

# Harry Potter

## *And The Doctor of Philosophy*



*How to succeed in grad school*  
M. Scott Shell, UCSB Chem Eng

# Why are you here?

- to learn more
- to get research experience
- to get a better job / an R&D job / an academic job
- to make more money
- you didn't know what else to do
- self / peer / parental pressure to “succeed”



# What's the point of a PhD education?

A PhD means you are capable of *leading* an independent research investigation to create *new* knowledge and to *communicate* it to the scientific world.



# How to succeed, the big picture

**1** Don't ask "what." Ask "how."

**2** Work hard and then harder

**3** Work smart



# How to succeed, the big picture

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**undergraduate mode**

***What do I need to do?***

answering questions  
structured coursework  
teacher guidance  
“me”-focused



**research mode**

***How can the problem be solved?***

posing questions  
self-guided learning  
highly independent  
project-focused

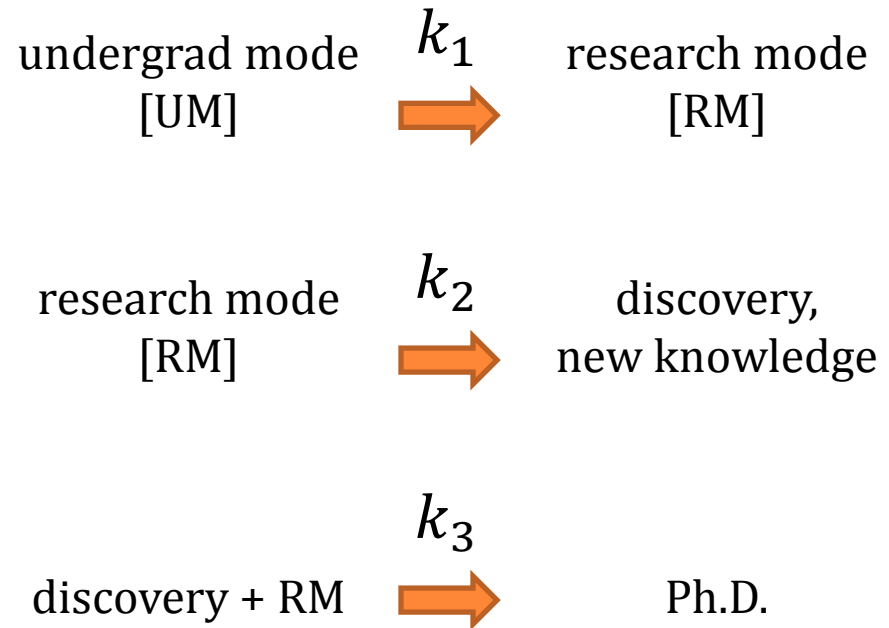
# A simple reaction mechanism

$$\frac{d[\text{UM}]}{dt} = -k_1[\text{UM}]$$

$$\frac{d[\text{RM}]}{dt} = k_1[\text{UM}]$$

$$\frac{d[\text{discovery}]}{dt} = k_2[\text{RM}]$$

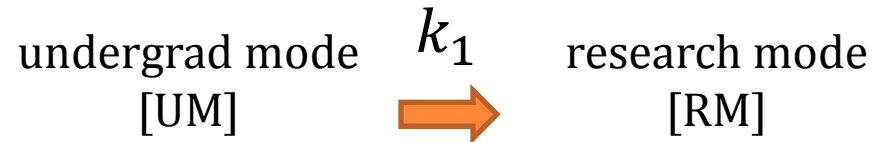
$$\frac{d[\text{Ph.D.}]}{dt} = k_3[\text{Discovery}][\text{RM}]$$



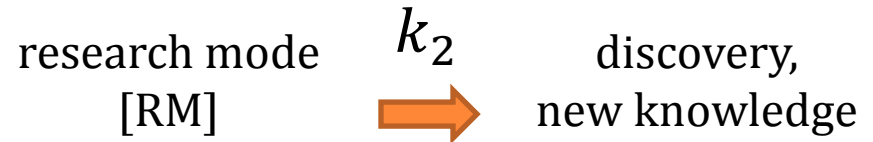


# A simple reaction mechanism

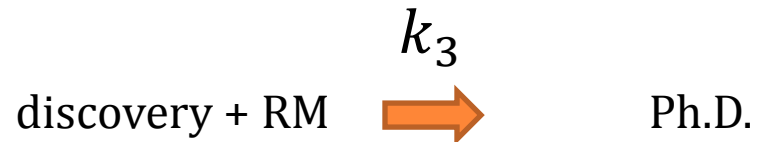
$$\frac{d[\text{UM}]}{dt} = -k_1[\text{UM}]$$



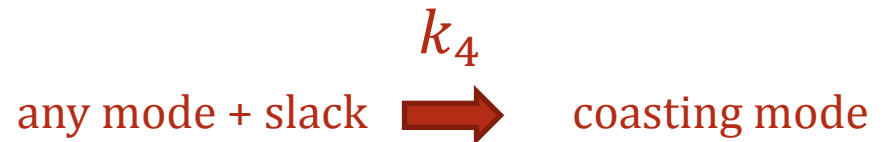
$$\frac{d[\text{RM}]}{dt} = k_1[\text{UM}]$$



