American Chemical Society

Science through a molecular lens – navigating an interdisciplinary career path

Natalie LaFranzo, PhD

Chair, American Chemical Society Younger Chemists Committee

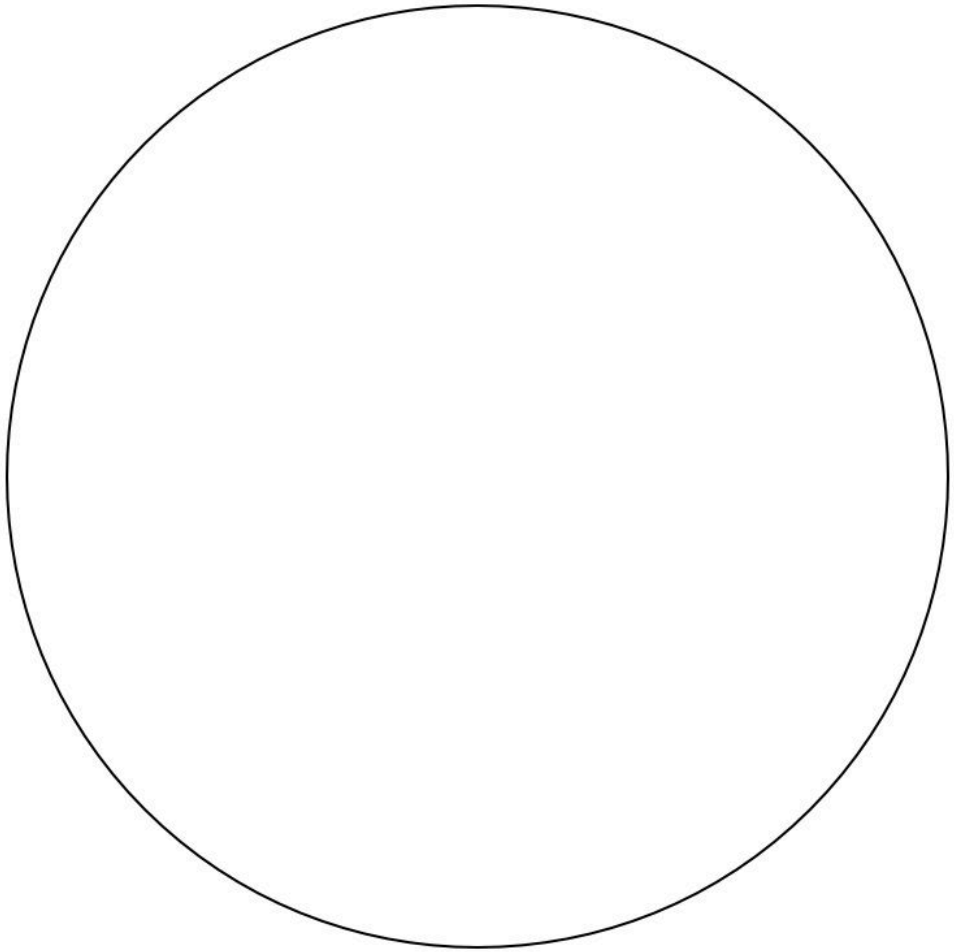
Director of Scientific Projects and Market Development, Cofactor Genomics

ACS Chemistry for Life®

YCC The Future of Chemistry

Illustrated Guide to a PhD By: Matt Might

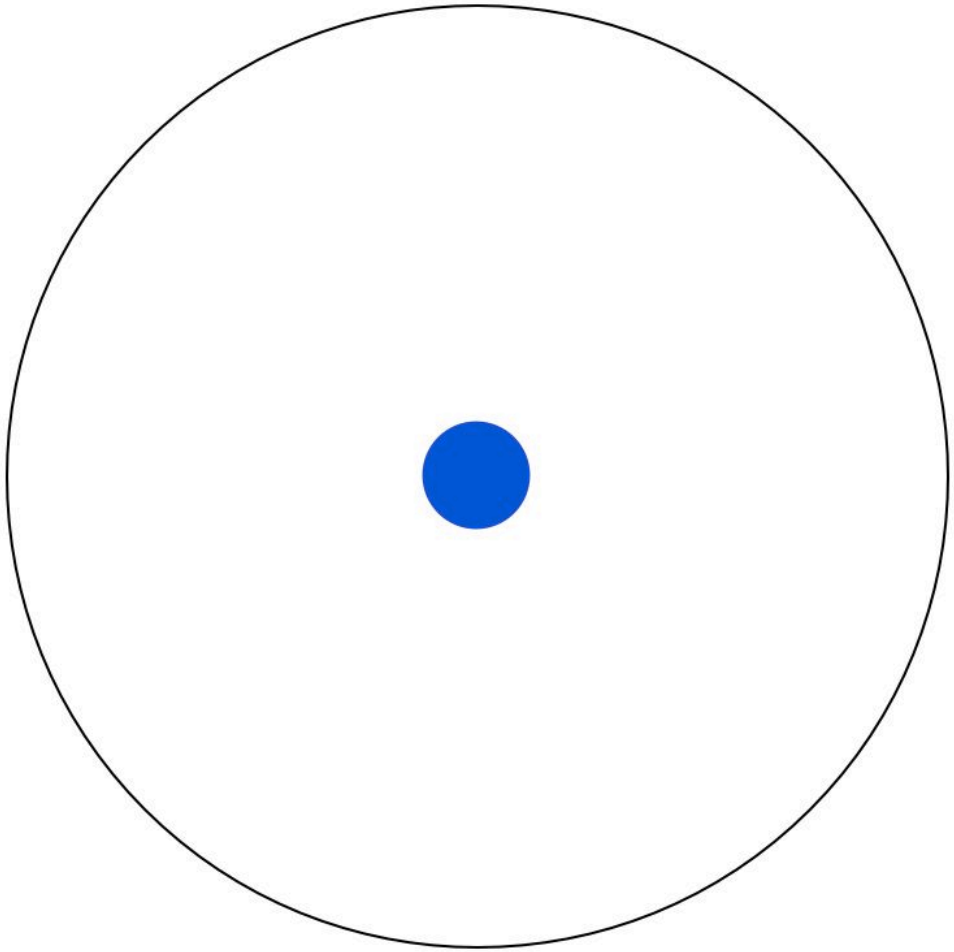
Imagine a circle that contains all of human knowledge:



http://matt.might.net/articles/phd-school-in-pictures/

Illustrated Guide to a PhD By: Matt Might

By the time you finish elementary school, you know a little:



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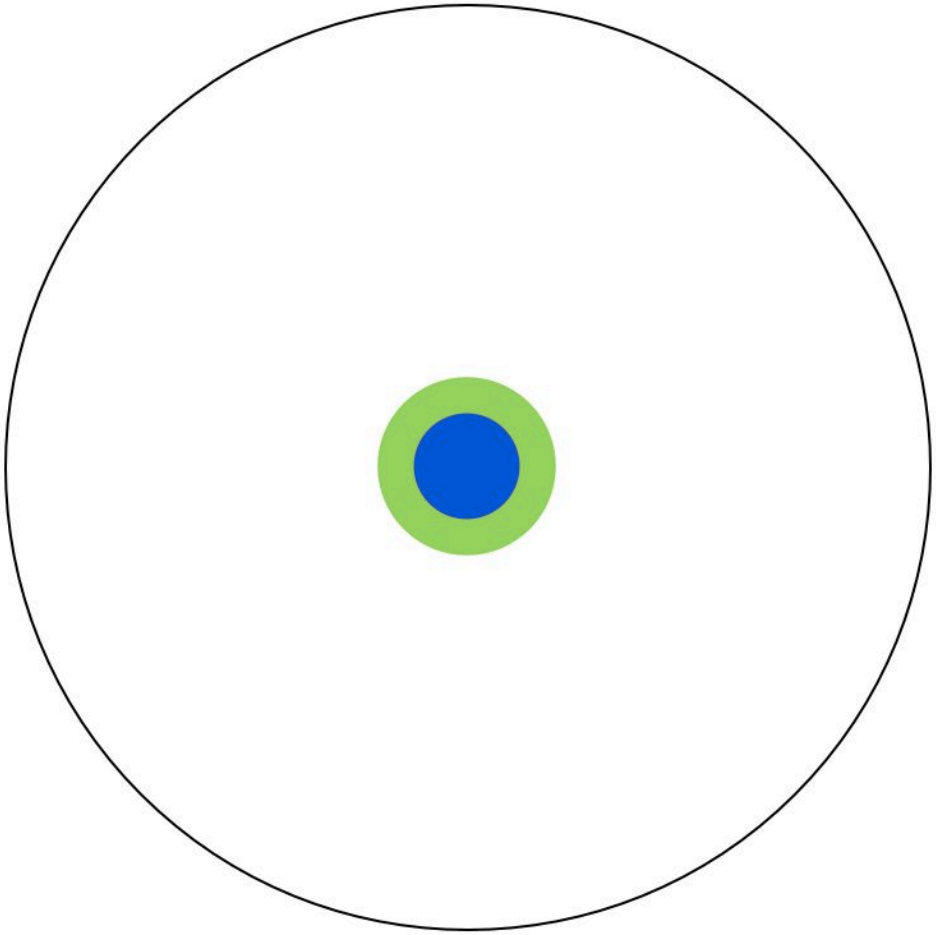
Illustrated Guide to a PhD By: Matt Might

By the time you finish high school, you know a bit more:



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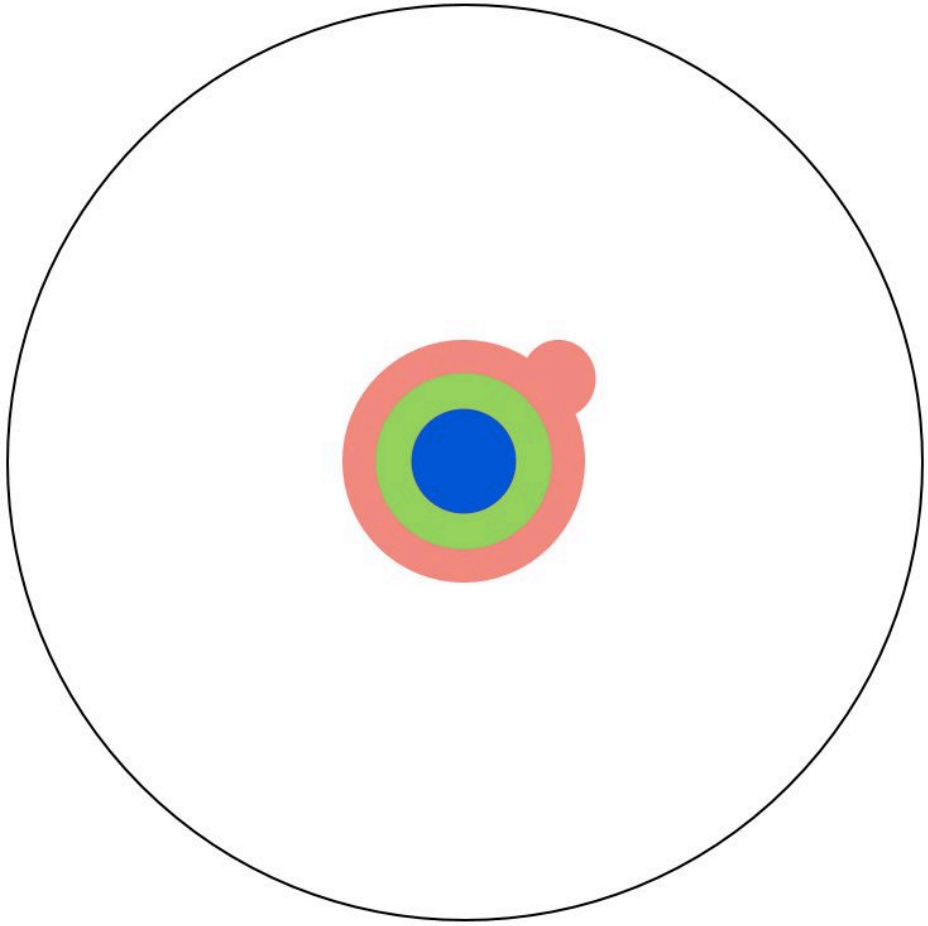
Illustrated Guide to a PhD By: Matt Might

With a bachelor's degree, you gain a specialty:



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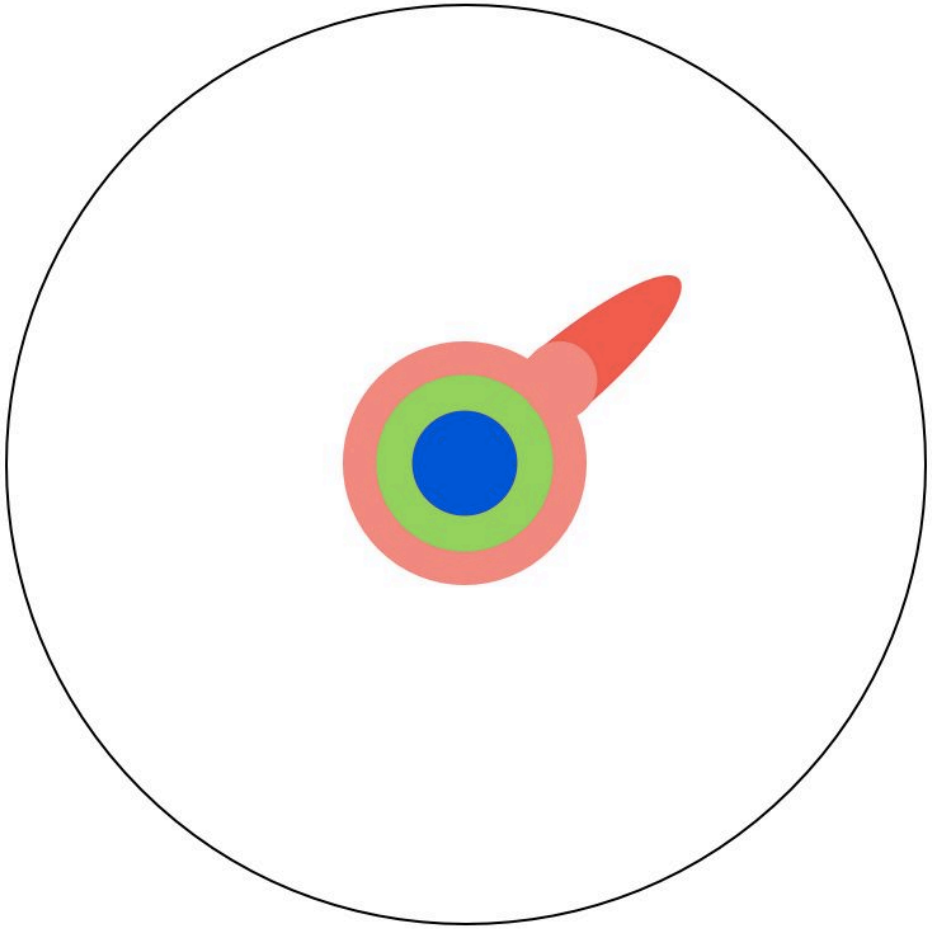
Illustrated Guide to a PhD By: Matt Might

