A Doctorate and Beyond: Building a Career in Engineering and the Physical Sciences

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“A Doctorate and Beyond”
by
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## The Book has Four Parts

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Today’s Talk will Focus on Parts I, II, and III

• Book is intended to support you throughout your career.
• Raises questions to think about rather than necessarily providing answers.
• Everybody’s circumstances are different.
I. Choosing whether or not to do a Doctorate

II. Doing a Doctorate

III. Using a Doctorate: The Early Years
Four Reasons for doing a Doctorate

1. Your career needs a doctoral qualification (e.g. Academic).
2. You are fascinated by a particular field of Engineering or Sciences.
3. You love Science / Maths / Engineering (Fermat’s Last Theorem).
4. You want to achieve the highest possible qualification (Roger Davies).

( in my case 3 + 4)
• Research is the ultimate expression of one’s self.

• Like Painting or Composing Music
I can't decide if I want to be an artist or do a PhD.
“Live as if you were to die tomorrow. Learn as if you were to live for ever.”
Things to think about if you decide to do a PhD

• Where to do it?
  • Is the institution research orientated: facilities / high profile staff / enthusiasm?

• Who should be your supervisor?
  • Make sure the person is research able - grants / publications.

• What topic?
  • One that interests your supervisor
  • One that interests you
  • One that is “hot”
  • A combination!
“The only way to do great work is to love what you do. If you haven’t found it yet, keep looking. Don’t settle.”

- Steve Jobs’ 2005 Stanford University commencement speech.
Outline

I. Choosing whether or not to do a Doctorate

II. Doing a Doctorate

III. Using a Doctorate: The Early Years
How hard will you have to work?

- 50 to 60 hours per week.
\[ \frac{\partial}{\partial t} (\rho u) + \nabla \cdot (\rho u \otimes u + pI) = \nabla \cdot \tau + \rho g \]
How does one work?

• Work smarter not harder
• Avoid mission creep
• Be focused
• Set achievable goals
• Balancing work, life and thesis
S.M.A.R.T.E.R. Goals

• Specific
• Measurable
• Achievable
• Results-focused
• Time-bounded
• Ethical
• Recordable
Nonlinear Progress
Professor Brian May
Imperial College London
• Took over 20 years to complete a doctorate.

• Successful career as Astrophysicist and Chancellor of a University.
Brian May - Queen Guitarist
Brian May

• “I think it’s about belief..., well, about having a clear vision of where you want to be, and believing in it.
• Sometimes you have to doggedly press on, in the face of what seems like an impossibility.”
Doing a Doctorate Part Time
Disadvantages

• It’s going to be difficult!

• Very hard to simultaneously satisfy your supervisor and boss at work.

• Different requirements
  • Research - looking for elegance and novelty.
  • Industry - looking for solutions that solve a problem.
Doing a Doctorate Part Time

Advantages

• Real world motivation.

• “The extended interview”

• Highly desirable if industry supports the work!
“Concurrently satisfying the demands of both my industrial position and those of my doctoral studies was the biggest challenge of my life! The industrial position required a different mind-set, even a different form of dialogue. The industrial position required rapid response to evolving events whilst the doctoral studies required a long term vision. The necessity of switching between these two roles was very demanding. I would caution others from taking this route unless it is necessary.

However, I want to stress that I would do it all again in a heartbeat. It was certainly challenging but also hugely rewarding. It completely changed my life.”
Student / Supervisor Interactions

• The supervisor's job is to lob a well placed ball (i.e., an idea) over the net. The student's job is to hit it back harder than it arrived (i.e., to amplify the idea).

• Students need to choose if they want exponential growth or decay to occur in the interplay with their supervisor.

• Most importantly, be passionate about what you do and your supervisor will respond in kind.
When a difficulty is encountered:

• An average student goes to the supervisor and says: “I need help.”

• A good student goes to the supervisor and says: “I have encountered a problem but I see ten ways around it. What do you suggest?”

• A very good student goes to the supervisor and says: “I have encountered a problem and I see ten ways around it. However, I think option 4 is best and I will look into it.”

• An excellent student goes to the supervisor and says: “I have encountered a problem and see ten ways around it. I think that option 4 is best and will look into it. Moreover, I feel this solution has much broader implications. Thus, I am keen to revisit other problems I have encountered.”
Publications, advantages of writing papers include:

- Building confidence.
- Establishing additional evidence that you are generating innovative results.
- Giving exposure to your work.
- Helping generate a strong Curriculum Vitae which can be crucial in gaining employment after completing your thesis.
- Providing a catalyst for networking.
Take time writing the paper! A great idea can be destroyed by a poorly written paper.

• Carefully decide what it is you want to claim in the paper.
• Say how others have approached the problem.
• Clearly state your “killer idea”.
• Prove, or illustrate, the idea as clearly as possible.
• Summarize the result clearly.
• In some cases, writing a great paper can take almost as much time as doing the research in the first place!

