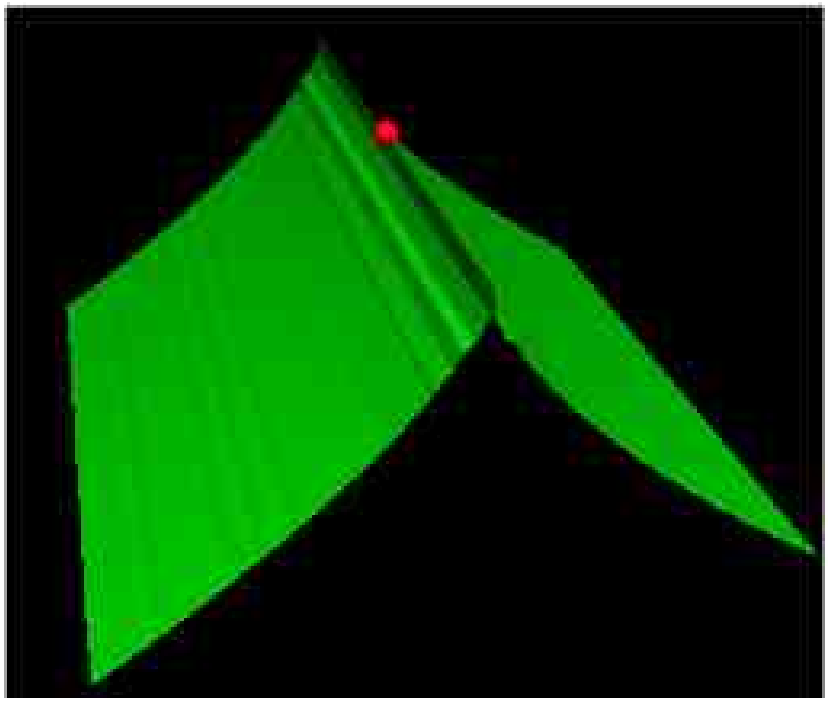
What happens beyond your undergrad degree? ... or... Should I go to grad school?

U. of Edinburgh, School of Maths

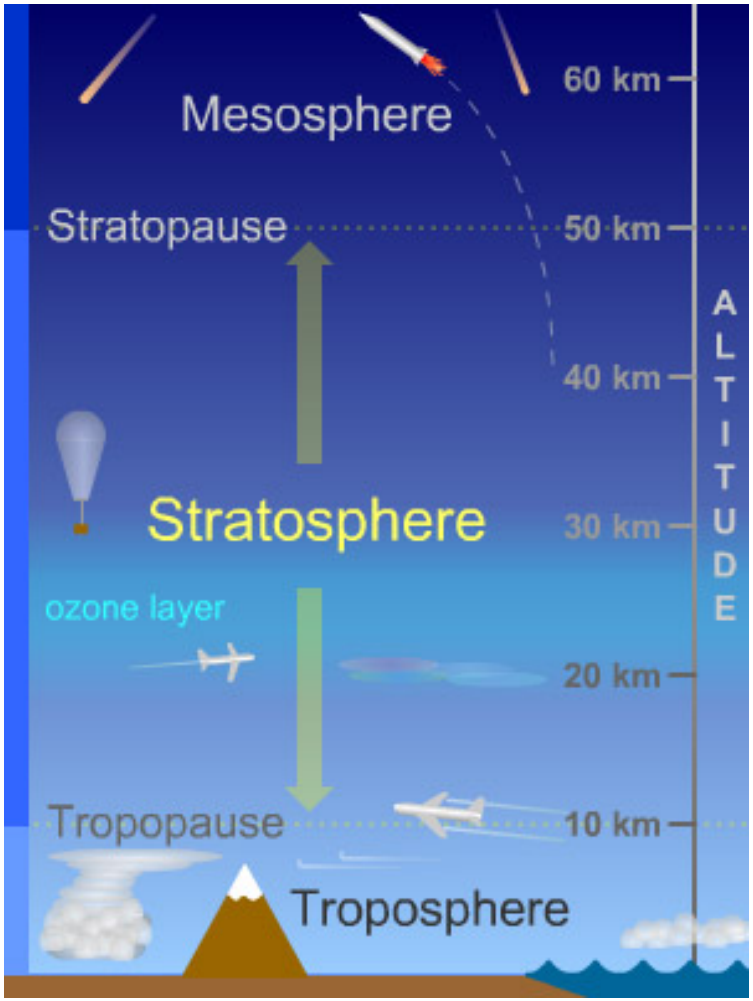
Agenda:

- Who we are
- What is a PhD
- PhD in the UK
- PhD in the US
- Life after a PhD: industry, academia, teaching colleges (US)
- Vocabulary – words to google
- Your questions: 5 min general audience questions, then 45 min informal discussion.