A master's degree deepens that specialty:



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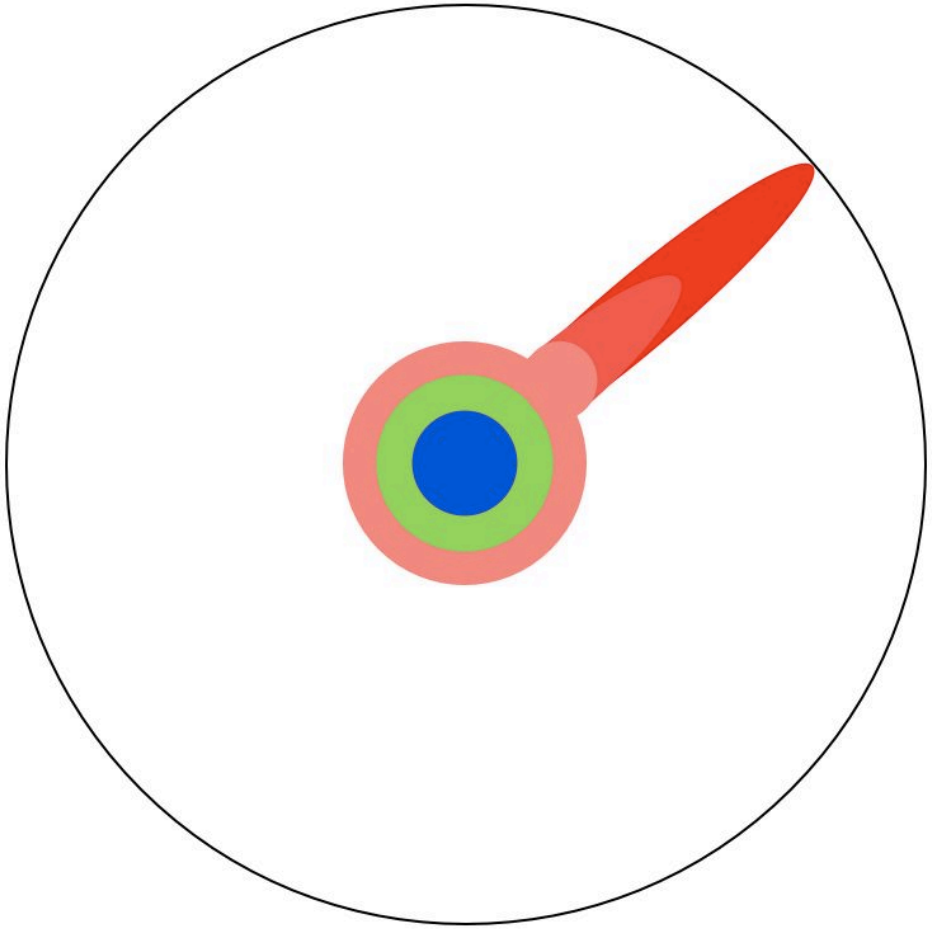
Illustrated Guide to a PhD By: Matt Might

Reading research papers takes you to the edge of human knowledge:



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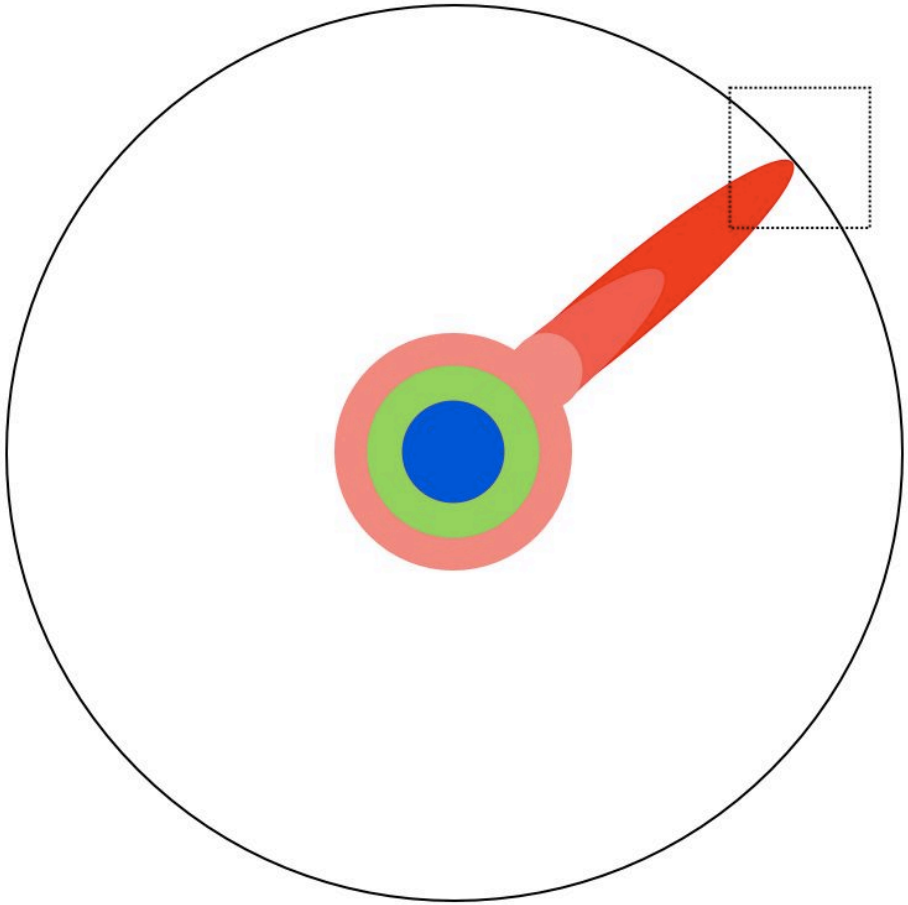
Once you're at the boundary, you focus:



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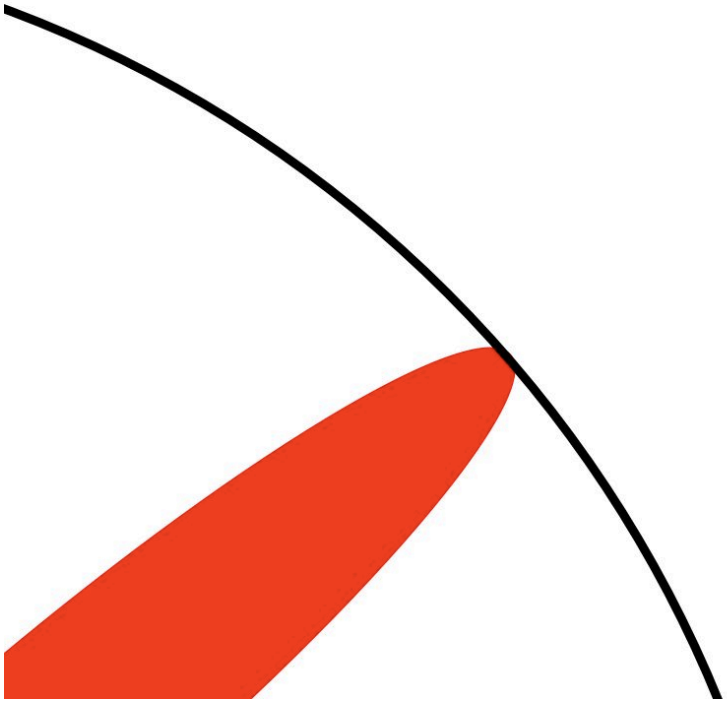
Illustrated Guide to a PhD By: Matt Might

You push at the boundary for a few years:



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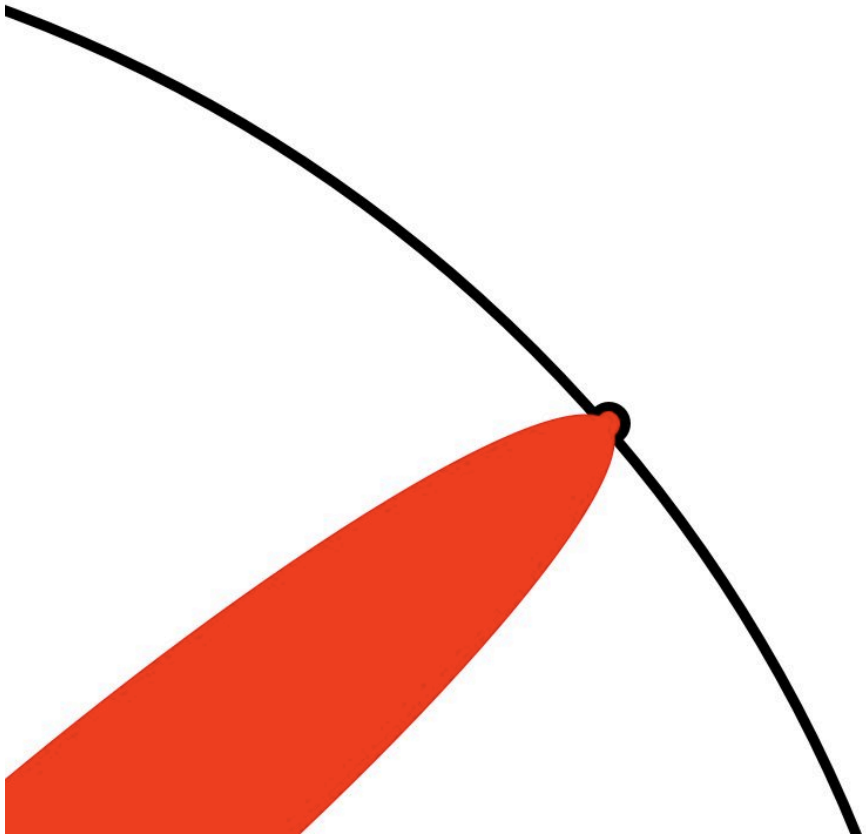
Illustrated Guide to a PhD By: Matt Might

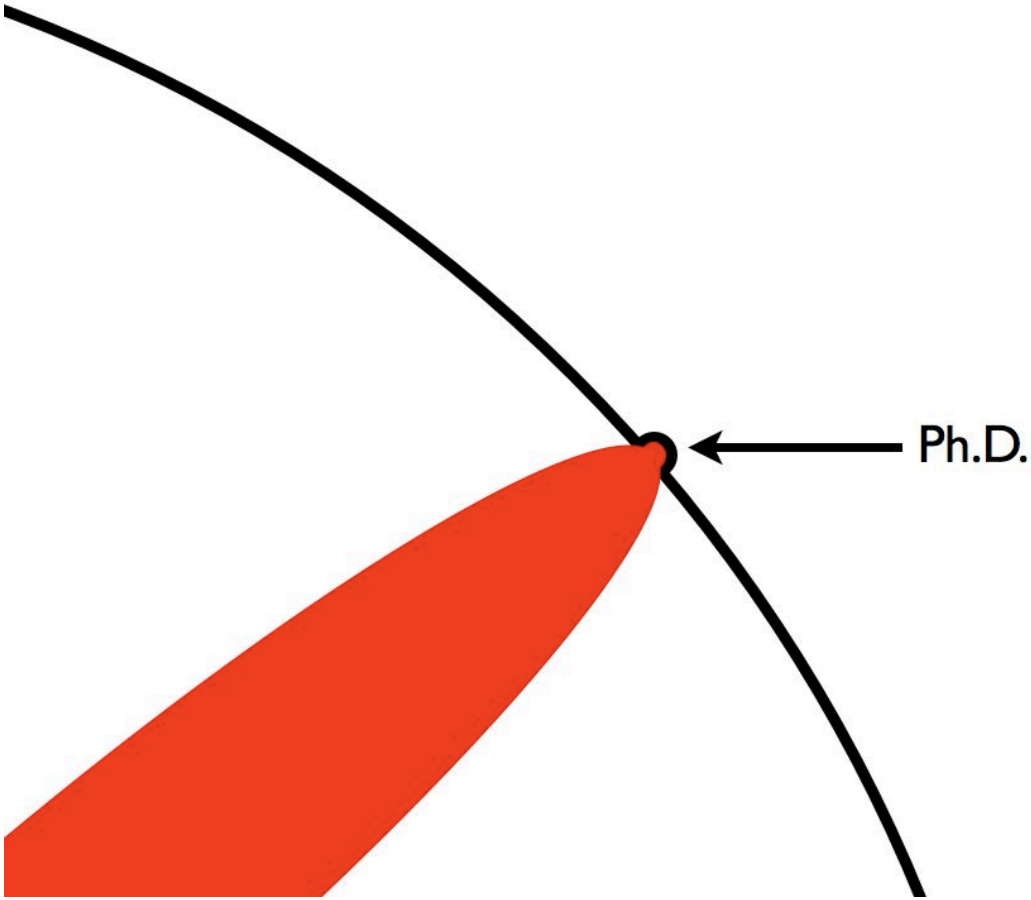
One day, the boundary gives way:



http://matt.might.net/articles/phd-school-in-pictures/

Illustrated Guide to a PhD By: Matt Might

And, that dent you've made is called a PhD:



http://matt.might.net/articles/phd-school-in-pictures/

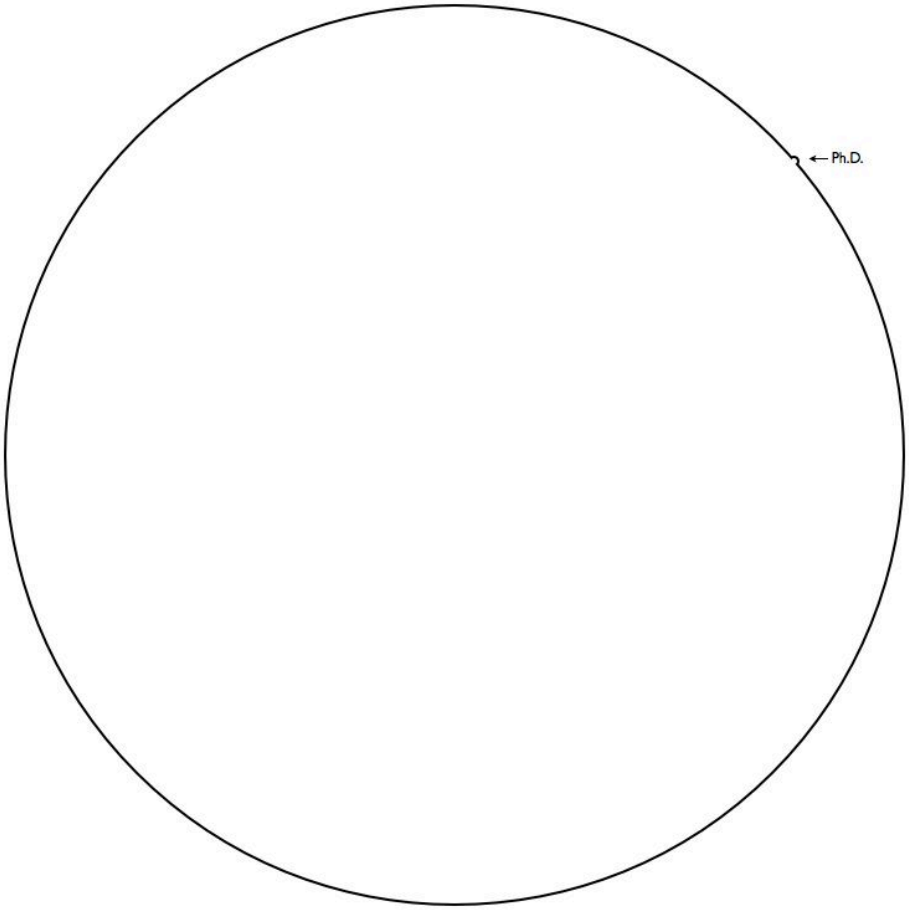
Illustrated Guide to a PhD By: Matt Might

Of course, the world looks different to you now:

http://matt.might.net/articles/phd-school-in-pictures/

Illustrated Guide to a PhD By: Matt Might

So, don't forget the bigger picture:



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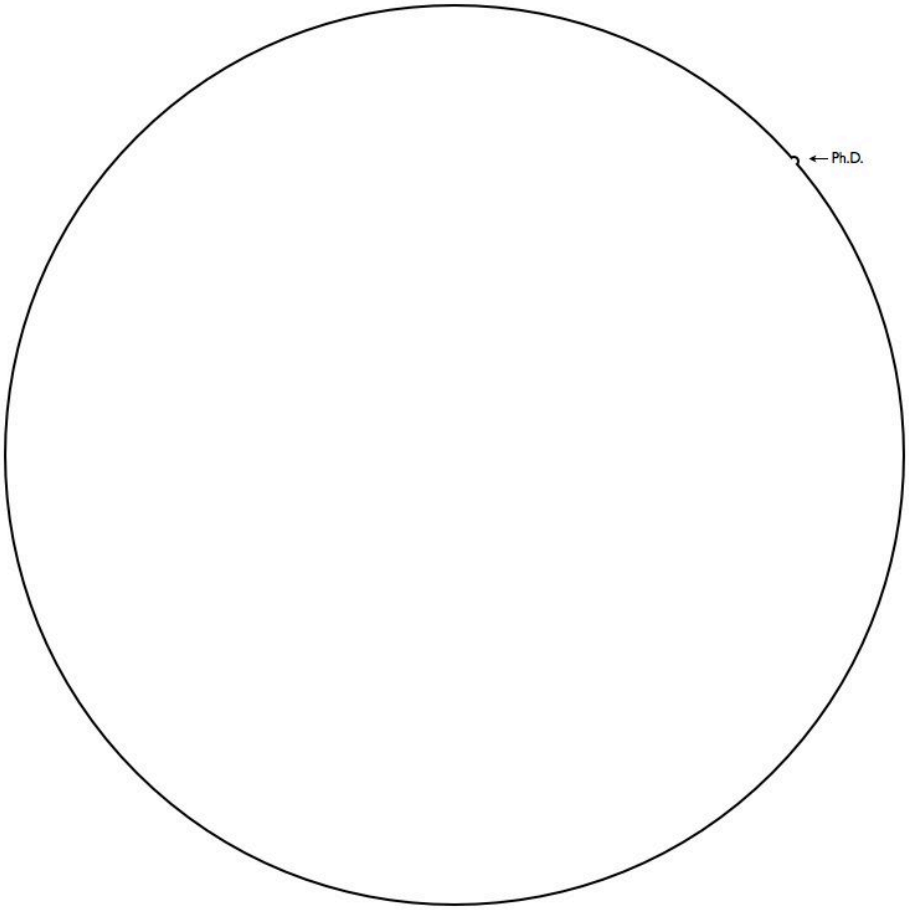
Illustrated Guide to a PhD By: Matt Might

