

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

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A Doctorate and Beyond

Building a Career in
Engineering and
the Physical Sciences

Illustrations by Adam Sandford

 Springer

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“A Doctorate and Beyond”
by
G.C. Goodwin and S.F. Graebe
Illustrations by Adam Sandford
Springer Nature 2017

The Book has Four Parts

Part I: Choosing whether or not to do a Doctorate

Part II: Doing a Doctorate

Part III: Using a Doctorate: The Early Years

Part IV: Using a Doctorate: The Later Years

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

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- Book is intended to support you throughout your career.
- Raises questions to think about rather than necessarily providing answers.
- Everybody's circumstances are different.

Outline

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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

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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).

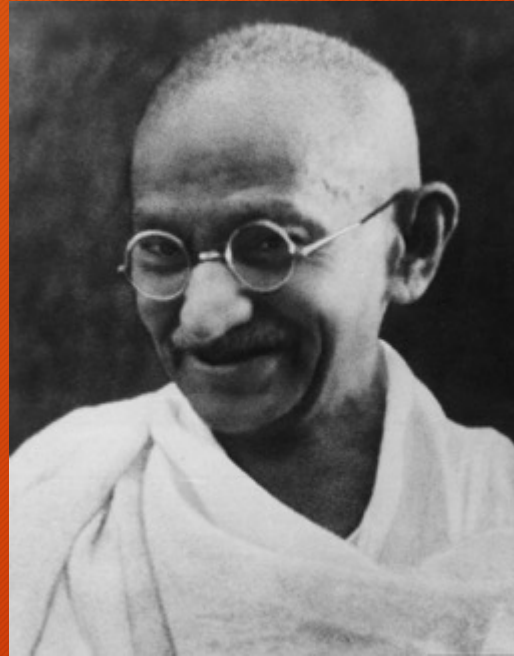
(in my case 3 + 4)

- Research is the ultimate expression of one's self.
- Like Painting or Composing Music



Mahatma Gandhi

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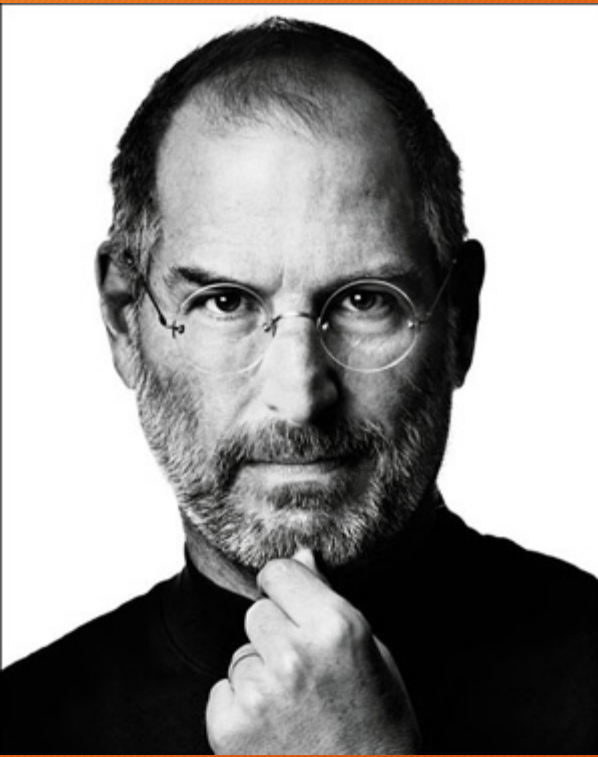
“Live as if you were to die tomorrow. Learn as if you were to live for ever.”

Things to think about if you decide to do a PhD

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- 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!

Steve



Co-founder and former
CEO of Apple



“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

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I. Choosing whether or not to do a Doctorate



II. Doing a Doctorate

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How hard will you have to work?

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Very!

- 50 to 60 hours per week.



How does one work?

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- Work smarter not harder
- Avoid mission creep
- Be focused
- Set achievable goals
- Balancing work, life and thesis