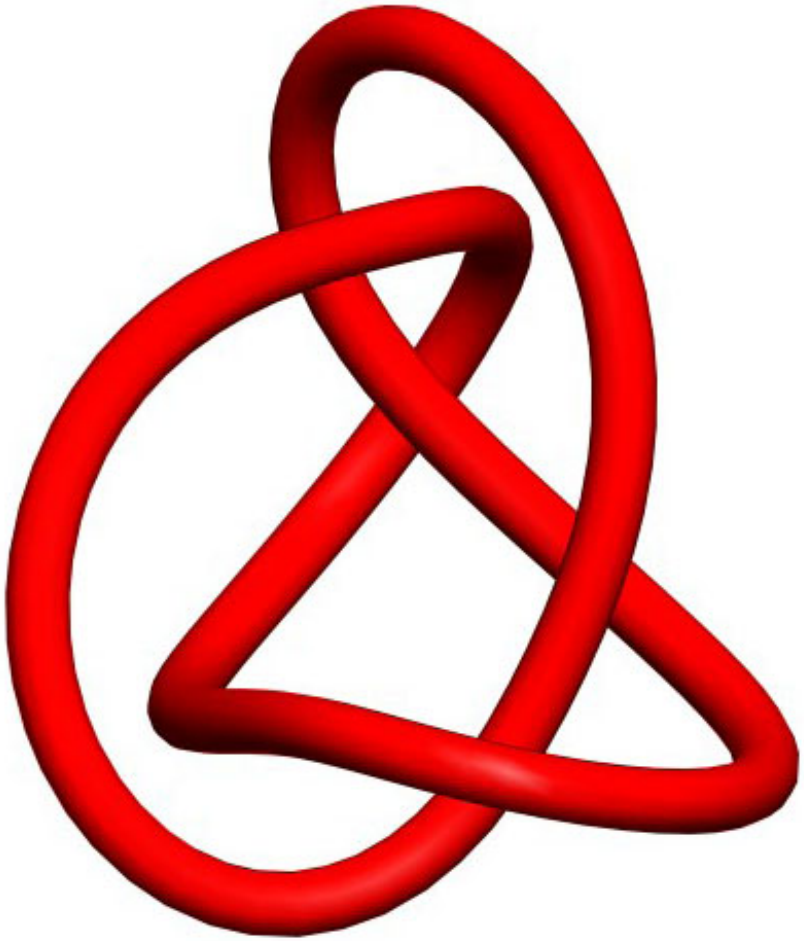
Let us introduce ourselves!



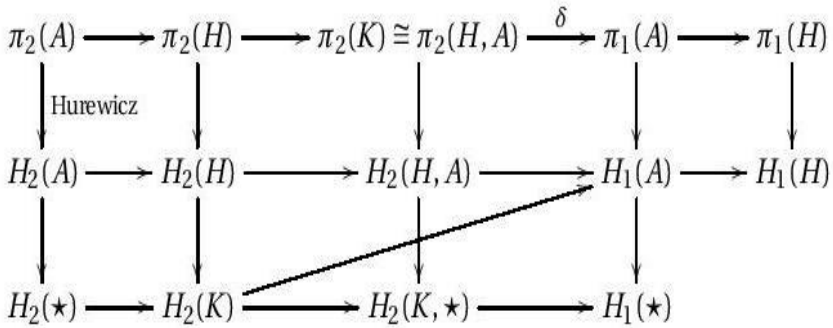
Dr. Sue Sierra
Lecturer
School of Maths, University of Edinburgh