$$\frac{d[\text{discovery}]}{dt} = k_2[\text{RM}]$$



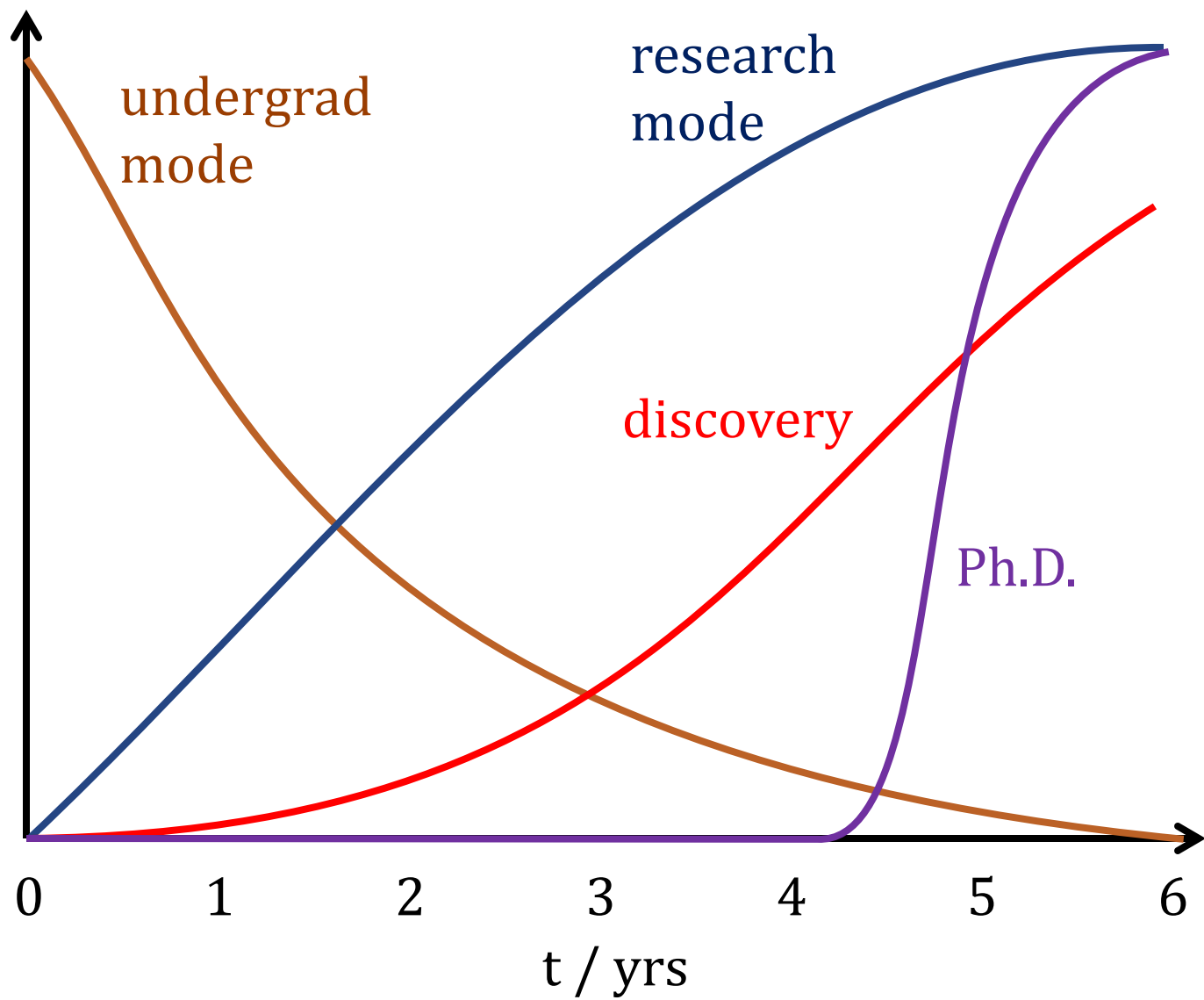
$$\frac{d[\text{Ph.D.}]}{dt} = k_3[\text{Discovery}][\text{RM}]$$




$$\frac{d[\text{CM}]}{dt} = k_4[\text{slacking}] - k_5[\text{fear}]$$





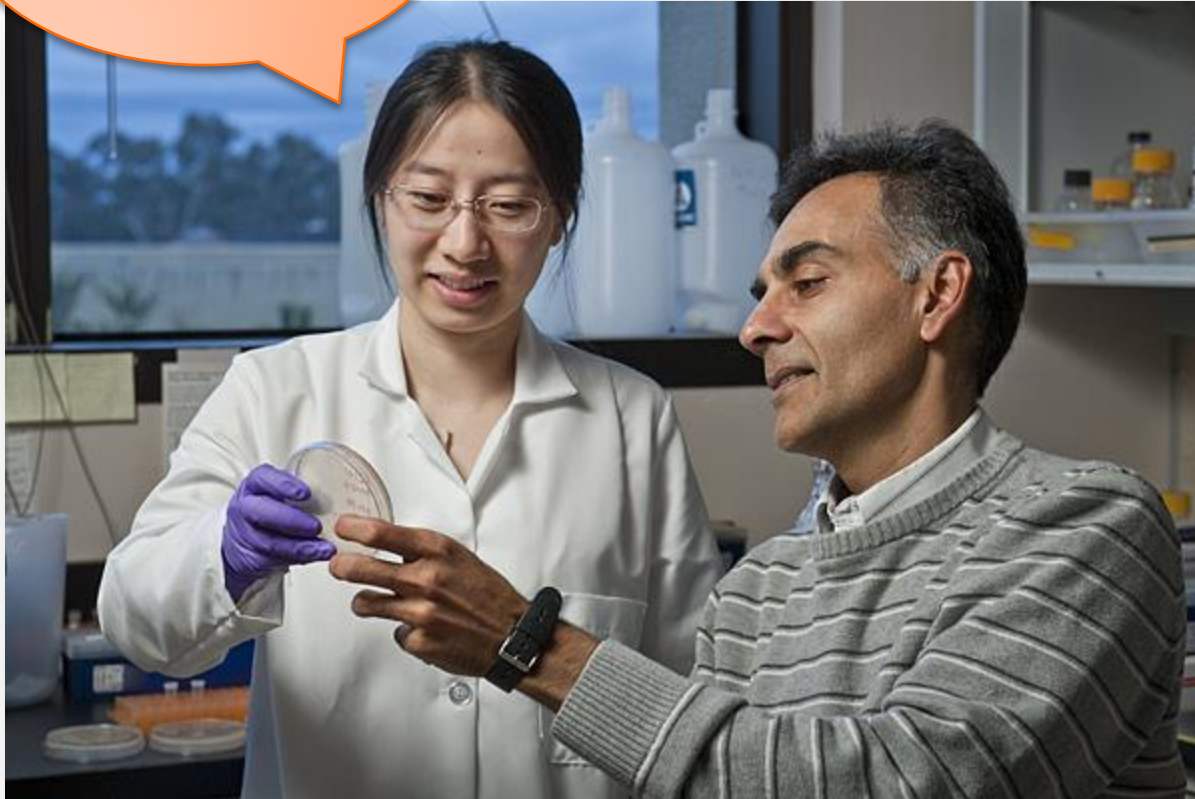


maximize  $k_1$

undergrad mode  $k_1$  research mode  
[UM]  [RM]

- Learn the material versus pass the course.
- Take ownership, initiative.
- Develop and pursue research directions and questions.
- Become a colleague rather than a worker bee.

