter — but every organization is different. Some people enjoy a relatively flexible, open workplace (HP); some people prefer a more rigidly structured one. Neither is necessarily "better".

What would happen if you went to talk to your boss's boss? In HP — something I expect to be able to do whenever I have something suitably valuable to say. In other cases — the kiss of death. Similarly: how are grievances aired?

Titles: may be meaningful or irrelevant. Your peers (both inside and outside your immediate group) usually matter much more than your management chain; expect to [have to] cut across organizational boundaries.

## Once you are in *Common misconceptions*

### PhDs are really worth something

- “it’s only a PhD” — just a license to get started
- “I won’t hold against you the fact that you have a PhD as long as you keep doing good work”
- what have you done for me lately?
- in HP, PhD’s success is bimodal

## Once you are in *Common misconceptions*

A PhD demonstrates only that you have managed to achieve a single piece of original research — not that you are certified to walk on water.

What do you think the people who graduated a few years ago with PhDs have been doing in the meantime?

In HP, “PhD” is only put on business cards in the UK, or if you are a consultant in the US.

In HP, PhDs are either very successful or abject failures. There seems to be a correlation between success and humility (aka willingness to learn).

**Once you are in**  
*Common misconceptions*

**I can always finish writing up in my spare time**

**Once you are in**  
*Common misconceptions*

**Don't ever try to finish your thesis while holding down a new full-time job.**

**Ever.**

## Once you are in *What's it like to work here?*

### Teamwork

- ❑ goal is to accomplish things, not show off
- ❑ ego-less programming/coding — humility helps

### Communication skills

- ❑ the more you know, the more examples you can draw on to communicate your ideas
- ❑ get things across in their terms, not yours
- ❑ don't try to score points
- ❑ build on knowledge — emphasize differences

## Once you are in *What's it like to work here?*

Things that occupy my day include:

- talking to people in my group;
- informal design discussions;
- semi-formal design reviews/walk-throughs;
- writing /attending talks;
- reading papers;
- attending/giving reviews;
- assisting with knotty technical and non-technical questions;
- helping out my boss, my peers, my team, other teams, students, ...

## Once you are in *Who decides what?*

### Who decides what

- how? when?

### Funding models - get to know yours

- central, independent (HP Labs)
- customer funded (SRI)
- mixture (IBM Yorktown)

### Who *are* your customers?

## Once you are in *Who decides what?*

Learn how decisions are really made. (It may not be obvious from the organization chart). Is there an annual budgeting cycle? Who participates? What about other times of year? How big a decision is made at what level?

Where does the money come from? Who influences this? (Does the customer get a say — if so, which customers? how?)

## Once you are in *How are you doing?*

### Evaluations

- regular evaluations
- calibration (ranking)

### Pay system

- annual raises are typical
- linkage to evaluation

## Once you are in *How are you doing?*

Understand the processes by which your work is evaluated and your pay gets calculated.

In HP:

- manager does yearly evaluation (exception: two in 1st year)
- cross-manager calibrations via yearly “ranking” when all the managers for a lab get together
- ranking sets position on pay scale
- position on pay scale sets salary/raises

If you are ranked on product transfers, and want more pay — then do more product transfers :-)

There's no need for this to be secretive.



## Summer students

### *A few additional considerations*

#### Why does industry hire summer interns?

1. long-term hiring process
2. short-term slave labor

#### How does industry hire summer students?

- Fixed assignment to group, or floating until arrival
- Full and part-time; telecommuting
- Just summer, or all year round

#### When should you do this? (not whether!)

## Summer students

### *A few additional considerations*

Typically there are two hiring goals. They can overlap, of course. And slave labor can be rewarding for both sides, too.

2 sample hiring processes:

- HP: individual managers.
- DEC SRC: a central pool.

Consider doing this:

- to build your skills, and learn how to do research in the “real world”
- to get exposure to different styles of research work
- to explore industry
- every summer

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