Dr. Lyuba Chumakova
Whittaker research fellow
School of Maths, UoE



Dr. Julia Collins
Mathematics Engagement Officer
School of Maths, UoE



Dr. Pamela Docherty
Student Learning Advisor
School of Maths, UoE

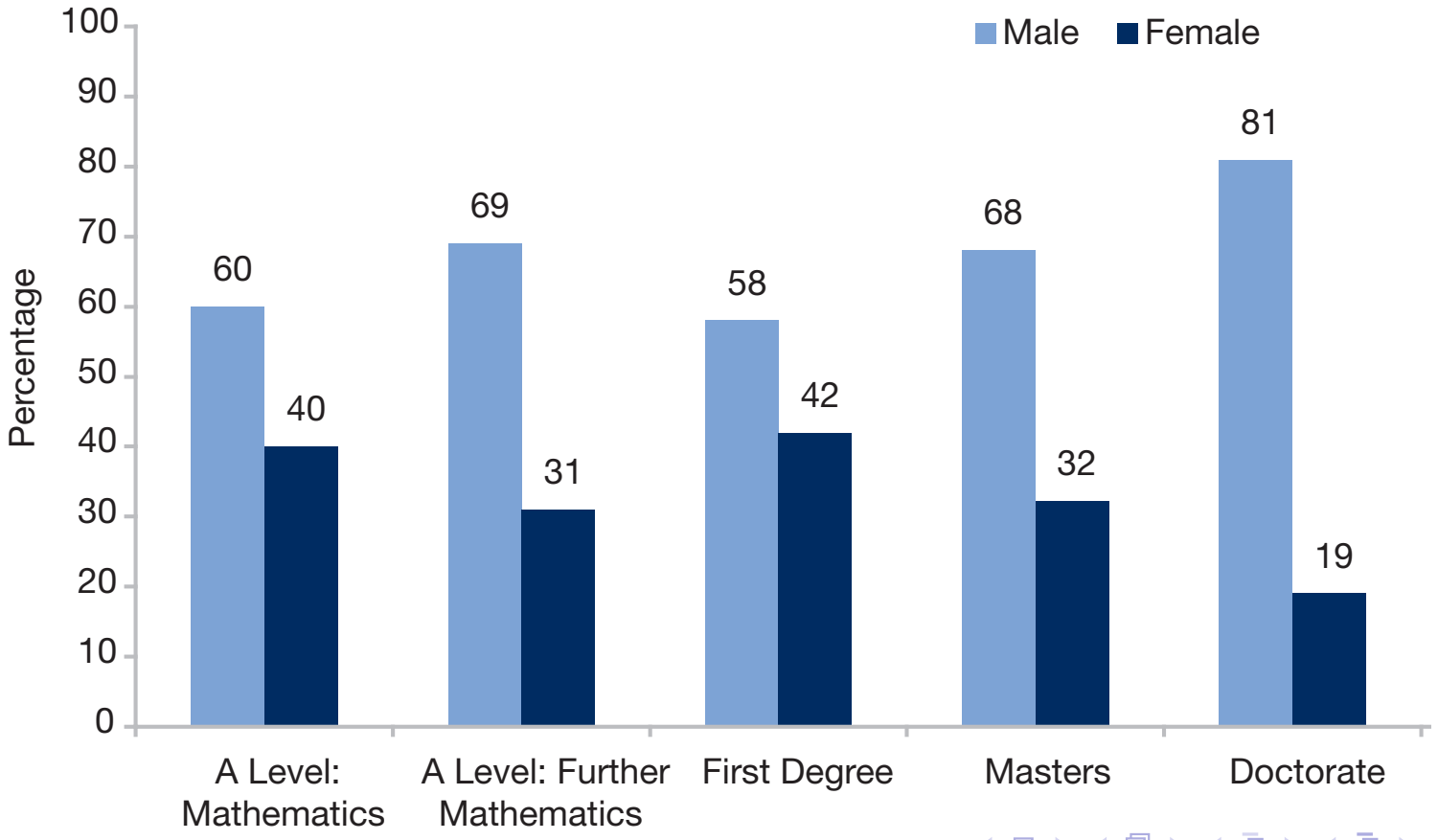
Karen Ogilvie
3rd Year PhD student
School of Maths, UoE

What happens during PhD?

What happens during a PhD?

- getting paid for doing what you like – research maths (or informatics, or physics)
- research = discover or invent new mathematics (or science)
- getting specialized in an area of science that you like
- learn how to think independently, do research, set up interesting problems for yourself, learn how to present your work (publish, conferences, talks)
- best time of your life

Why are we having this meeting?