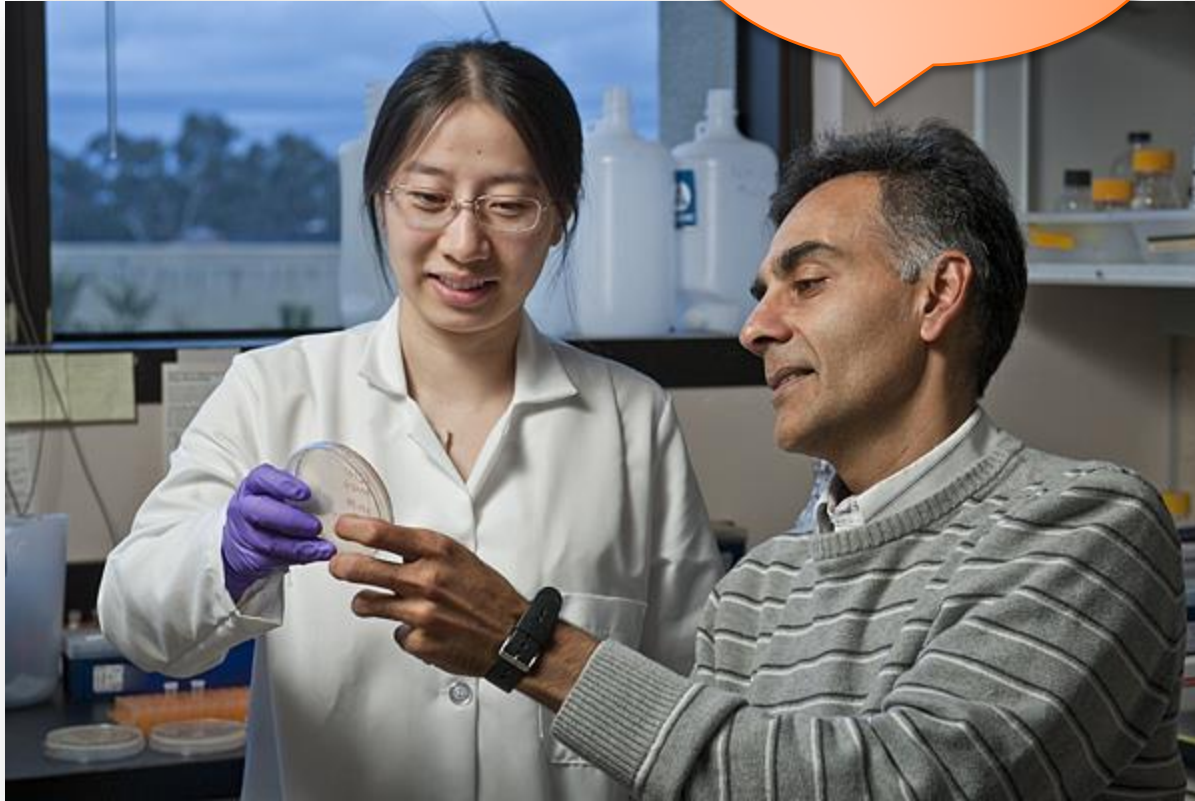
**What  
next?**



grad student

advisor

**What  
next?**



grad student

advisor

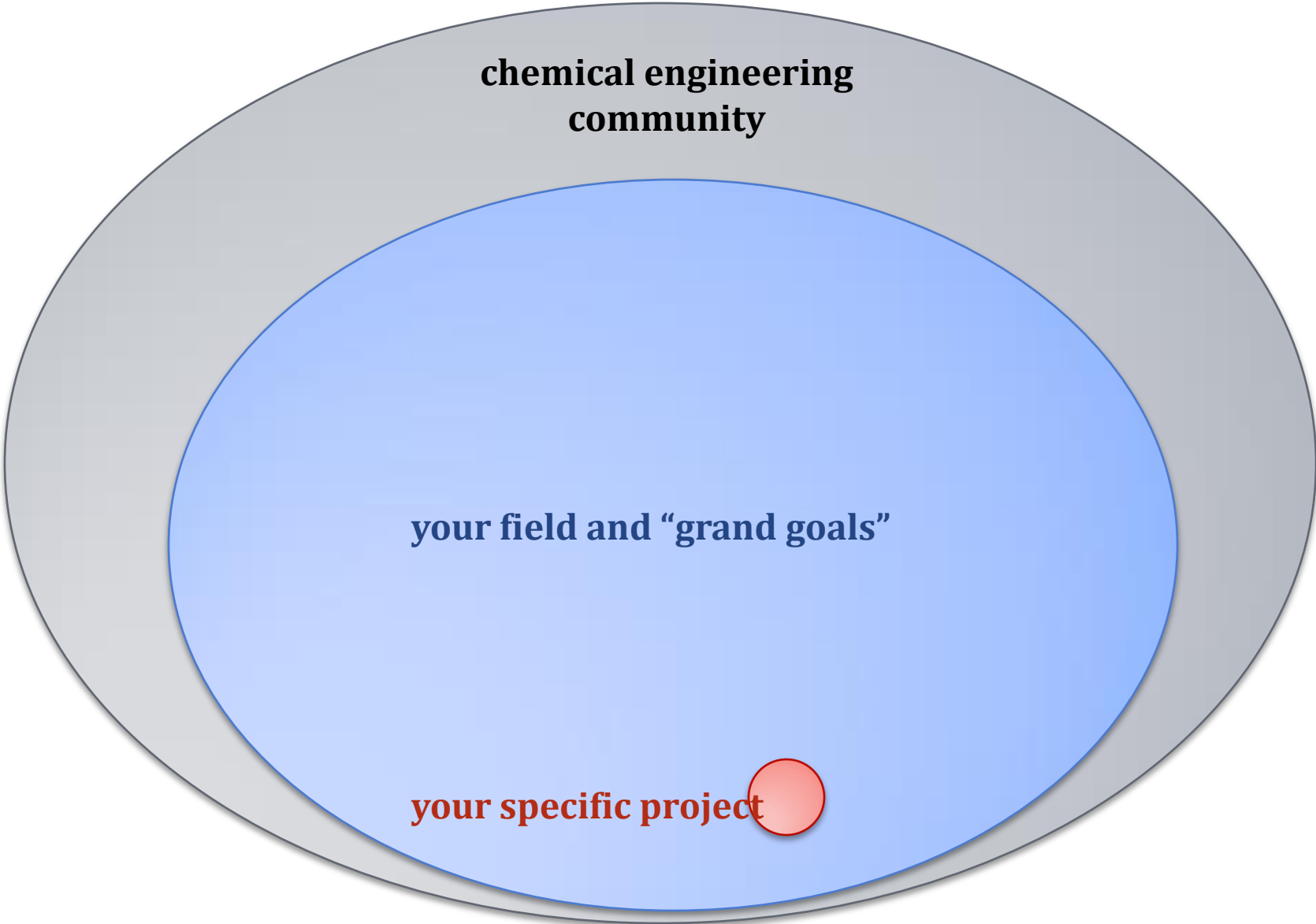
# How to succeed, the big picture

**1** Don't ask "what." Ask "how."

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**3** Work smart

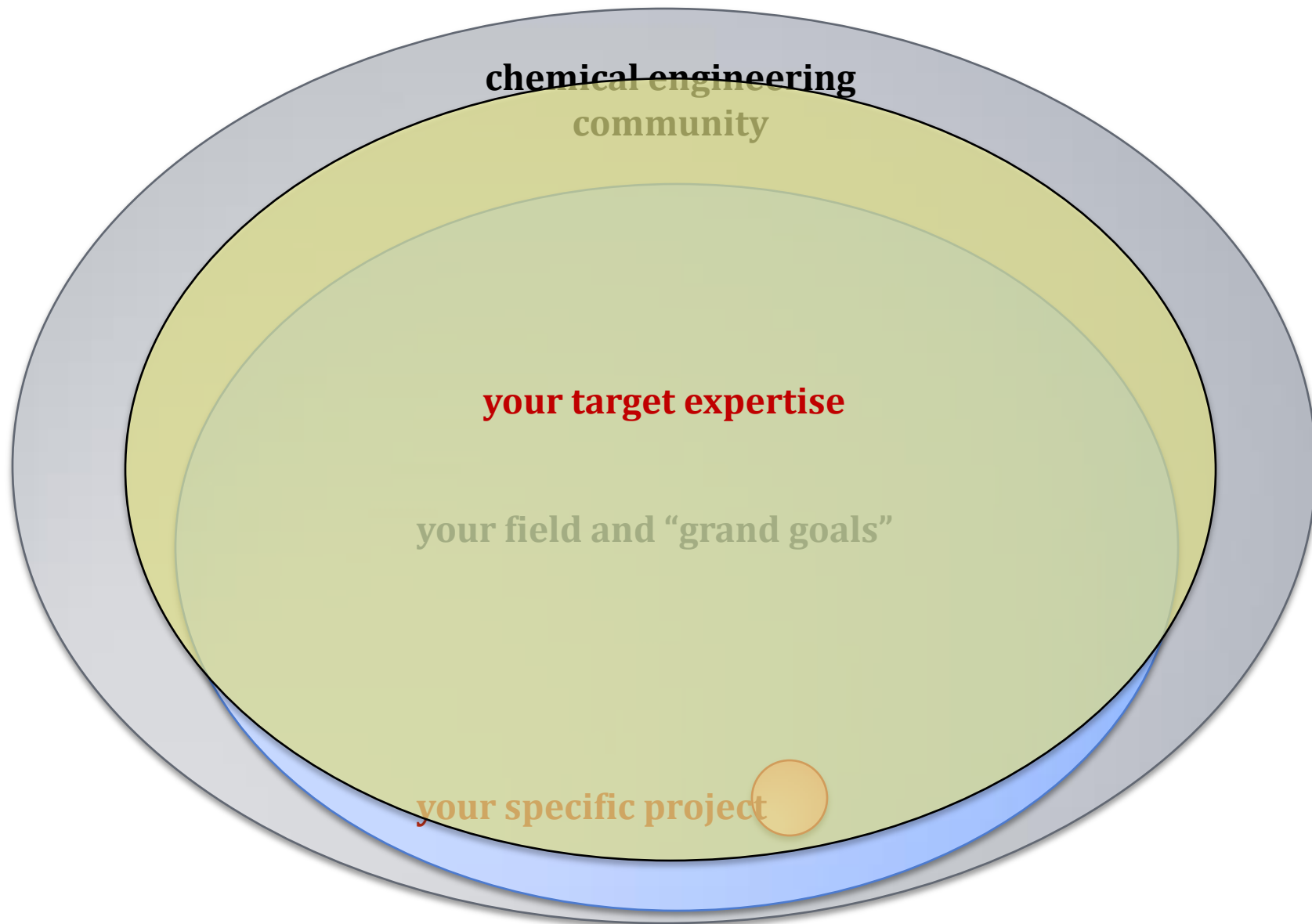





**chemical engineering  
community**

**your field and “grand goals”**

**your specific project**





- 
- A man with short dark hair and blue eyes, wearing a black tuxedo with a white shirt and a black bow tie, is holding a black handgun. He is looking directly at the camera with a serious expression. The background is dark and out of focus.
- Why not learn it?
  - Why not figure it out?
  - Yes you can.

# What does it take to become an expert?

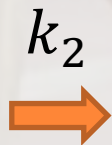
$$\frac{10,000 \text{ hours}}{4 \text{ years}} \approx 50 \frac{\text{hrs}}{\text{wk}}$$