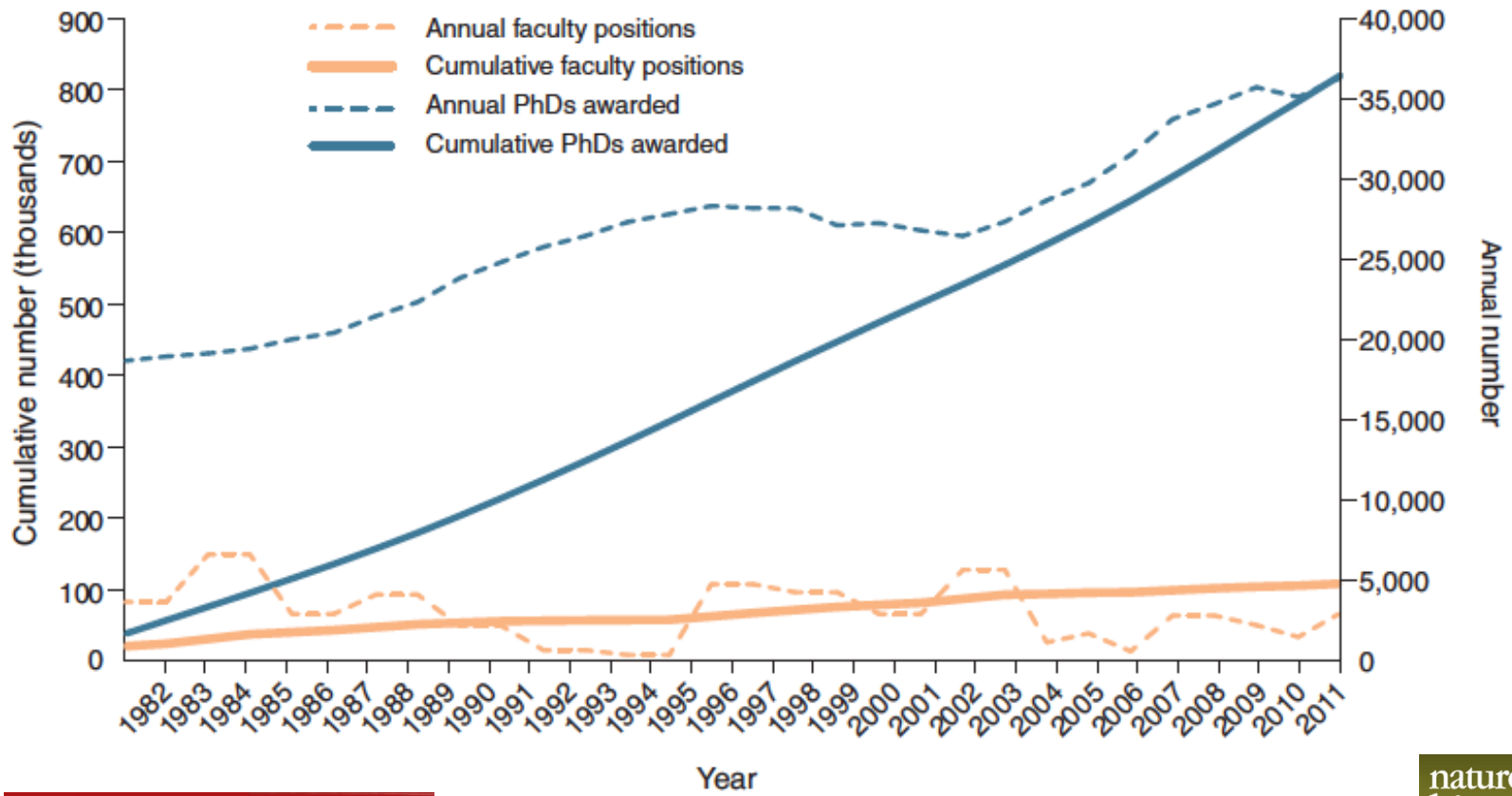
So, don't forget the bigger picture:



Keep Pushing.

http://matt.might.net/articles/phd-school-in-pictures/

Career Paths for PhDs in US



Science Careers From the journal Science

Issues & Perspectives

In Person: Consulting for Career Enhancement

genomeweb Genome Technology

Student-Run Consulting Group Aims to Bridge the Gap Between the Bench and Business

nature biotechnology

The missing piece to changing the university culture

My personal story and advice

1. **Follow (and expand and nurture) your passions**
   - Scientific and personal

2. **Learn how to work with people who see things differently than you**
   - Seek and relish in these experiences

3. **Be open to trying new things**
   - Don’t question your ability to learn

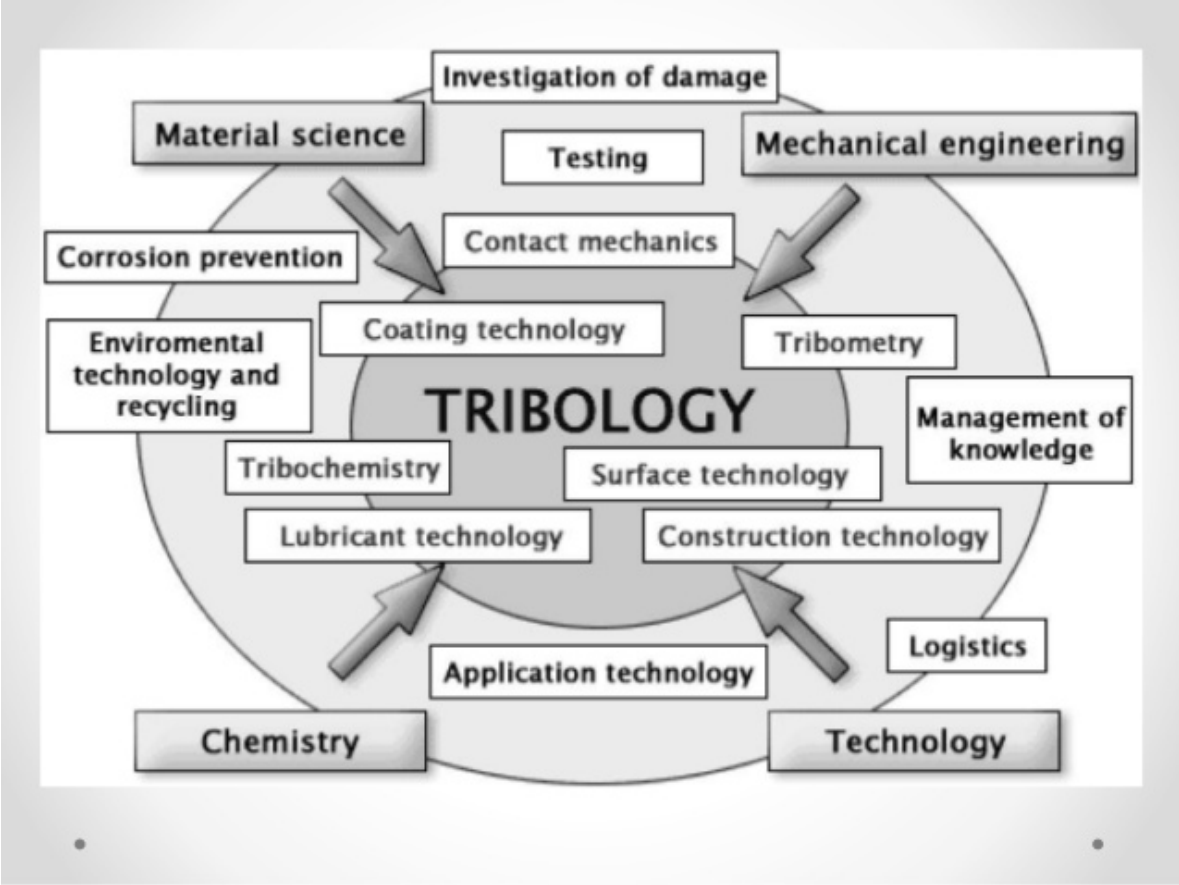
4. **Science is not static**
   - Know when to pivot

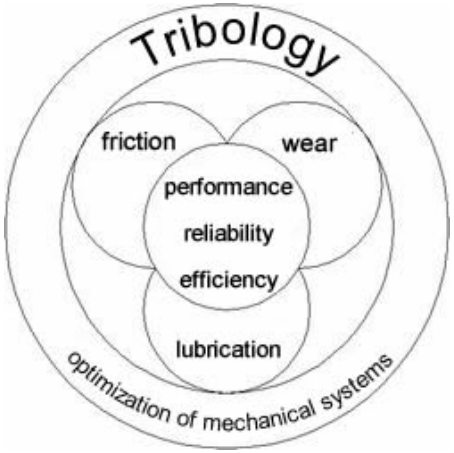
Where I started

BRADLEY™

United States Department of Agriculture
National Center for Agricultural Utilization Research