PhD Life

- Mostly do research of your own particular interest!
- Reading/discussion groups
- Attend conferences/meetings
- Meet/collaborate with other people in your field (or outwith!)
- Teaching

PhD in the UK:

How to apply

Choosing a supervisor

Choosing a university

PhD in the UK – Overview

- Length: 3-4 years
- Entrance level at top unis: First class or good 2:1 degree plus an MSc or MMath
- Start time: Sept & January are traditional; some unis let you start any time
- Apply: 6 months before your start date
- Supervisor: named already on application form; can switch in Y1
- Structure: Take courses in Y1, then focus on research
- Completion: thesis + oral exam (viva) with two examiners
- Funding: 13,863 standard; may vary

PhD in the UK - Application process

- Choose a research area, then choose a supervisor.
- (Recommended) Email potential supervisors to see if they want new students and to ask about research topics.
- Visit web pages of relevant unis to find out application details & deadlines.
- Usually apply by Jan, Feb or March for September start.
- You will need:
  - Degree transcript (or certificate)
  - At least two referees
  - Research proposal
  - CV
- You will be invited for interview. Read up on your chosen topic & revise final year courses!

PhD in the UK - Choosing where to go (supervisors)

- Choose potential supervisors first - they are the most important factor in getting through a PhD. Get recommendations from current lecturers of who is interesting/good to work with.
- Email/Skype them: does their research sound interesting? Do they sound friendly?
- Ask to contact current/former students of your potential supervisor. What supervision style does the person have?
- How many students have completed?
- How many students does the supervisor currently have?
- How big/active is the research group? The bigger the better!

PhD in the UK - Choosing where to go (university)

- Does the university have a CDT in your chosen area?
- What (moral) support will the uni provide?
- What training opportunities does the uni provide, re teaching, transferable skills courses?
- What funding opportunities are there? Scholarships? Extra teaching? Travel grants?
- What facilities are there? E.g. office space, IT support, library, common room.
- Is the uni near to other good unis?
- Do you like the city/town enough to spend 4 years there?

Words to google for – UK and EU

- **WISE** (Women In Science and Engineering)
- **EPSRC studentships** (Engineering and Physical Sciences Research Council) (http://www.epsrc.ac.uk/skills/students/)
- **CDT** (Centres for Doctoral Training) (http://www.epsrc.ac.uk/skills/students/centres/current/)
- **EURAXESS** (EU-funded PhD positions in several EU member states, often project-specific) (http://ec.europa.eu/euraxess/index.cfm/jobs/index)
  - it's a pathway to phd positions in several countries in Europe,
  - the salary is often very good, for EU standards,
  - way to do get familiar with the horrible machinery of EU funding as soon as possible! It's a skill of growing importance in a possible subsequent academic career,
  - math-bio people often advertise here.

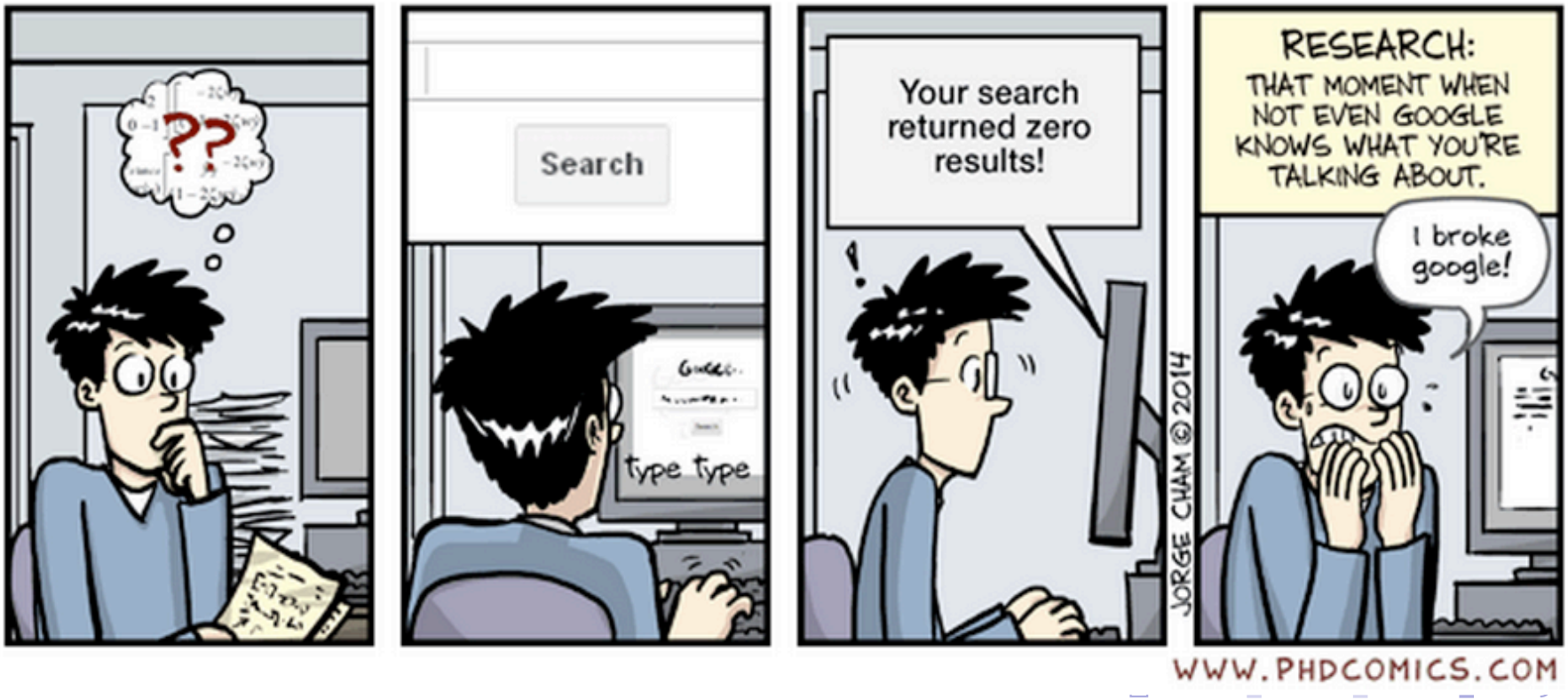
PhD in the US:

How does it work?

How to apply for it?

PhD in the USA

- why I did it? – travel, maths, what makes me happy (aka research)
- main point: learn how to do research and present your work



PhD in the USA

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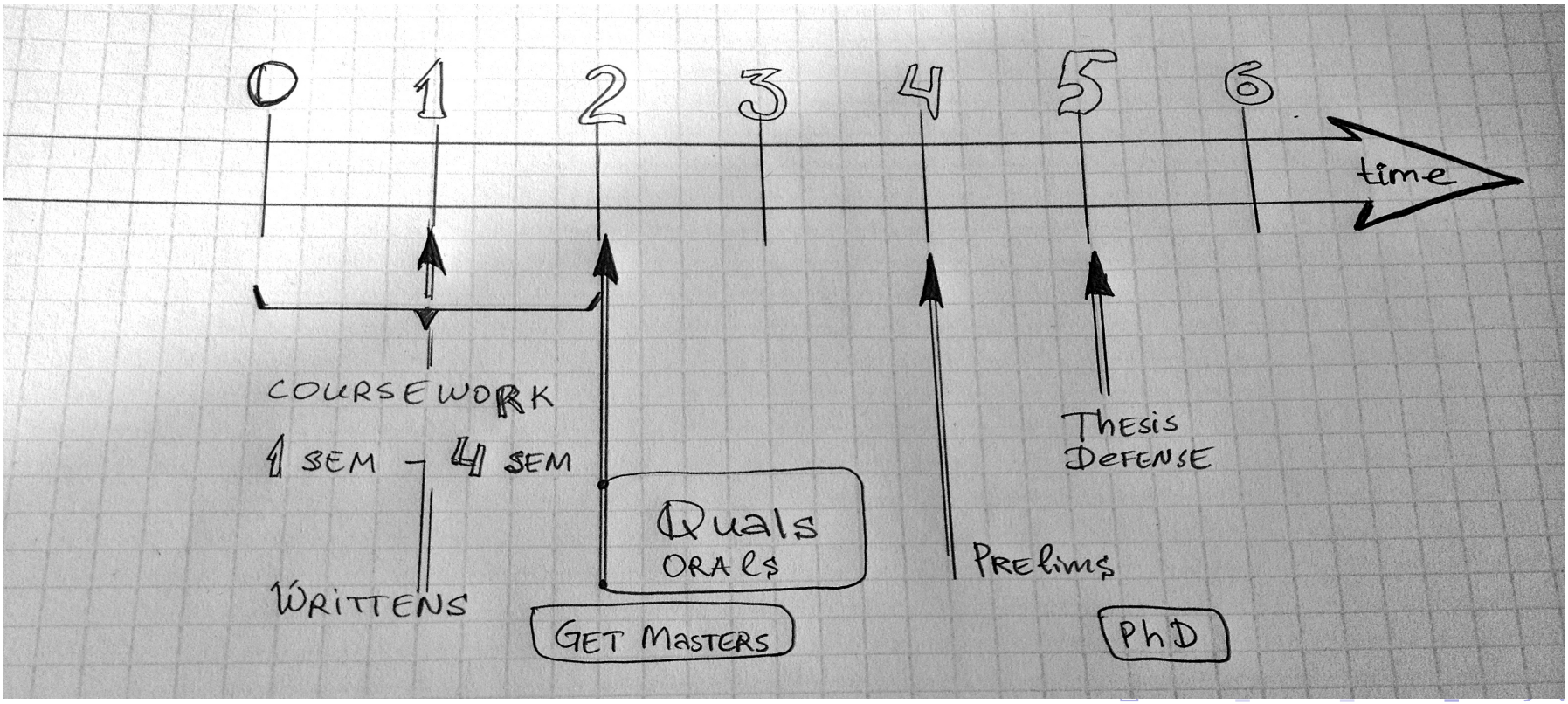


