How to Win Graduate School

Joseph C. Ayoob, PhD

http://www.csb.pitt.edu/faculty/ayoob/

This presentation was given to the first year students of the Joint CMU-Pitt PhD program in Computational Biology (CPCB) as a part of their orientation in August 2015. The purpose was to pass along some general information from a number of sources and personal experiences to help prepare them for successful tenures in the CPCB program and a head-start in securing a position for the next step in their scientific careers. While most of the advice is general for students pursuing PhDs in biology and related fields, some of the advice is specific to the computational biology students in the CPCB program. Dr. Ayoob is thankful to the many colleagues who helped shape this presentation and especially to Dr. Matt Might for The Illustrated Guide to a Ph.D. and his reminder to all students to “Keep Pushing”.
Grad School – why are you here?

The Illustrated Guide to a Ph.D.

To Obtain & Contribute to our KNOWLDEGE

Matt Might

Please visit Matt Might’s full Illustrated Guide to a Ph.D. at http://matt.might.net/articles/phd-school-in-pictures/
Grad School – how do you get there?

The Illustrated Guide to a Ph.D.

study/search/research
hard work/publish
assistance/guidance
planning and preparation

Matt Might

Please visit Matt Might’s full Illustrated Guide to a Ph.D. at http://matt.might.net/articles/phd-school-in-pictures/
Grad School – it doesn’t just stop ‘there’

The Illustrated Guide to a Ph.D.

Please visit Matt Might’s full Illustrated Guide to a Ph.D. at http://matt.might.net/articles/phd-school-in-pictures/
Grad School – why are you here?

The Illustrated Guide to a Ph.D.

To Obtain & Contribute to our

KNOWLDEGE

...and to prepare for your...

CAREER

Matt Might

Please visit Matt Might’s full Illustrated Guide to a Ph.D. at http://matt.might.net/articles/phd-school-in-pictures/
I like big BUTS... and I cannot lie

Advice is here and everywhere, BUT you have to define your own path/process define mutual goals and expectations with your advisor(s)

Peers can be a good guide, BUT they shouldn’t be your measuring stick e.g., introverts and extroverts process, think, and work differently

All have different advice and experiences, BUT some advice is universal don’t be a $#!& (insert your favorite 3-4 letter word)
Your job search starts now
(at least thinking about what you want to be when you grow up)

How Do You Find the Right Career?

Be Proactive and Creative

• Research your options
• Take self-assessments
• Make a career plan
• Build new skills
• Start job searching

see 1-page guide for links
talk to people and network
myIDP @ sciencecareers.org
keep track of what you’ve done
see 1-page guide for links

Career Options and Job Resources
Tianna Hicklin, Ph.D.
some basic advice

networking &
getting involved

career planning

funding

ka myoo nah kay shun

CPCB 1 page guide to graduate school

Work hard… duh… and seek advice of others.

- Strive to become an expert in something.
- 10 Simple Rules for Reproducible Computational Research
- Other 10 Simple Rules from Plos Comp Bio
- Perspectives from previous/senior graduate students:
  - http://prouvene.net/PhD-memoir.htm
  - http://www.myscizzle.com/blog/how-to-survive-your- PhD/
- An oldie, but a goodie: The Final Exam – Don Coffey

Be an active member of the science community and start networking (it’s not a dirty word).

- Go to seminars/events (in the program/your department & elsewhere) and meet with visiting speakers.
- Actively listen at talks (stay off your phone and computer, unless you’re taking notes).
- Present your work locally and at regional/national conferences — get additional perspectives on your work.
- Get involved with Grad Student Association and/or CPCB Government.
- Create a LinkedIn profile, connect to people, and join groups — they are a great source of info (jobs, etc.).
- Look for mentors who will help guide you along your career path.
- Look for opportunities to get teaching experience and to be a mentor for a nascent scientist.
- Summer undergrad and high school programs have opportunities for both (great to build your CV).
- Be an active TA — do more than just the minimum.

What do you want to be when you grow up?