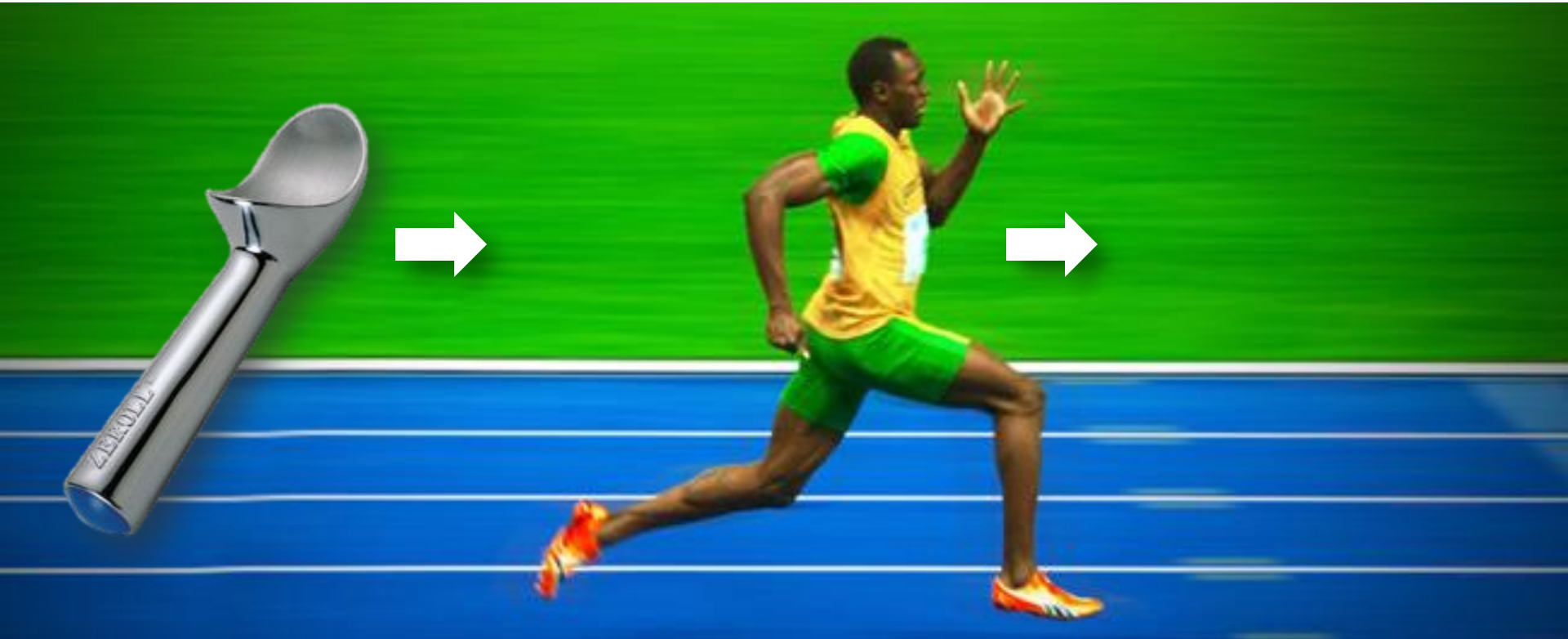
maximize  $k_2$

research mode  
[RM]



discovery,  
new knowledge

# The pace of research





# Never be bored or “waiting”

Firefox

Google Calendar

https://www.google.com/calendar/render?skin=0

+You Gmail Calendar Documents Photos Sites Web More

msscottshell@gmail.com

Google calendar

Search my calendars [Show search options](#)

Your event was updated. [Undo](#)

Create event [Quick add](#)

Today [Aug 22 – 26, 2011](#) [Print](#) [Refresh](#) Day Week Month 4 Days Agenda

August 2011

S	M	T	W	T	F	S
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3
4	5	6	7	8	9	10

**My calendars**

- M. Scott Shell
- Charlotte 2009
- Tasks
- ZAM CASP8 Timeline

[Add](#) [Settings](#)

**Other calendars**

Add a friend's calendar

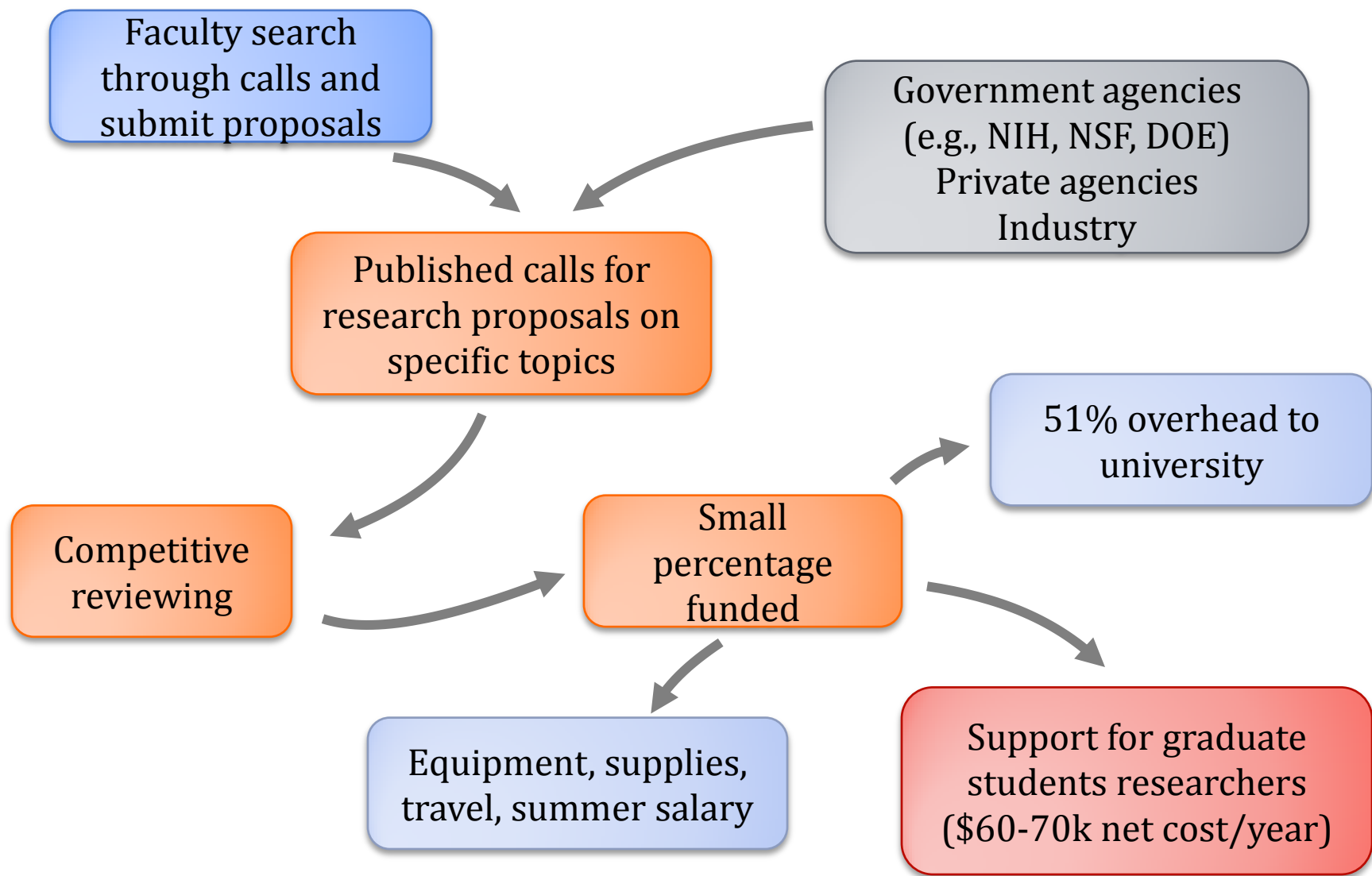
- US Holidays
- Weather

[Add](#) [Settings](#)

GMT-08	Mon 8/22	Tue 8/23	Wed 8/24	Thu 8/25	Fri 8/26
7am	7 – 10 ☰ read nanotube papers	7 – send emails for aiche ☰ 7:30 – 10 ☰ read papers	7 – 10 ☰ write draft of nanotube proposal letter of intent	7 – 8 ☰ schedule mtgs w jacob, kevin 8 – 10:30 ☰ read preprint from jacob, work on theory	7 – 9 ☰ pull together materials and email kit about proposal
8am					9 – 10 ☰ call DOE program manager
9am					
10am	10 – 12p ☰ work on JCP review	10 – 11:30 ☰ edit joohyun's paper draft	10 – 12p ☰ brainstorm nanobubble project ideas	10:30 – 12:30p ☰ work through bazant theory	11 – 1p ☰ northrup grunman luncheon
11am		11:30 – 1p ☰ send emails to DOE program managers			
12pm	12p – 3p ☰ draft section 3 of proposal; send to gary				
1pm			1p – joohyun ☰ a 1:30p – 2:30p ☰ a avi	1p – 2p ☰ brian	1p – 3p ☰ mike doherty
2pm		2p – scott ☰ a 2:30p – 4p ☰ avi annual		2p – 4p ☰ work on nanobubble proposal	
3pm					
3:30p – 5p ☰	3:30p – 5p ☰ draft syllabus, prep for CHE210a course	4p – mikos ☰ 4:30p – 6:30p ☰ dinner with scientists SIMS			
4pm					
5pm	5p – 6p ☰ find aiche hotel, flight				
6pm					

Schedule: literature search, paper reading (and note-taking), journal TOC perusing, working through classic derivations, experiments, brainstorming, organizing, mapping out ideas, etc.

zotero



A week in the life of a faculty member...