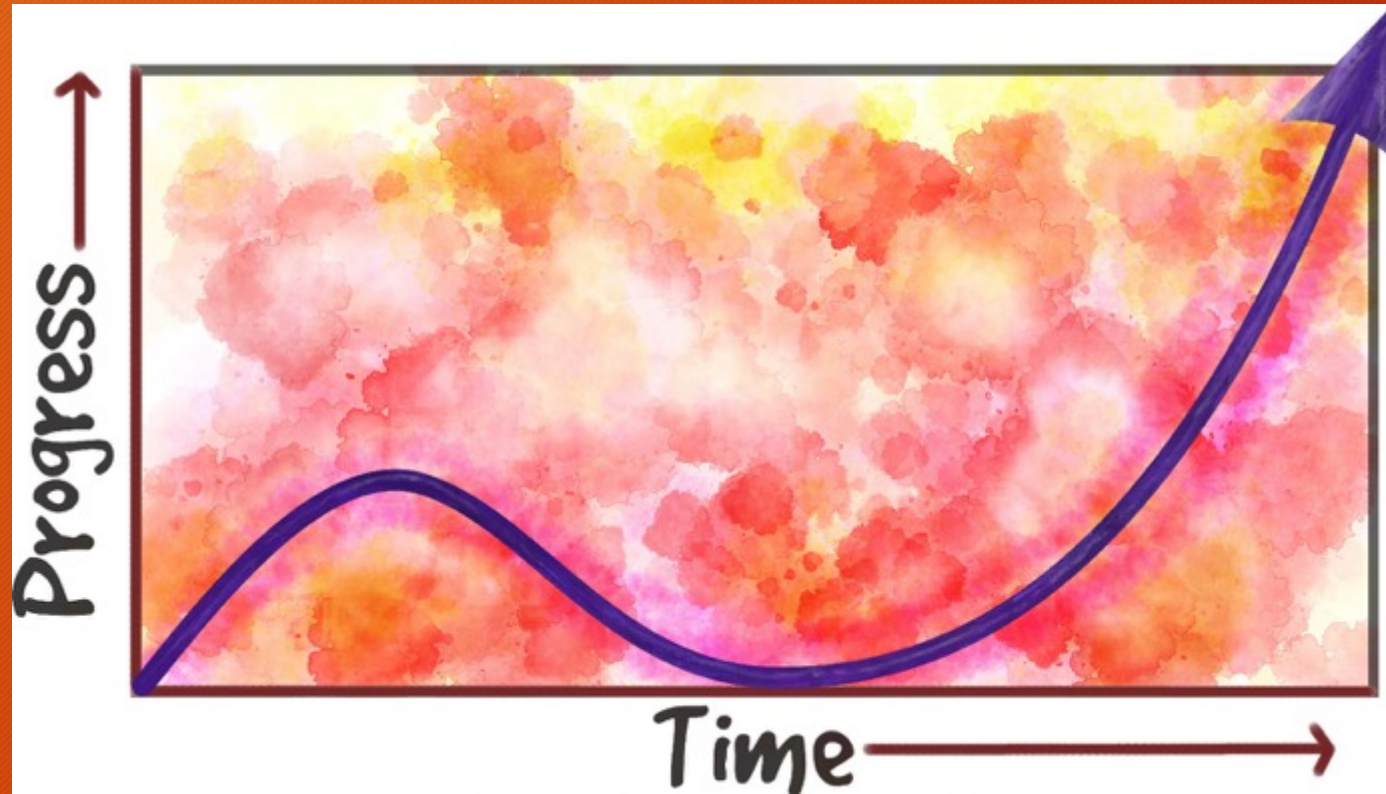
S.M.A.R.T.E.R. Goals

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- Specific
- Measurable
- Achievable
- Results - focused
- Time - bounded
- Ethical
- Recordable

Nonlinear Progress

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Professor Brian May Imperial College London

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- Took over 20 years to complete a doctorate.
- Successful career as Astrophysicist and Chancellor of a University.

Brian May - Queen Guitarist

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Brian May

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- “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

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- 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

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- Real world motivation.
- “The extended interview”
- Highly desirable if industry supports the work!

Raheleh Nazari

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- “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

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- 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:

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- 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:

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- 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.

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- 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

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- 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 2nd half of C²⁰.

Outline

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I. Choosing whether or not to do a Doctorate

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Topics

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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

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- 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



Remember

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You don't get a second chance to make
a good first impression.

Topics

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- 2. The value of networking
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The value you will derive from networking in the early years include

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- 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

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- Research collaborations
- Grant collaborations
- Sabbatical
- Book opportunities

Topics

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-  3. Making great presentations
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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



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- 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)

The Board Room Pitch - Be Prepared!

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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

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- 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

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- Tell them what you plan to say
- Tell them
- Tell them what you have said



I'M GOING TO SAY IT.

IT.

THERE, I SAID IT.

COULDN'T HAVE SAID IT BETTER.


WAS THAT IT?

NOW I GET IT!

I DID IT!
ONCE.
ALMOST...

Topics

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-  4. How to apply for a grant
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Why is funding important?

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- 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


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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

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- Note that it is impossible to remain in steady state
- Your cycle of success either
 - Goes upwards, or
 - Downwards
- Choose carefully



Topics

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- You must have a long term goal
- Have high values
- Believe in what you are doing!
- Enjoy your work and life

David Mayne



Topics

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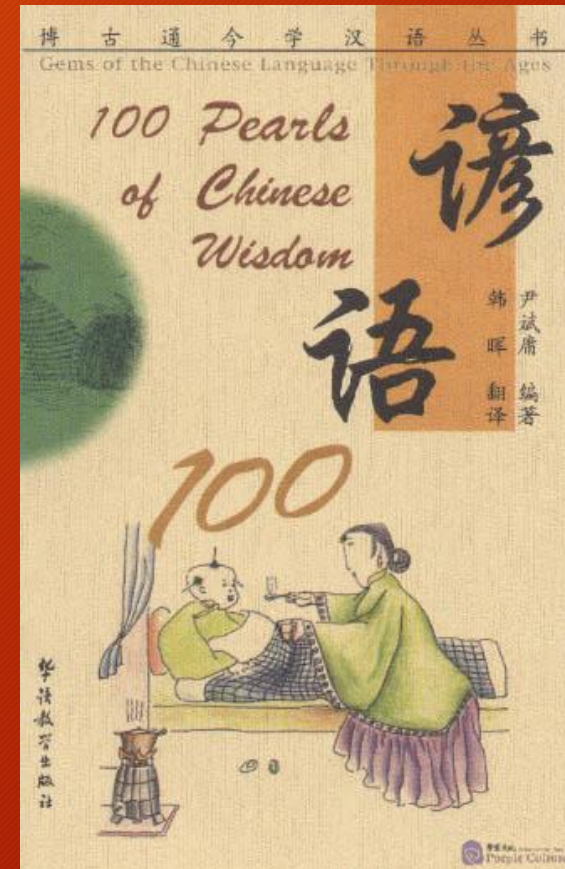
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Work Hard
- but maintain a healthy life balance

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





Thank

you



A Personal Career Highlight

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