PhD in the USA – Overview

- variable length: 4.5-6 years, includes MSc
- adviser choice
- coursework (heavy workload)
- support: TA, RA, working with a particular prof (Eng, CS)
- exams: orals / writtens / qualifiers
- to finish: thesis = 2-3 papers (depends on the area)
- difference with the UK (length, coursework, project length)
- to get to the top uni's = after MSc's / have done research / have done something else with you life, e.g. industry / you're very good

PhD in the USA - Application process

- where do **you** want to go? whom do you want to study with? which discipline do you like?
- GRE subject (maths/phys) — think about it EARLY (Sept - Oct)
- **personal** statement
- letters of recommendation - Who knows you the best? - 1 mo notice
- official transcripts
- cover letter (it's me, want to work with Martha)
- application – see a webpage of Courant

PhD in the USA - Be proactive before, during and after

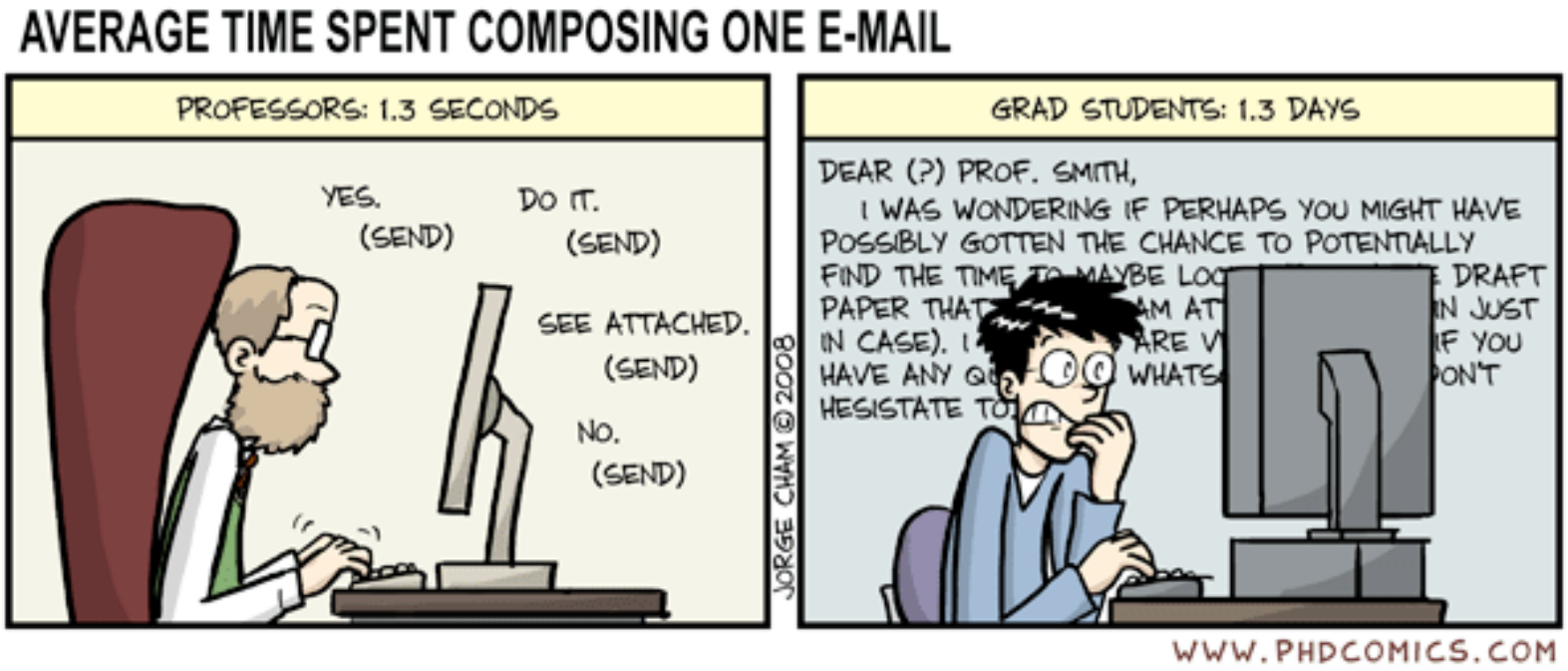
... before ...