Teaching responsibilities: lecture, class prep, making exams and homeworks, office hours, grading...

	Mon	Tue	Wed	Thur	Fri
8am					
9am			class prep		
10am			class prep		
11am	class prep		<b>class</b>		class prep
12am	<b>class</b>		<b>class</b>		<b>class</b>
1pm	make HW				
2pm	office hrs	office hrs			
3pm					
4pm					
5pm					
6pm					

Admin. committees: graduate admissions, student affairs, alumni, seminars, website, promotions, fellowships, university service...

	Mon	Tue	Wed	Thur	Fri
8am					
9am			class prep		
10am		admin	class prep	admin	
11am	class prep	admin	class	admin	class prep
12am	class		class		class
1pm	make HW		admin		
2pm	office hrs	office hrs			
3pm					
4pm					
5pm					
6pm					

Scientific community: seminars, meeting with seminar speakers, conference calls with collaborators, organizing conferences...

	Mon	Tue	Wed	Thur	Fri
8am					
9am			class prep		
10am		admin	class prep	admin	
11am	class prep	admin	class	admin	class prep
12am	class		class	fac. lunch	class
1pm	make HW		admin	visitor	
2pm	office hrs	office hrs		conf. call.	
3pm					
4pm		seminar		seminar	
5pm					
6pm					

Email correspondence with: students in courses, students in group, faculty, collaborators, journals, prospective students...

	Mon	Tue	Wed	Thur	Fri
8am	email	email	email	email	email
9am			class prep		
10am		admin	class prep	admin	
11am	class prep	admin	class	admin	class prep
12am	class		class	fac. lunch	class
1pm	make HW		admin	visitor	
2pm	office hrs	office hrs		conf. call.	
3pm					
4pm		seminar		seminar	
5pm	email	email	email	email	email
6pm					

## Research discussion and planning meetings with students in group and faculty collaborators

	Mon	Tue	Wed	Thur	Fri
8am	email	email	email	email	email
9am			class prep		
10am		admin	class prep	admin	
11am	class prep	admin	class	admin	class prep
12am	class	meetings	class	fac. lunch	class
1pm	make HW	meetings	admin	visitor	
2pm	office hrs	office hrs	meetings	conf. call.	meetings
3pm	meetings		meetings		
4pm	meetings	seminar	meetings	seminar	
5pm	email	email	email	email	email
6pm					

# Thinking, interpreting, generating new ideas about research results and new possible directions

	Mon	Tue	Wed	Thur	Fri
8am	email	email	email	email	email
9am	thinking	thinking	class prep	thinking	thinking
10am	thinking	admin	class prep	admin	thinking
11am	class prep	admin	class	admin	class prep
12am	class	meetings	class	fac. lunch	class
1pm	make HW	meetings	admin	visitor	
2pm	office hrs	office hrs	meetings	conf. call.	meetings
3pm	meetings		meetings		
4pm	meetings	seminar	meetings	seminar	
5pm	email	email	email	email	email
6pm					

# Time for random walk-in or in-the-hall discussions with students, faculty colleagues, and staff

	Mon	Tue	Wed	Thur	Fri
8am	email	email	email	email	email
9am	thinking	thinking	class prep	thinking	thinking
10am	thinking	admin	class prep	admin	thinking
11am	class prep	admin	class	admin	class prep
12am	class	meetings	class	fac. lunch	class
1pm	make HW	meetings	admin	visitor	random
2pm	office hrs	office hrs	meetings	conf. call.	meetings
3pm	meetings	random	meetings	random	
4pm	meetings	seminar	meetings	seminar	
5pm	email	email	email	email	email
6pm					



## Anonymous reviewing of papers by other researchers, requested by peer-reviewed journals

	Mon	Tue	Wed	Thur	Fri
8am	email	email	email	email	email
9am	thinking	thinking	class prep	thinking	thinking
10am	thinking	admin	class prep	admin	thinking
11am	class prep	admin	class	admin	class prep
12am	class	meetings	class	fac. lunch	class
1pm	make HW	meetings	admin	visitor	<i>random</i>
2pm	office hrs	office hrs	meetings	conf. call.	meetings
3pm	meetings	<i>random</i>	meetings	<i>random</i>	reviewing
4pm	meetings	seminar	meetings	seminar	reviewing
5pm	email	email	email	email	email
6pm					

# Editing paper drafts of graduate students and collaborators

	Mon	Tue	Wed	Thur	Fri
8am	email	email	email	email	email
9am	thinking	thinking	class prep	thinking	thinking
10am	thinking	admin	class prep	admin	thinking
11am	class prep	admin	class	admin	class prep
12am	class	meetings	class	fac. lunch	class
1pm	make HW	meetings	admin	visitor	<i>random</i>
2pm	office hrs	office hrs	meetings	conf. call.	meetings
3pm	meetings	<i>random</i>	meetings	<i>random</i>	reviewing
4pm	meetings	seminar	meetings	seminar	reviewing
5pm	email	email	email	email	email
6pm	editing	editing	editing	editing	

Reading literature papers

Writing own papers and proposals, or perhaps textbooks

	Mon	Tue	Wed	Thur	Fri
8am	email	email	email	email	email
9am	thinking	thinking	class prep	thinking	thinking
10am	thinking	admin	class prep	admin	thinking
11am	class prep	admin	class	admin	class prep
12am	class	meetings	class	fac. lunch	class
1pm	make HW	meetings	admin	visitor	random
2pm	office hrs	office hrs	meetings	conf. call.	meetings
3pm	meetings	random	meetings	random	reviewing
4pm	meetings	seminar	meetings	seminar	reviewing
5pm	email	email	email	email	email
6pm	editing	editing	editing	editing	reading
7pm		reading	reading	reading	
8pm					
9pm+	writing	writing	writing	writing	writing

