Overview

– My Group
  (a bit of background)

– PhD Supervision Approach
  (team supervision)

– Planning A PhD Project
  (strategy to maximise publications)

– Stages of a PhD
  (systematic approach)

– Epilogue: Whitesides Group: Writing a Paper
  (everything you do should be writing a paper)
My Group: The Microplatforms Research Group (MRG)

• The MRG evolved from my own research projects and interests/funded projects
• Currently >50 people (!), including
  • 5 Academic staff
  • 10 Research Fellows
    (5 competitive ARC Fellows, DECRA, APD)
  • >30 PhD students
    (I am first supervisor of about 14 PhDs ...)
  • About 5-10 research assistants/interns/honours ...
• Such a big group needs some structure ...
  (how do we stop PhD students getting ‘lost’?)
Previous Approach (pre 2009)

• One-on-one Student Supervision
  • Senior supervisor driven
  • Limited roles for ECRs
  • Fairly egalitarian: a team of peers
  • Large number of students = large number of meetings! (Exhausting!)

• What happens if a large number of students want to work in one research area?

• What if a number of researchers in the area are early career researchers?
New approach

• The team defined ourselves (and defined our research foci)

• Microplatforms Research Group Teams
  • Integrated optics
  • Photonic Signal Processing
  • Lab-on-a-chip
  • Functional materials and microsystems
  • Electromagnetics and Metamaterials
  • ‘Liquid Metal Marbles’ (new in 2012)

• Microelectronics & Materials Technology Centre
  • Affiliated enabling facility but distinct culture
Composition of a-sub group (eg: Integrated Optics Group)

- Group Leader: An ECR researcher (Dr Thach Nguyen, APD)
- MRG Director (Me)
- 1-2 post-doctoral fellows who are involved
- 3-5 PhD students
- 2-3 Honours students
- 1-2 Visiting researchers/interns
- Total: About 10 people.
Sub-Group Definition

• Each Sub-group has:
  • A mission statement *(defined by the original group)*
  • Several funded projects *(providing support and direction)*
  • A physical laboratory *(managed by ECR team leader)*

• New projects are aligned
  • New project proposals align to mission
  • New PhD projects align to funded projects

• Prevent PhD being ‘out on their own’

• Ensure PhDs are at the ‘frontier’ *(can publish)*

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Supervision Approach: Team Supervision

• Fortnightly sub-group meetings
  • 2 hours per fortnight for each sub-group
    − Equates to about 10-12 hours per fortnight for Director (me)
  • Involves all students in that sub-group
  • Supervisory team group leader and ECRs
  • Senior supervisor provides broad direction (Producer)
  • ECR provides daily point of contact, ‘hands on’ support (Director)
• Ensures a more interactive exchange of ideas
  − Team members with different levels of experience
  − New research questions and solutions

• Every other week is reserved for ad-hoc dedicated meetings
  − Often for planning and executing papers
Team Supervision Downsides

• Weekly sub-group meetings has negatives
  • Student may feel lack of personalised attention
  • Hesitancy to ask questions in presence of a group
  • Many others ... (it is not perfect!)

• Additional one-on-one meetings
  • Tackle negatives encourage separate one-off meetings
    (but must have defined outcome)
  • Modified supervisory approach allows time for this
  • Such meetings also required when defining new projects and finalising publications
PhD Project Strategy
Planning a PhD project: Overview

• Fundamental premise:
  – A PhD = 4 Publications (or so)
  – Publications comes 1\textsuperscript{st}, thesis comes later
    (it is easy to turn a paper into a chapter, it is hard to do the reverse)

• Year 1:
  – Prescriptive

• Year 2:
  – Independent exploration

• Year 3:
  – Consolidation
Year 1: Confirmation of Candidature

• Define the Project:
  • Use Confirmation of Candidature form as a guide
  • Identify 4 research questions
    – Each question should be general, but deep
      (an answer should constitute at publication)
  • Identify the ‘frontier’ for each research question
    – What key recent research paper relates to each question?
      (your literature survey is not a tutorial!!)
    – What small step will be taken beyond the frontier?
      (this is a proposal for research leading to a paper)
• At the end of Year 1, student should present CoC
  (will likely include material from 1st Paper to show capability)
Year 1: The First Publication

• In Year 1 the supervisors prescribe the first paper for a PhD student (this is essentially an ‘apprenticeship’)
  • This will give the student
    – Practice in actually doing research
    – Familiarity with the tools they will need
    – Understanding of how to write a paper
    – Understanding of how to publish paper
  • The first paper should, to some extent answer your first research question (hence first question = low risk)
    – Understand how general research questions turn into specific publication outcomes
• Question 1: is prescribed by the supervisor team (very safe)
• Question 2 & 3: incremental extensions to the frontier (medium risk)
• Question 4: wild idea (high risk)
Year 2: Explore ...