- want to do research? – ask your PT about whom with/where/how.
- like a class from a prof here? – ask how/when you can do a project on that.
- like the material? – ask for the info to read more about it.
- like a topic? – ask who does it in the world, so that perhaps you can work with them later.
- NOTE: many profs won't push you to go into maths (since it's so very peculiar, and "the desire has to come from within")

... during ... read the "PhD comics", avoid obvious pitfalls

- bring work to the superviser, s/he is guiding you, not doing things for you and not ordering you around
- act when you're stuck – ask for guidance

PhD in the USA - Be proactive before, during and after



- ask for advice
- if they reply harshly or don't reply – it's not a big deal; try again.
- be concise: what do you want from them, who you are, where are you coming from.

Words to google for – USA

- fellowships for international students, financial aid, fullbright
- GRE (general, subject, dates are usually **early**)
- whom do you want to work with?
- statement of purpose / personal statement
- is the school strong in pure / applied maths?
- 3 letters of recommendation - ask 1-2 months in advance (these would probably be your PT, your 4th year project mentor, and somebody else who knows you well (this could be Pamela Docherty).
- how much teaching is there – 20 hrs per week TA ?
- financial support: TA, RA, 9mo or 12mo? is there a summer salary?
- ask if you could visit
- "society for women ..." (in Engineering, in Mathematics, etc). A great example is http://swe.mit.edu/

What to do after a Maths PhD

... Examples...

Dr. Anna Fensel
Senior Researcher and Lecturer
Head of Research Unit at STI Innsbruck
U. Innsbruck, Austria

In Austria, PhD is a pre-requisite for leading R&D projects in industry and academia.

I am very happy to have completed my PhD in informatics in 2007. Since then I have coordinated applied projects e.g. in social media marketing.

My research has to do with semantic technologies, content, data and knowledge management.

Dr. Sara Grundel
scientific researcher
at MPI Magdeburg, Germany

I always loved solving math problems and now I can do that while solving problems in the world: modelling of energy systems to help Germany pull through with their energy goals.

During my PhD I met my husband and had both my children in a foreign country, while working with the most amazing people in the world.

Dr. Raia Hadsell
Researcher at Google

I was dubious that I could survive the PhD exams and write a dissertation. But I dove in, and it was a wonderful, life-changing experience. I learned that I was an ambitious, smart, creative person, and I've used that confidence and energy ever since.

Now I am a researcher at Google, developing new neuroscience-based navigation algorithms for robots.

Prof. Hala Shehadeh
James Madison University, USA

I always thought that math was a true science, and I always thought I will understand a bit more then I will leave and do something else with my life. The more I understood the more I realized how beautiful our world is and how great it will be to keep researching and discovering new scientific facts.
I never left, I love teaching and doing research.
I also wanted to travel the world, live in beautiful cities and meet great people. A PhD in math has allowed me that lifestyle. I had my daughter right after graduate school, and even through the first few years were very difficult and sometimes I was blatantly discouraged by some, it has been a great thing and my academic schedule works perfectly well for raising my daughter. PhD is great.

Prof. KC Kerby-Patel
UMass Boston, USA

As a professor, my job description is "here's some money; go do some cool engineering stuff." I can work on anything where I feel I might make a difference. Before that, my job at an R&D corporation was "here's our problem; come back later and tell us what we should do."

In both cases, having a Ph.D. gives me the freedom to work on topics I find interesting and to take risks on problems whose solutions are still unknown. By getting a Ph.D. one joins a worldwide community of researchers - being part of that community motivates me to do interesting work I can share.

Dr. Ayse Naz Erkan
Twitter, New York

To me pursuing a PhD was more than a career choice. It is a journey that grows you intellectually. You learn how to work all alone on an unsolved problem (that you can't even google about). Even if you decide to move on to the industry this is a key skill that'll put you ahead of everyone else.