Reading literature papers

Writing own papers and proposals, or perhaps textbooks

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
8am	email	email	email	email	email		
9am	thinking	thinking	class prep	thinking	thinking		
10am	thinking	admin	class prep	admin	thinking		
11am	class prep	admin	class	admin	class prep		
12am	class	meetings	class	fac. lunch	class	email	email
1pm	make HW	meetings	admin	visitor	random	writing	writing
2pm	office hrs	office hrs	meetings	conf. call.	meetings	writing	writing
3pm	meetings	random	meetings	random	reviewing	writing	writing
4pm	meetings	seminar	meetings	seminar	reviewing		
5pm	email	email	email	email	email		
6pm	editing	editing	editing	editing	reading		
7pm		reading	reading	reading			
8pm							
9pm+	writing	writing	writing	writing	writing		

# Travel to scientific meetings and conferences

## Seminars at other universities and departments

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
8am	email	email	email	email	email		
9am	thinking	thinking	class prep	thinking	thinking		
10am	thinking	admin	class prep	admin	thinking		
11am	class prep	admin	class	admin	class prep		
12am	class	meetings	class	fac. lunch	class	email	email
1pm	make HW	meetings	admin	visitor	random	writing	writing
2pm	office hrs	office hrs	meetings	conf. call.	meetings	writing	writing
3pm	meetings	random	meetings	random	reviewing	writing	writing
4pm	meetings	seminar	meetings	seminar	reviewing		
5pm	email	email	email	email	email		
6pm	editing	editing	editing	editing	reading		
7pm		reading	reading	reading			
8pm							
9pm+	writing	writing	writing	writing	writing		

# Travel to scientific meetings and conferences

## Seminars at other universities and departments

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
8am	email	email	email	email	email		
9am	thinking	thinking	class prep	thinking	meetings		
10am	thinking	admin	class prep	admin	meetings	email	email
11am	class prep	admin	class	admin	class prep	email	email
12am	class	meetings	class	fac. lunch	class	thinking	thinking
1pm	make HW	meetings	admin	visitor	random	writing	writing
2pm	office hrs	office hrs	meetings	conf. call.	meetings	writing	writing
3pm	meetings	random	meetings	random	reviewing	writing	writing
4pm	meetings	seminar	meetings	seminar	reviewing	editing	reading
5pm	email	email	email	email	email		
6pm	editing	editing	editing	editing	reading		
7pm		reading	reading	reading			
8pm							
9pm+	writing	writing	writing	writing	writing		

# How to succeed, the big picture

**1** Don't ask "what." Ask "how."

**2** Work hard and then harder

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Thursday 6-20-03

1st step is to strip small piece of T. claudon, measure width + length with delivery scope, then count capsules, estimate of capsule per cap.

T. claudon #2

(145 units long)

2x as 2045 = 40 + 40 + 65 (145 units long) (10 units)  
width 31, 32, 29, 34, 35 (10 units)

93 capsules

73 units of caps units cap-1: 45, 38, 45, 45, 34, 48, 43, 48, 48  
2.03 mm<sup>2</sup>  
2.03 mm<sup>2</sup>  
2.03 mm<sup>2</sup>

Section #1

271 capsules

Section #2

45 + 43



49 capsules total

(forget to do width)

Section #3

44 mm long

40 + 48 . width 27, 30, 35

1.85 mm

53 caps total

8.16 mm<sup>2</sup>

Thursday 6-20

- Fix E. comparison - all mosses
- division of T. claudon - T. claudon
- find out where new mosses are
- look at Dendroica also mosses
- look for new mosses
- get E. to look @ mosses and culture map
- get data up E. -
- get all files
- organize Moss files
- make sure E. has all photos in data
- look through notebook
- call M. Ranson