- Year 2: Student demonstrates independence
  (This is this is their project)

- Go exploring
  - Pursue their other 3 research questions
  - Follow their own path ...
  - Get ‘lost’ in the wilderness ...

- Supervisory team provides broad guidance
  (but is not prescriptive ... )
At the end of Year 2

• End of year 2, student should have
  • Partial answers to research questions 2 and 3
  • Material for 1 or 2 more papers
  • New appreciation for what their project is really about

• You could be quite lost at this stage though ...
Year 3: Consolidation

• Year 3, the supervisory team returns
  • Ensure that at least 3 of the research questions have some sort of answer
  • Help finalise the partial papers
  • If lost in the woods ... help find the way home

• In Year 3, the thesis should also be prepared ...
Year 3: Consolidation

• Preparing the thesis:
  (1 Thesis = 3 or 4 Journal articles)
  • If student has published 3-4 papers, no question that they have made a contribution to the field (assessor does not need to assess worthiness)
  • Very easy to turn a journal article into a thesis chapter (much harder to turn a chapter into an article)
• publication is not optional!
• Never say: ‘I don’t have time to write a paper, I have to get on with writing my thesis ...’ (they are the same thing!)
Conclusions/Summary

• Ensure work is really at the frontier ahead of time
  – use CoC to ensure Frontier well defined
    (and proposed work builds directly on this)

• Publish early, publish often!
  • Ensure one paper comes out early
    (Prescribe a publication in Year 1)

• Free exploration is important
  (take a step back in Year 2 ...)

• PhD thesis = a few papers
  • Make student’s life easy
  • Make examiners job easy

• Note: Nothing goes according to plan ...
Epilogue: Ensure **everything you do** is a paper

- George Whitesides, Harvard
  (1123 papers, **108,530** citations, h-index: 127)
Epilogue: Ensure **everything you do** is a paper

- Can we do what Whitesides does? (he has written a paper on writing papers!)

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Whitesides’ Group: Writing a Paper**

By George M. Whitesides*

1. What is a Scientific Paper?

A paper is an organized description of hypotheses, data and conclusions, intended to instruct the reader. Papers are a central part of research. If your research does not generate papers, it might just as well not have been done. “Interesting and unpublished” is equivalent to “non-existent”.

Realize that your objective in research is to formulate and test hypotheses, to draw conclusions from these tests, and to teach these conclusions to others. Your objective is not to “collect data”.

For this reason, a paper does not have to communicate all of your research. It should only cover the most important results and conclusions. If this means that you have to omit a lot of work, so be it.

do **not** agree on the outline, any text is useless. Much of the time in writing a paper goes into the text; most of the thought goes into the organization of the data and into the analysis. It can be relatively efficient in time to go through several (even many) cycles of an outline before beginning to write text; writing many versions of the full text of a paper is slow.

All writing that I do—papers, reports, proposals (and, of course, slides for seminars)—I do from outlines. I urge you to learn how to use them as well.

*Adv. Mater. 2004, 16, No. 15, August 4

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Epilogue: Ensure **everything you do** is a paper

• Choice Quote:
  
  ‘If your research does not generate papers, it might just as well not have been done. “Interesting and unpublished” is equivalent to “non-existent”’

• My Take
  
  – Outlines are critical (*prior to text*)
  
  – As soon as you/your students have an idea sketch a paper outline (*what data is needed?*)
  
  – Discuss and agree on this outline with your co-authors
  
  – Get the data
  
  – Re-organise the outline depending on data (*make sure everyone agrees at this outline stage*)
  
  – Finalise the figures, tables & graphs to ‘tell the story’
  
  – Then (*and only then*) start writing the text