Getting Tenure: The journey is more important than the destination

Thoughts on management, creativity and having fun

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Getting Tenure-- and Beyond

• Most faculty get tenure
• More important than the journey to tenure is making a contribution to a field(s)
• Don’t worry about getting tenure early or late
  – Don’t take credit for post doc assignments
  – Do take maternity/spousal leave
• Learn how to be an effective manager
• Collaborate
Keys to success

• Organizational skills & management
• Communication skills
• Creativity
The Power of 3

- 3 = Research, Teaching and Service?
- Develop your own research ideas, but try to collaborate on a project with a more senior professor/mentor
- Limit yourself to 3 research areas
  - (... coming up in section on “creativity”)
- 3 courses: hopefully, includes one graduate course specifically aligned with your research interests
Working with students–M.S.

• Present each M.S. student with a “contract”: topic of research, one or two hypotheses and a list of what they should work on (but be flexible!). Don’t overwork them.

• Three semesters:
  – Fall: Study literature, learn techniques
  – Spring/summer: Get most of data
  – Fall: Fill in data gaps; write thesis (likely defend in January)

• Don’t depend on your M.S. (or even Ph.D.) students to write papers once they leave... they are gone...
  – Most M.S. students don’t care about publishing
  – If you can’t get a paper done before a student leaves: Have the “final figures” completed (with the data files in your hands)
Working with students-- Ph.D.

• Guide a new Ph.D. student like an M.S. student for the first year
  – Get them on a project from day 1 that will produce a 1st author paper.
  – Require a publication within the first two years or cut funding.
  – Aim for a four-year (four paper) study program.

• Emphasize getting out of the department, and developing a specialty in another field (preferably science)

• Students from an M.S. in a foreign institution may take a little longer to graduate (need to re-take courses in the US style)

• First two years, you help to guide them; last two years, they tell you what they are doing...
# The Logan Group “playbook”

Maximum was 15 pages, 45 people; Each objective/hypothesis = 1 paper

<table>
<thead>
<tr>
<th><strong>Valerie Watson (PhD, NSF, NSF Fellow/KAUST)</strong> 2-7-12</th>
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<tbody>
<tr>
<td><strong>Hypothesis 1:</strong> Membrane layer on catalyst/cathode surface can remove direct electron loss and improve coulombic efficiency <em>(published, JPS)</em></td>
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<td><strong>Hypothesis 2:</strong> “Power overshoot” in MFCs eliminated with acclimation <em>(published, ElectrochemCommun)</em></td>
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<tr>
<td><strong>Hypothesis 3:</strong> Neutral hydrophilic binders work best in MFCs <em>(Tomonori led, published EnergyEnvironSci)</em></td>
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<tr>
<td><strong>Objective 4:</strong> Evaluate the effect of the activated carbon precursor and surface area/structure (pore size distribution) on oxygen reduction at the cathode using RDE and MFCs and statistical DOE analysis.</td>
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| **Objective 5:** Explore the effect of adsorbed wastewater contaminants on activated carbon catalyst performance for oxygen reduction in MFCs,  
  - Test activity of different AC samples using RDE, RRDE, and MFCs before (done) and after adsorption (working on repeatability quantification) |

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<th><strong>Fang Zhang (PhD, KAUST)</strong> 2-6-12</th>
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<td><strong>Objective 1:</strong> Examine the effect of mesh size on the MFC performance <em>(published, JPS)</em></td>
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<td><strong>Objective 2:</strong> Examine the anode materials and configurations using AC cathode <em>(w/ Sarah; published, JPS)</em></td>
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<tr>
<td><strong>Objective 3:</strong> Long-term performance of AC cathodes with different DLs <em>(published, BiosenBioelec)</em></td>
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| **Hypothesis 4:** PDMS can be used as an anti-flooding binder for improved performance vs Nafion binder *(ms in prep)*  
  - Electrochemically compare the cathode performance using either Nafion or PDMS binder that built around SS or copper mesh current collectors.  
  - Examine the performance of PDMS binder cathodes in MFCs |
| **Hypothesis 5:** Performance of carbon mesh anode in MFCs using sandwich setup with porous AC cathodes can be improved by setting appropriate anode potential *(almost all data collected)*  
  - Compare startup, power production, CV/EIS with different poised anode potentials, and control reactors connected to external resistance.  
  - Compare the performance with wastewater inoculums and transferred culture. |
| **Hypothesis 6:** Metal mesh can be coated with carbon materials for using as anode *(done, anode failed in separator assembly setup)*  
  - Compare the use of carbon black coated titanium mesh with carbon mesh as anode in 2 cm spacing setup  
  - Compare different anode material in separator assembly setup |
Important vs Incremental?