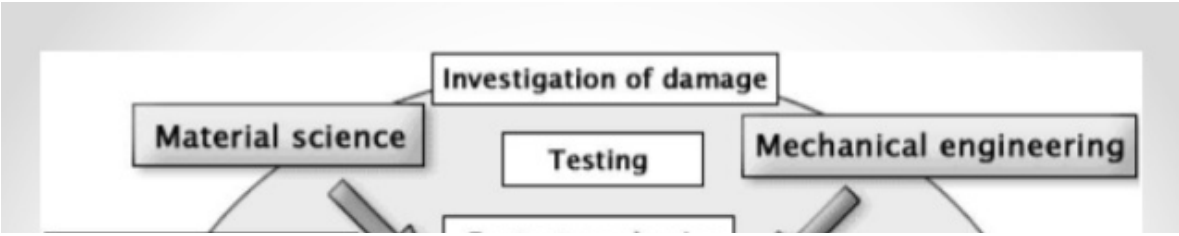
Tribology and publishing





https://pt.slideshare.net/Pulkkit009/tero-technology-and-tribology-maintenance-management

Tribology and publishing



J Amer Oil Chem Soc (2007) 84:281–288 287

Rheology

Although all the samples were visibly homogeneous, consistent results in the magnitude of the shear storage modulus were difficult to obtain. Network strength of a gel-forming material can be judged from G', the shear storage modulus, which reflects the ability of a material to store elastic energy that is recoverable through elastic deformation of the bonds. Thus, when extensive crosslinking occurs in a system so that it becomes one vast network, G' increases.

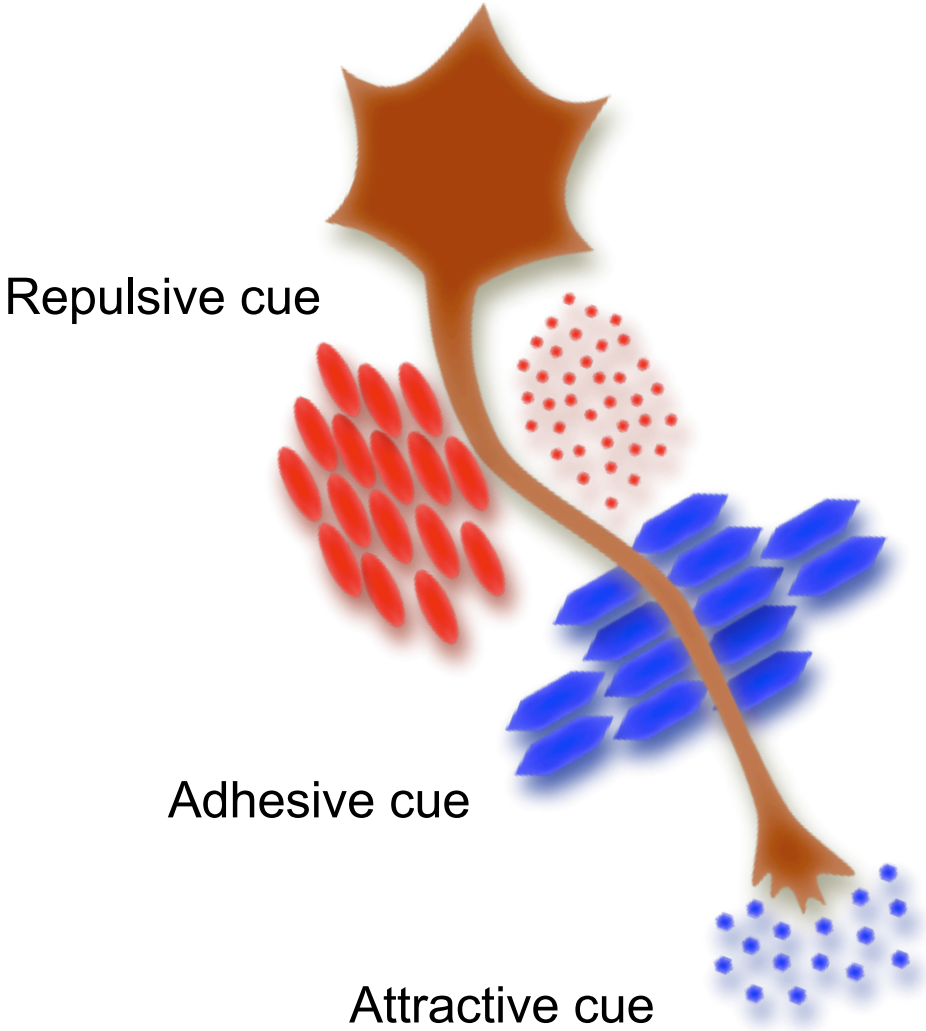
Figure 5 shows the averaged strain sweep data for the barley flour and BPI samples. The reproducibility of the magnitude of G' was poor. Error bars for both the defatted barley-flour samples (empty points) and the acetylated and crosslinked BPI sample (filled down triangles) all had a fair amount of overlap. The symbols other smaller structures that yield a lower G' value for the entire sample. This was consistent with the reduced solubility associated with crosslinked proteins.

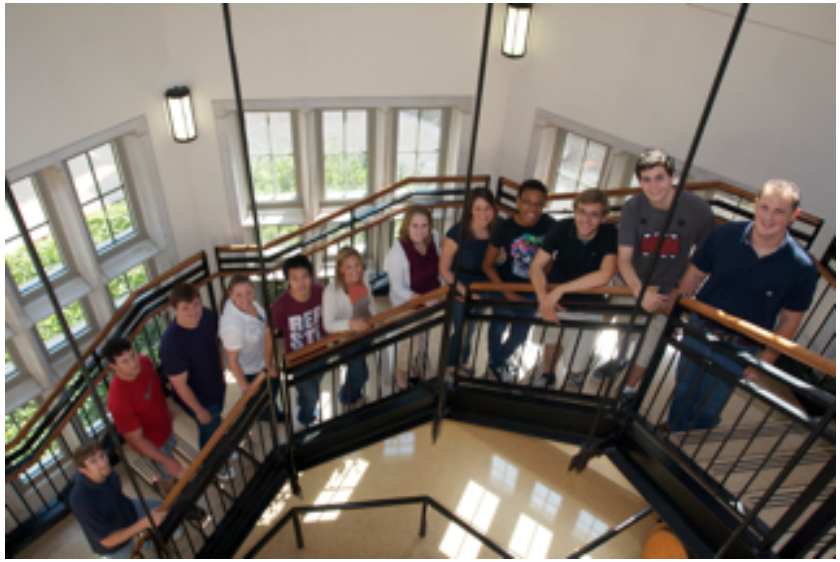
Acknowledgments The authors would like to thank Jason Adkins for his technical support and Natalie Lafranzo for conducting the surface-tension measurements. The surface hydrophobicity of BPI was doubled compared to native protein in barley flour due to denaturation.