Dr. Natalyia Bulgakova
Postdoctoral researcher
Cambridge Univ., UK

For me, there are three important sides of my work as a postdoc in biology:

creativity – I design my own projects to work on,

freedom – there are no fixed working hours and you are your own boss;

and *social life* – I have met and continue meeting the most inspiring and interesting people.

Dr. Caroline Muller
CNRS researcher
Ecole Polytechnique, France

Doing a PhD in applied math gave me the necessary tools to specialize in a field that I am passionate about, namely climate science. As a scientist, I can now work on problems that I find interesting scientifically and important for society.

Dr. Juliana Dias
Research Scientist
NOAA, USA

The decision to go to grad school for a Phd in Math was among the easiest choices I had to make so far. I always liked school, I always liked learning new things, and I have always been up to new challenges. In that way, the PhD in math got me to make a living while doing the things I like and you can't go wrong with that! I'm still happy with my choice, still "in school", still learning new things, and still encountering new challenges.

Dr. Maria Gehne
Research Associate
NOAA, USA

Getting a PhD allows you to take the time to learn about an interesting topic in great depth. I like learning about new things and new ideas and working as a researcher allows me to do exactly that.

Dr. Nicole Vittoz
Faculty
Douglas College
Vancouver, Canada

Completing a PhD allowed me to get to the very cutting edge of knowledge in a specialized area of brain research. That depth of knowledge comes from no other type of study or work. Now I use my PhD to teach that expertise to people who will go out and apply such knowledge in their own lives and careers.

Dr. Agnieszka Mrowiec
Research sci. at Validus RE
New York, USA

Going to graduate school felt like a natural continuation of my undergraduate studies. PhD allows to choose an interesting study topic that extends beyond the scope of typical college programs, to do something new and to contribute to the common pool of knowledge. Even though I decided not to pursue an academic career further and took an industry job, I couldn't have done it without my PhD.

Dr. Natalia Bochkina
Lecturer, SoM, UoE

During my PhD I had freedom to investigate a challenging mathematical problem that I have not had in any other time.

Before doing the PhD I was concerned whether I were able to do research, and I am glad that I gave it a try because now I can't imagine my life without it.

When I finish writing a paper it gives me a great sense of accomplishment, and makes me happy about who I am, independently of anything else in my life.

Prof. Lesley Yellowlees
Head of College of Science and Engineering, UoE

On finishing my undergraduate studies I went to work in a research lab and realised that all the interesting projects went to people with a PhD. I therefore returned to University, completed my PhD and undertook challenging, absorbing, worthwhile research from then on.

Ultimately I got the 2 jobs I always wanted - President of the Royal Society of Chemistry and Head of the College of Science and Engineering. I wouldn't have had a chance in securing either of them without a PhD.

Broad Options

1. Traditional academic career path i.e. academic research and/or teaching
2. Research in a non-academic environmnent e.g. industry
3. Use expertise or subject knowledge but not to conduct research e.g. science communication
4. Something else...

"Traditional" Academic Career Path

- PhD $\rightarrow$ Postdoc(s) $\rightarrow$ Lecturer $\rightarrow$ Senior Lecturer / Reader $\rightarrow$ Professor (UK)
- Post docs are temporary roles focused on research
- Day-to-day work of permanent staff consists of three main areas - research, teaching and administrative duties (e.g. committee membership)
- Promotion scale based on all three work areas but primarily research
- "Leaky pipeline" - only 6% of Mathematics professors in the UK are women.

Research in a non-academic environment

- Public sector e.g. Civil Service, NHS, Environment Agency (Applied, Statistics, Optimization)
- Private Sector e.g. Financial Services, Manufacturing, Engineering (Probability, Statistics, Applied, Optimization)
- Unexpected applications of Pure Mathematics (Topology in Robotics, Category Theory in Biology . . .)

University teaching (non-research)

- Very rare in the UK (particularly at research-intensive universities)
- This may be changing (new pseudo-academic positions and changes to promotional scales)
- Teaching-track (US)

Useful literature to read

Useful literature to read

- **PhD comics:** http://www.phdcomics.com/
- **From Student to Scholar:** A Candid Guide to Becoming a Professor by Steven M Cahn
- **Nice Girls Don't Get The Corner Office:** Unconscious Mistakes Women Make That Sabotage Their Careers by Lois P. Frankel
- **Women Don't Ask:** Negotiation and the Gender Divide Hardcover by Linda Babcock and Sara Laschever

Any questions – please ask us now – 5-10 min

And talk to us during the reception !