6-21

T. festiva #2 claudon (this is the one laid in field - collect from field - in box) - to find so much

Section #1

75 units long

width 20, 21, 21, 21, 21

206 caps

3.76 mm long

3.18 mm<sup>2</sup> volume

2.73 mm<sup>3</sup>

Section #2

42 + 30 + 38 units long

20, 20, 21, 21, 21 width 341 caps

85 mm long

1.65 mm wide

4.57 mm<sup>2</sup>

238.1 capsules

Section #3

62 long 20, 17, 17, 17 wide

113 caps

3.1 mm

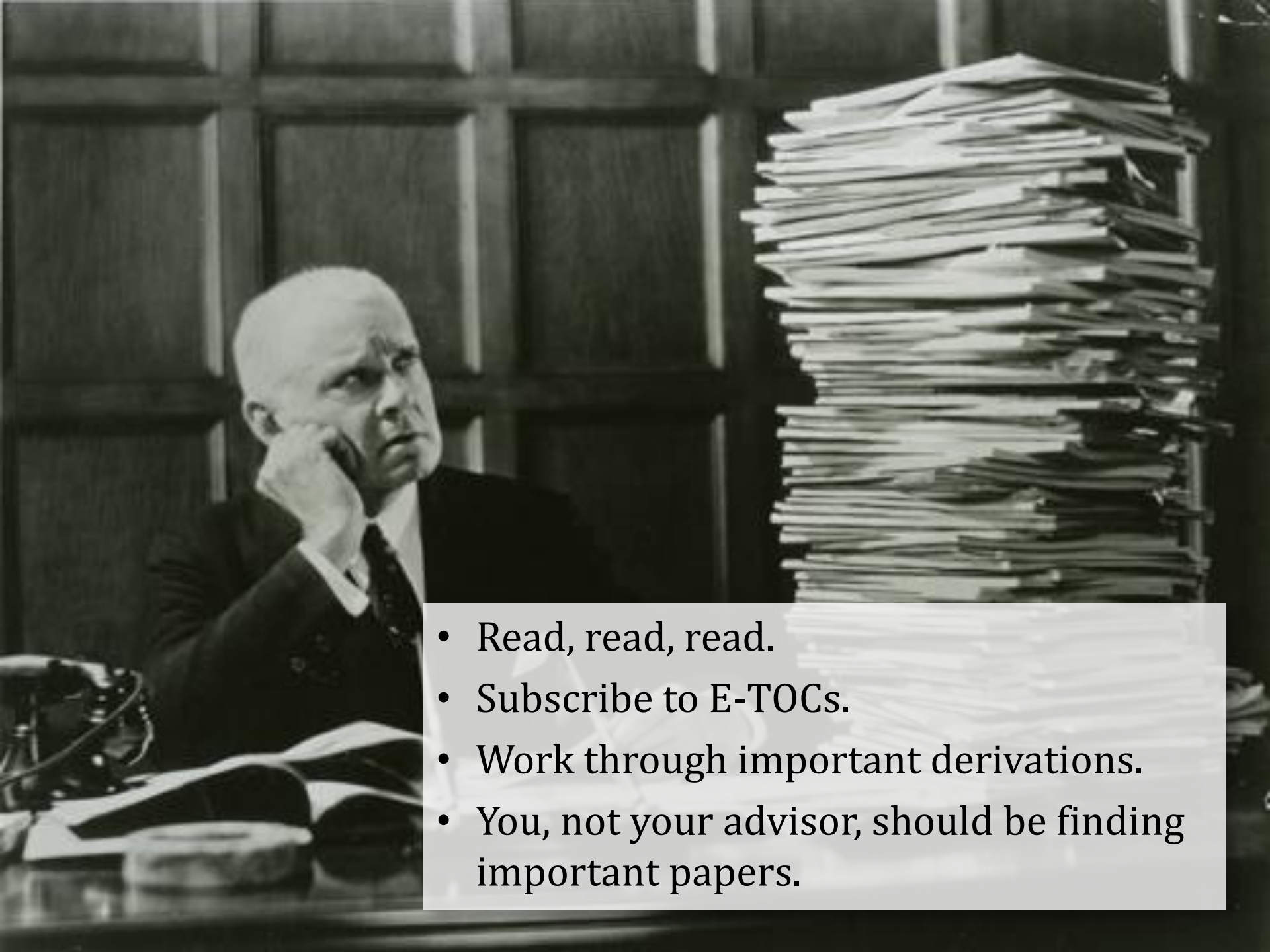
0.76 wide

mm = 2.25 mm<sup>2</sup>

170.8 caps. m<sup>2</sup>

handy 5. cult into white leaves.

- Always keep a notebook with you.
- Write down everything!
- Constantly generate and explore new ideas (90% will fail).



- Read, read, read.
- Subscribe to E-TOCs.
- Work through important derivations.
- You, not your advisor, should be finding important papers.

# Professional Development Series (PDS)

for Post-docs and Graduate Students

[csep.cnsi.ucsb.edu/graduate/pds](http://csep.cnsi.ucsb.edu/graduate/pds)

## Winter 2013 schedule

- 1) Career Talk: My 37 Years at Corning (in partnership with Corporate Programs)
- 2) **Preparing Figures for Publications and Presentations**
- 3) Career Talk: Avoiding the Fiscal Cliff After Graduate School - How I Got a Job in DC
- 4) Grant Writing A: Grants, Funding Agencies and Foundations: A-Z
- 5) Grant Writing B: Faculty Panel on Funding Programs
- 6) Grant Writing C: Story and Structure: the Foundation for Successful Grant Writing
- 7) Dress for Success: Job Interviews and Professional Attire
- 8) **Grant Writing D: Concise and Effective Writing**
  - Attend as many seminars as you can.
  - Interact with visitors and guests.
  - Take advantage of professional development workshops.
- 9) A Versatile PhD: Preparing for "Alternative" Careers
- 10) Performance Enhancement Series A: Increase Your Emotional Intelligence
- 11) Employment Visas (J-1, H-1B, TN) and Green Cards: An Information Workshop
- 12) Grant Writing E: Writing with Confidence
- 13) Performance Enhancement Series B: Mindful Communication and Conflict Resolution
- 14) **Career Talk: Life at the intersection of Science, Technology, and Security Policy**

Two white, featureless 3D figures are shown against a solid blue background. The figure on the left is gesturing with both hands open, palms facing forward. The figure on the right is pointing its right index finger towards the first figure. Both figures have large, smooth, spherical heads and simple, rounded bodies.

## **Interact! Don't go it alone!**

- Student colleagues
- Faculty
- Collaborators
- Others in your field





## **Be prepared for challenges**

- People will be smarter than you
- Few definitive mileposts and metrics
- Self-pressure to do well
- The research roller coaster

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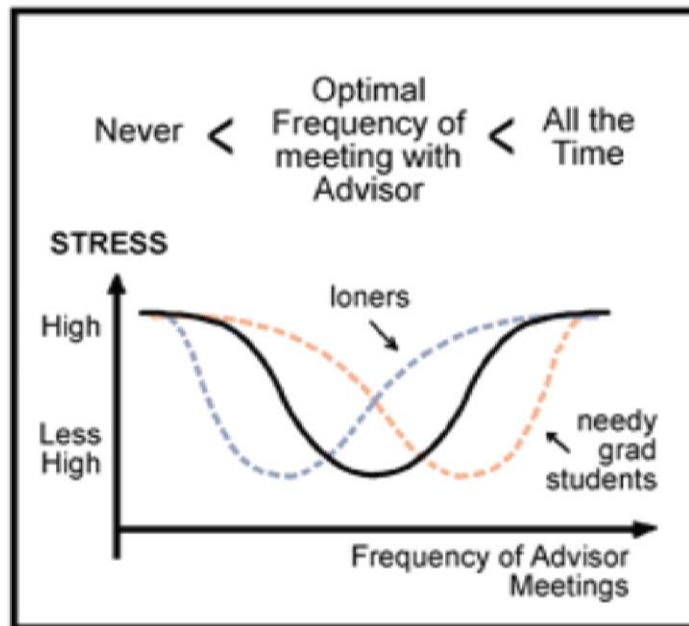
**Some more immediate tips...**

## Picking a research area

- Explore all the options – the most familiar isn't necessarily the best fit
- Are the basic research questions (not just methods) interesting to you and seem important?
- What is day-to-day life like? Experiments? Simulations?
- ***All projects evolve and change*** – do you like the research area and see opportunities for growth?



# Finding an advisor



JORGE CHAM © 2007

WWW.PHDCOMICS.COM

## What an advisor is not

- The main expert on your PhD project
- Your personal problem-solver and tutor
- Someone to tell you what to do next
- Designer of your daily task list and agenda
- Career services

## What an advisor is

- A short- and long-term mentor to provide scientific and professional guidance
- A role model
- An intellectual colleague
- Someone who is well-informed of current scientific topics and methods
- Leader and administrator of a small research enterprise

## Your life outside of the lab

- Develop a schedule for work, exercise, social
- Make sure time spent working is *quality*
- Know when to: take a break, buckle down, reward yourself
- Nurture hobbies and friends outside of work; be proactive

## What now?

- Buy a notebook for chats, seminars, research thoughts, to-do lists... and *use* it.
- Apply to fellowships, especially NSF.  
Yes, you do have time.
- Talk, engage, ask questions, explore, become known
- Pursue every opportunity. Attend all department seminars, find other seminars, group meetings, etc.
- Be confident, not scared or timid!  
You're an elite, talented group.