**Both!**

- **Mapping expeditions**
  - When you map/survey an area, you always come back with data.
  - Such studies are useful!... But they rarely are big discoveries or have a big impact.
  - MS projects good for new researchers, and a PhD student might have some of this especially when starting out.

- **Hunting expeditions**
  - Sometimes you should go after the bear and ignore the squirrels
  - When you land the “big game”, you get a big reward
  - New discoveries are more important than building on existing information, but it is much riskier (you may go hungry)
  - PhD students must have some (not all!) of these types of hunting investigations
Writing papers

• Keep them simple
  – Intro: 3 paragraphs
  – Methods: short as possible
  – Results: They tell a story. Put your most important figures first. Limit figures to \( \leq 9 \).
  – Discussion: Don’t speculate too much (and don’t combine with Results section)

• Work out a plan for first and last authors, and inclusion of co-authors

• Avoid publishing with your former advisor(s)
Plan the paper at the start

• Construct a “Mock Paper” rather than an outline
  – Mock paper: Draft of the findings, in the form of a few items, and several figures

• Titles:
  – The title gives the first clue on whether it is hypothesis-driven research
  – Avoid descriptive “look-see” research where you just vary a bunch of variables.
  – Bad titles = Descriptive work
    • “Effects of materials on ...”
    • The “Effects of...”, “Analysis of...”, “Comparison of...” papers are usually low impact
  – Better titles = Evolutionary work
    • “XXX that achieve improved energy efficiency using low cost, non-precious metals”
    • Make the title reflect the innovation of the topic
Mock paper title:
States a hypothesis

What we think we know, and what the “controversy” is that motivated our research (3-4 points)

Examples of figures that we expect to produce... and what they should show
The mock paper is a dynamic document... Modify it as the research progresses.

Add a new title

Put in actual figures as you get the data

Graphite Fiber Brush Anodes for Increased Power Production in Air-Cathode Microbial Fuel Cells
Eventually, you have the final product.
Publish great quality figures!
Examples: 3 poor ones, 1 good one ...


Increase font and marker sizes
Watch font sizes... here, the legend is impossible to read...

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**Fig. 1.** Voltage generation of SMFCs produced with sediments subjected to different pretreatment methods. (A) 0–15 days and (B) 15 days onwards.
Think about figure layout in the journal:

Poor layout leads to the use of two columns for a figure that should only take 1 column.
Think about figure layout in the journal: “Paste” your figures over ones that look good.
Comments and Review papers

• Old advice
  Don’t write them

• New advice:
  Write them! Aim high
Teaching tips— before tenure

• Try to teach the same courses in the first few years.
• Teach a graduate class directly in your research area
• Don’t teach a lab class without appropriate TA support
• Track and catalog exam questions and homework questions (students will keep copies of past exams)
• Avoid getting pulled into too many “guest lectures” in classes you are not directly assigned.
• Don’t overly focus on SRTEs.
• Enjoy yourself in the classroom— it is why we are here!
Conferences, Invited talks, panels

• Limit the number of conferences you attend, even if you can afford it.
  – Each conference takes 2-4 weeks of your life.
• Accept invited talks, particularly from universities (but don’t “self invite”)
• Try to get on proposal review panels
Service

• Department
  – Keep a modest to low profile in the department
  – Let senior faculty do the hard administrative work.
  – Choose a few low-profile committees
  – Avoid chairing a department committee

• College:
  – Good to get on a college or university committee before your tenure package is submitted to the university.