- Consider job prospects and paths early in your career (some useful blogs/websites/info below)
- Highlight and keep track of all of your accomplishments and academic activities in an updated CV.
- Be active in your professional development — keep up to date on career options, fields, and trends.
- Consult the following links for job postings, info on career paths, and career development advice:
  - http://blogs.nature.com/naturejobs/
  - http://versatilephd.com/
  - http://www.biospace.com/
  - http://jobs.newscientist.com/
  - http://whatareallthejobs.tumblr.com/
  - http://www.sciencemag.org/content/337/6099/1149.full

Show me the Money!

- Establish a track record of funding early — money begets money in science.
- Seek grad student fellowships (NIH F33, NSF GFRP), internal university awards, conference travel awards, etc.

Put your best words forward.

- Become an effective communicator — this is incredibly important in science today!
- Seek out assistance in writing and presenting.
  - Writing Centers: CMU — http://www.cmu.edu/gcc
  - Pitt — http://www.writingcenter.pitt.edu/
- Prepare and practice for all talks you will give.
- You never know who is going to show up.
- Talks/presentations are a great opportunity to make a good (or bad) impression.

Useful Links:
- Growen and Swan on Science Writing
- Zurknman on writing
- Zhang on writing
- Bourne on oral presentations
- Give credit where it’s due. Prior work, plus acknowledge any assistance, ideas, materials, & guidance received.

Don’t be afraid of the F-word — Failure is an important part of success.

Get a life!

- Seek a work-life balance.
- Make sure you have an outlet(s) and have fun!
What do you want to be when you grow up?  
(with or without a doing a postdoc)

Tenure-track faculty
  research + teaching + service + mentoring + granting + managing...

Teaching- or Research-track faculty

Biotech/Industry/NIH scientist

Scientific/technical writer
Journal editor

Grant/academic administrator

Consulting
  Finance (Boston CG, McKinsey)
  Government (Booz Allen Hamilton)

Public policy (Rand/NIH/NSF/Capitol Hill)

Patent law

Technical sales

No matter which path you choose, you need to put the most into your graduate school studies and work
What else will you learn during your PhD?
(some answers to what exactly gets Piled higher and Deeper)

• Independent and team-based research
• Proposing, planning, executing, and managing (multiple) projects
• Problem solving and the scientific method
• Critical thinking
• Data analysis and management
• Communication (oral, written, interpersonal)
• Preparing and delivering public presentations
• All your quantitative and computational skills
• Working knowledge of your field
• Mentoring/coaching/teaching experience
• Being detail orientated and able to translate work to bigger picture
• Ability to meet deadlines
• Budgetary skills
• etc...
Who are you?
(your CV is your academic passport – keep it up to date)

Curriculum Vitae = Course of your Life = Catalog of your academic career

<table>
<thead>
<tr>
<th>Education</th>
<th>Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>Service</td>
</tr>
<tr>
<td>Publications</td>
<td>Mentoring</td>
</tr>
<tr>
<td>Presentations</td>
<td>Professional Memberships</td>
</tr>
<tr>
<td>Honors/awards</td>
<td>Other relevant experience(s)</td>
</tr>
</tbody>
</table>

Lots of formats – make sure yours is organized and consistent throughout.
Keep it up to date (when you do something noteworthy, put it on your CV).

WhoRU?
(Resumes are succinct and tailored)

Will likely only get a **10 sec.** review
Most relevant (to them) skills/experiences/accomplishments (quantified)
Different for every job posting (use their key words)
Speak actively and carry a big stock (of words)

- Developed
- Analyzed
- Designed
- Wrote
- Published
- Presented
- Determined
- Administered
- Moderated
- Collaborated
- Demonstrated
- Formulated
- Fabricated
- Assessed
- Collected
- Devised
- Evaluated
- Encouraged
- Facilitated
- Trained
- Reviewed

Expertise
What can be offered

Most recent experience

Active words
Quantified

SUMMARY
- PhD in Computational Biology with specialization on analysis of dynamical and evolutionary properties of proteins using incomplete and ambiguous experimental structure datasets.
- Solid background in data analysis, software engineering, and computational modeling, and excellent machine learning skills.
- Passionate about learning new technologies, building data analysis and visualization tools and pipelines to solve real world problems.