• Ask a colleague (or preferably a joint author) to sit with you while you explain the concept of the paper in three minutes.
Rejection

• Inevitably papers get rejected.
• Two Choices:
  (a) Fall back and regroup
  (b) Get angry (some careers destroyed!)
My Story

• 1978 write a paper.
• Four reviews - all **VERY** negative.
• Regrouped.
• Resubmit.
• Ultimately chosen as one of the top 25 papers in Systems and Control in the 2\textsuperscript{nd} half of C\textsuperscript{20}.
I. Choosing whether or not to do a Doctorate

II. Doing a Doctorate

III. Using a Doctorate: The Early Years
1. How to apply for a job
2. The value of networking
3. Making great presentations
4. How to apply for a grant
5. The cycle of success
6. Goals, values and feelings
7. Some final thoughts
• If you aim too high, then you may fail but, if you aim too low, you may have already failed.

• Success depends on being extremely courageous but never so much that it leads to injury.
The Job Interview

• Dress neatly
• Be on time
• Do your homework so you know about the organization
• Think about possible questions and have clear and unambiguous answers ready
• Do not over- or under-sell yourself
• Be direct and firm in your approach
• Never use sexist or racist language
I'm so sorry I'm late for the interview, but I couldn't find your 2nd rate lab, even with my superior intellect. What do you chicks research here anyway?
Remember

You don’t get a second chance to make a good first impression.
1. How to apply for a job
2. The value of networking
3. Making great presentations
4. How to apply for a grant
5. The cycle of success
6. Goals, values and feelings
7. Some final thoughts
The value you will derive from networking in the early years include

• Exchanging tricks and ideas
• Helping you solve research and other problems
• Moral support
• Hints on literature
• Contacts for employment
• Possible postdoctoral opportunities
As your career matures, these same networks will help you with

• Research collaborations
• Grant collaborations
• Sabbatical
• Book opportunities
1. How to apply for a job
2. The value of networking
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In all work environments (government, industry, university, consulting), securing adequate resources for your work is crucial to your success.

Success requires that you make a great presentation.
Many Formats

• The elevator pitch
• The “board room” pitch
• Conference presentations
The Elevator Pitch

- You should practice getting your core message over in 1 to 3 minutes.
- It’s a valuable tool, even for yourself, to make sure you know your topic well enough to be able to summarize it in 3 minutes.
Stefan Graebe

• Taught me the value of 3 minutes.

• “Graham, you have just 3 minutes - tell me about…”

• He became CFO of OMV oil.
  • ($40 Billion turn-over company)
Briefing notes can be structured with headings such as

- Background
- The opportunity
- Other groups
- Our strategic advantage
- What we can deliver
- Benefits
- What we are seeking from you today
Conference Presentations

• So many people make a mess of this
• Have a central theme (core idea)
• Be clear and precise
• Talk to and not at your audience
• Don’t use Power Point as a crutch
Toastmaster’s Recommendations

- Tell them what you plan to say
- Tell them
- Tell them what you have said
I'm going to say it.

There, I said it.

It.

I did it! Once. Almost...

Was that it?

Couldn't have said it better.

Now I get it!
1. How to apply for a job
2. The value of networking
3. Making great presentations
4. How to apply for a grant
5. The cycle of success
6. Goals, values and feelings
7. Some final thoughts
Why is funding important?

• If you end up working in academia (or industry) then applying for grants (funding) will be one of your key activities.

• Success or failure with great applications can influence your entire career.

• The Golden Rule (The people who have the gold make the rules).
The Structure of Grant Application

Tips for writing a grant application

i. Describe the broad problem you wish to study (Aims)

ii. Explain how it is being done now (Background)

iii. Explain your “killer” new idea (Technical Details)

iv. Discuss who will benefit from your ideas and why (Impact)

v. Describe the steps needed to reach your goals (Methodology and Timetable)
Topics

1. How to apply for a job
2. The value of networking
3. Making great presentations
4. How to apply for a grant
5. The cycle of success
6. Goals, values and feelings
7. Some final thoughts
Leadership

Skills / Resources

Position / Reputation
• Note that it is impossible to remain in steady state
• Your cycle of success either
  • Goes upwards, or
  • Downwards
• Choose carefully
1. How to apply for a job
2. The value of networking
3. Making great presentations
4. How to apply for a grant
5. The cycle of success
6. Goals, values and feelings
7. Some final thoughts
• You must have a long term goal
• Have high values
• Believe in what you are doing!
• Enjoy your work and life
David Mayne
1. How to apply for a job
2. The value of networking
3. Making great presentations
4. How to apply for a grant
5. The cycle of success
6. Goals, values and feelings
7. Some final thoughts
Work Hard
- but maintain a healthy life balance

“Man stand for long time with mouth open before roast duck flies in”

Chinese wisdom!
I CAN'T DECIDE IF I WANT TO BE AN ARTIST OR DO A PHD.

I DID IT! I ENDUP DOING A PHD AND BECOMING AN ARTIST. LIFE IS GOOD.
Thank you
A Personal Career Highlight