• Profession
  – Try to organize or chair a session at a conference
  – Get on professional society committees
Improving student communication skills

• Form a seminar series. For the EnvE group:
  – Student presentations of ~20 minutes in “conference style”
  – Visitors (~1 / month), 30 minutes
  – Students in the audience are required to ask a few questions over the course of the semester

• Organize a weekly literature review class
  – Give students experience in critically reading the literature and speaking technically in small groups (8-12)
Literature review class

• Choose a new topic each semester (students should suggest these)
• Professor chooses the first paper, and leads only the first discussion– and then attends but is as quiet as possible!
• Students choose papers in following weeks, and they lead discussion (not instruction).
• Focus your discussion on:
  – Identify the main hypothesis
  – Do the data support the statements?
  – Look at each figure and discuss what is says and if it is needed or helpful.
  – Are there errors in tables, figures, calculations?
• Learn to be critical of what you read, and don’t assume it is correct because it is published!
Creativity
Two views on success

• There are 3 types of researchers
  – Bricklayers
  – Kingdom builders
  – Mad bombers

• 3 things to be successful (it takes 2)
  – Work hard
  – Be very smart
  – Be creative
How to succeed without being creative

• Don’t get distracted: work only on the first topic of your PhD and hammer away at it and nothing else.
• Don’t bother reading new papers; you are the expert now
• Never ask a question that might make it look like you don’t have total command of a subject; stay away from any field that you didn’t master as a student
• Go to a conference: spend the whole time there preparing your talk and don’t waste time on other presentations; ignore posters as those people are probably losers
• Eliminate the competition; cut down anyone else that tries to work in your field
• Lament and agonize that they just don’t fund any research anymore in “your field”.

How to build in creative work into your life

• Continue to develop all of those excellent skills that got you where you are.

• *Be more creative by taking risks...*
  – Once tenured, you can take more risks in new directions for your research
  – Evolve a *new field*-- one that you will become known for (vs. your advisor’s main field).

• How to do this?-- Work in **3 areas:**
  – Continue in the area of your dissertation work (keep steady)
  – Find a new area but aligned with your dissertation work (evolution)
  – Pursue crazy idea(s) (mutation?).. this is the MOST FUN!
Research Topics… the evolution of the Logan Lab

Using atomic force microscopy to understand bioadhesion

Particle transport in the subsurface

Effect of fluid environment on mass transfer to bacteria

Biofilm reactors (trickling filters)

Dissertation: mass transfer to microbial aggregates and biofilms

Microbial fuel cells

Aggregation rates in sheared reactors

Aggregate formation in the ocean

Fractal coagulation (of aggregates)

Bacterial respiration with perchlorate

Bacterial respiration with chlorate

Pollutant degradation in fungal bioreactors

Hydrogen generation via fermentation
Using atomic force microscopy to understand bioadhesion

Microbial fuel cells

H₂ in microbial electrolysis cells

Hydrogen generation via fermentation

Bacterial respiration with perchlorate
Microbial fuel cells

Biofuel production

(H₂, CH₄)
in microbial electrolysis cells

Desalination

Conc flow cells, RO biofouling

Salinity Gradient Energy (SGE)

RED, CapMix, BatMix, HEx

Thermal Regenerative Batteries (TRBs)

(Heat Energy → Electricity)

Reverse electrodialysis & MFC technologies

A new method for water desalination

Biofuel production (H₂, CH₄) in microbial electrolysis cells

H₂ in microbial electrolysis cells

Microbial fuel cells

Biotechnology based on “electromicrobiology”
Summary

• Keep students focused on hypotheses
  – Be organized!
• Conduct evolutionary research
  – …and look for radical mutations…
• Spend time thinking about where the field is going
  – What will be the next most important topic?
• Work on things that are fun!
Questions?
Discussion...