EXPERIENCE
Fellow at Insight Data Science, Mountain View, CA
Jan, 2014 - present
- Created EURoute.me app that suggests vacation routes in Europe to maximize traveler experience
- Consolidated data from Wikivoyage and EuroRail to build a graph of cities using NetworkX
- Recommended routes based on traveler interests along with factoids calculated for each city
- Designed an interactive front end using Flask, jQuery, Google Maps API and deployed on AWS

Research Associate at University of Pittsburgh, Pittsburgh, PA
2010 - 2013
- Created ProDy API and software suite in Python/C/TCL for protein structure and sequence analysis, that received $1.1M grant support from NIH-NIGMS for further development
  - Homepage: http://prody.csb.pitt.edu
  - Github: https://github.com/prody/ProDy
    - Handles missing structure data and ambiguities in sequence alignments (pandas for proteins)
    - C40 to 80x faster parsers and 10x more memory efficient classes compared to other Python APIs
    - Implemented SQL-like selections for atoms, e.g. “same chain as name CA and within 5 of water”
    - Implemented C modules for information theoretical calculations on sequence alignments
    - 1000+ users from 300 institutions worldwide and over 482K+ downloads
- Studied protein-drug interactions using molecular dynamics simulations on CPU/GPU clusters
- Discovered inhibitors of cytochrome c peroxidase function as potential anti-radiation drugs
- Designed and initiated development of a web platform using Django and PostgreSQL for management and analysis of data from drug testing on human-on-a-chip models (http://mps.csb.pitt.edu)
- Lectured on Drug Discovery, Bioinformatics and Software Engineering Best Practices for Scientists

Graduate Intern at GlaxoSmithKline
Summer 2009
- Developed Python based tools for simulating and analyzing drug target proteins

Graduate Researcher at Carnegie Mellon - University of Pittsburgh
2005 - 2009
- Performed first of a kind analysis of large experimental structure datasets with missing atoms and segments to gain insights on the dynamical properties of proteins
- Performed simulations and modeling to elucidate molecular mechanism of action of a compound in zebrafish and human cells
- Implemented tree augmented naïve Bayes in MATLAB with feature selection for fMRI data

EDUCATION
Carnegie Mellon - University of Pittsburgh, Pittsburgh, PA
Joint PhD Program in Computational Biology
Relevant Graduate Coursework: Machine Learning (CMU), Linear Algebra (Pitt)
Koç University, Istanbul, Turkey
BSc in Chemistry
Relevant Coursework: Algorithms & Data Structures, Programming with C, Computational Science

SKILLS
Languages: Python, JavaScript, C, SQL, BASH, TCL, MATLAB*, Java* (* prior experience)
Analysis & Modeling: NumPy, SciPy, Scikit-Learn, Matplotlib, NetworkX, Pandas, iPython
Web & Visualization: D3, jQuery, React.js, Flask, Django, Sphinx, BeautifulSoup

Relevant contact info
(email, phone, web, github, LinkedIn)
Don’t forget about the Government BS...
(The NIH BioSketch, that is)

### BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2. Follow this format for each person. DO NOT EXCEED FOUR PAGES.

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
</table>

**ERA COMMONS USER NAME** (credential, e.g., agency login)

**EDUCATION/TRAINING** (begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE (if applicable)</th>
<th>MM/YYYY</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
</table>

**NOTE:** The Biographical Sketch may not exceed four pages. Follow the formats and instructions below.

**A. Personal Statement**

Briefly describe why your experience and qualifications make you particularly well-suited for your role (e.g., PD/PI, mentor, participating faculty) in the project that is the subject of the application. Within this section you may, if you choose, briefly describe factors such as family care responsibilities, illness, disability, and active duty military service that may have affected your scientific advancement or productivity.

**B. Positions and Honors**

List in chronological order previous positions, concluding with the present position. List any honors. Include present membership on any Federal Government public advisory committee.

**C. Selected Peer-reviewed Publications**

NIH encourages applicants to limit the list of selected peer-reviewed publications or manuscripts in press to no more than 15. Do not include manuscripts submitted or in preparation. The individual may choose to include selected publications based on recency, importance to the field, and/or relevance to the proposed research. When citing articles that fall under the Public Access Policy, were authored or co-authored by the applicant and arose from NIH support, provide the NIH Manuscript Submission reference number (e.g., NIHMS97631) or the PubMed Central (PMC) reference number (e.g., PMCID234687) for each article. If the PMCID is not yet available because the Journal submits articles directly to PMC on behalf of their authors, indicate "PMC Journal - In Process." A list of these Journals is posted at http://publicaccess.nih.gov/submit_process_journals.htm. Citations that are not covered by the Public Access Policy, but are publicly available in a free, online format may include URLs or PMCID numbers along with the full reference (note that copies of publicly available publications are not accepted as appendix material.)

**D. Research Support**

List both selected ongoing and completed research projects for the past three years (Federal or non-Federally-supported). Begin with the projects that are most relevant to the research proposed in the application. Briefly indicate the overall goals of the projects and responsibilities of the key person identified on the Biographical Sketch. Do not include number of person months or direct costs.
Networking
(It’s not a dirty word)

Networking strategies

1. Don’t just look for ways that you can benefit
2. Be helpful and collaborative
3. Understand the interests/needs of others
4. Become an expert in something

www.tcd.ie/wiser/build-profile/networking/tips/
Don’t be afraid of the F word

**Failure**  ...all the cool kids are doing it.

“I have not failed. I’ve just found 10,000 ways that won’t work.” - Thomas A. Edison

*different perspective*

“The only real mistake is the one from which we learn nothing.” - Henry Ford

*learn something from them*

“When we give ourselves permission to fail, we, at the same time, give ourselves permission to excel.” - Eloise Ristad

*open yourself up to great things*
Don’t be afraid of the F words

**Failure**  ...all the cool kids are doing it.

“I have not failed. I’ve just found 10,000 ways that won’t work.” - Thomas A. Edison

*different perspective*

“The only real mistake is the one from which we learn nothing.” - Henry Ford

*learn something from them*

“When we give ourselves permission to fail, we, at the same time, give ourselves permission to excel.” - Eloise Ristad

*open yourself up to great things*

Having **Fun**  ...all the cool kids are doing it.
Get involved and learn by doing...

<table>
<thead>
<tr>
<th>Why?</th>
<th>How?</th>
</tr>
</thead>
<tbody>
<tr>
<td>...in the program</td>
<td>• actively participate in seminars/class/</td>
</tr>
<tr>
<td>• learn from others’ experiences</td>
<td>MetaSchool</td>
</tr>
<tr>
<td>• share your expertise</td>
<td>• CPCB government</td>
</tr>
<tr>
<td>• make your program &amp; experience better</td>
<td>• recruiting events</td>
</tr>
<tr>
<td>• get strong recommendations</td>
<td>• be a kick-ass TA</td>
</tr>
<tr>
<td>• acquire ‘soft’ skills</td>
<td>• gain non-curricular experience</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>...outside of the program</td>
<td>• attend other seminars</td>
</tr>
<tr>
<td>• pursue other scientific interests</td>
<td>• meet with speakers</td>
</tr>
<tr>
<td>• get to know your field</td>
<td>• BGSA involvement</td>
</tr>
<tr>
<td>• networking opportunities</td>
<td>• attend conferences – posters</td>
</tr>
<tr>
<td>• discern your next step</td>
<td>• apply for pre-doctoral fellowships,</td>
</tr>
<tr>
<td>• get $$$ / establish a track record</td>
<td>travel awards, STIR, etc.</td>
</tr>
</tbody>
</table>
Taking charge of your own destiny
(or something motivational like that)

CPCB Pre-Advising Committee Worksheet

Courses
- Have you taken all of your core courses? If not, what is your plan for taking the rest of them?
- Which electives (Life Sciences, Quantitative, Specialization, Open) have you taken or plan to take?
- For electives you plan to take, did you check...
  - enrollment availability?
  - semesters/years in which the course is offered?
  - permissions needed (if any) to take the course?
- Did you take the Ethics Course in your first summer semester? If not, did you make arrangements to take it in your second summer semester?

Thesis proposal
- Who are (will be) the members of your thesis committee?
- When will you propose your thesis?

Career musings and professional development
- What are you thinking about for a next step after grad school?
- How are you preparing yourself?
- What professional development activities have you pursued or need to pursue?
- How can we help you in your career preparations?
- Are you considering a summer internship to explore a field/company?
- What are your goals?
- Have you completed or updated your Individual Development Plan (IDP)?
- Who are your mentors and how will they assist you?
- Are you planning on going to any conferences?
- Do you have any requests for MetaSchool topics?