References

1. Benetrix F, Sarrafi A, Autran JC (1994) Effect of genotype and nitrogen nutrition on protein aggregates in barley. Cereal Chem 71:75–82
2. Robin GS, Pomeranz Y (1971) Composition and utilization of milled barley flour. I. Gross composition of roller-milled and air classification fractions. Cereal Chem 48(1):47–51

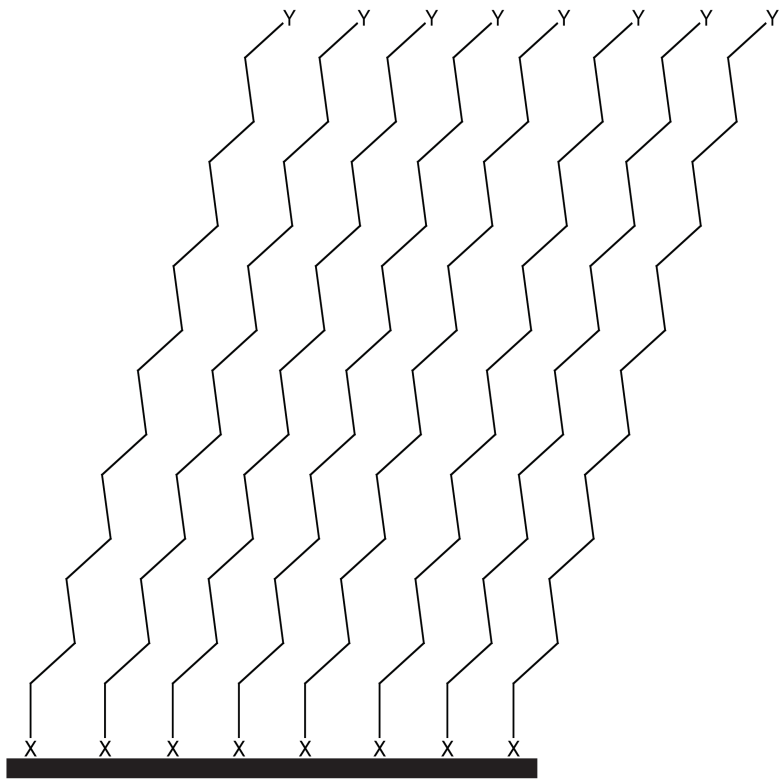
Graduate School - Washington University in St. Louis



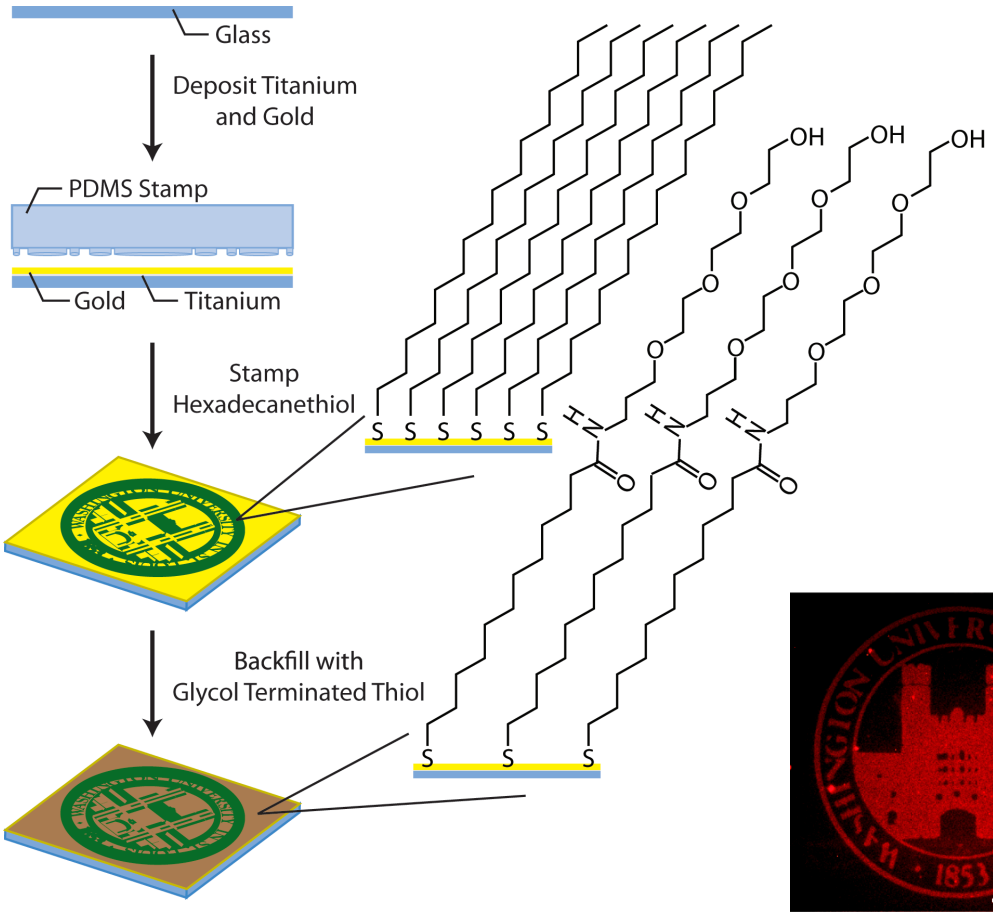


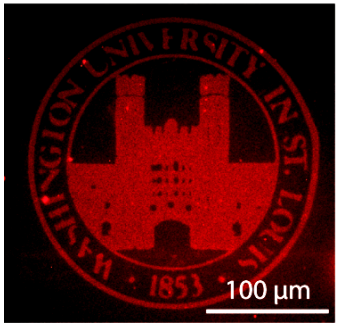
Chemical Tools for Biological Applications

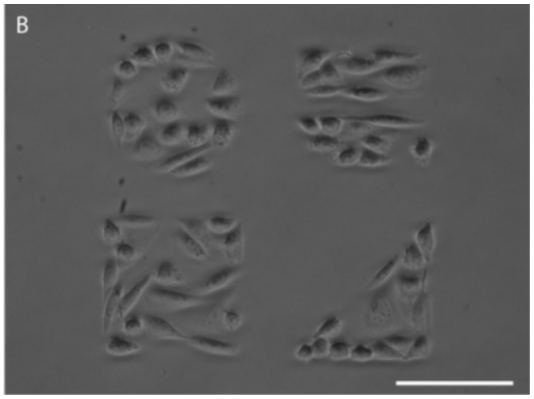
- Surface-reactive head group (X) and long alkane tail
- van der Waals interactions between alkane (carbon) chains facilitate order
- Tails (Y) may be derivatized to present desired functionality on surface



Patterning Surfaces – Proteins and Cells



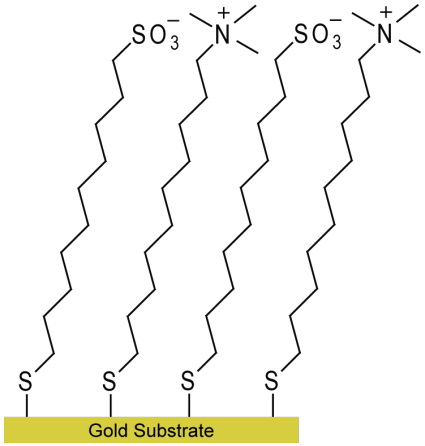


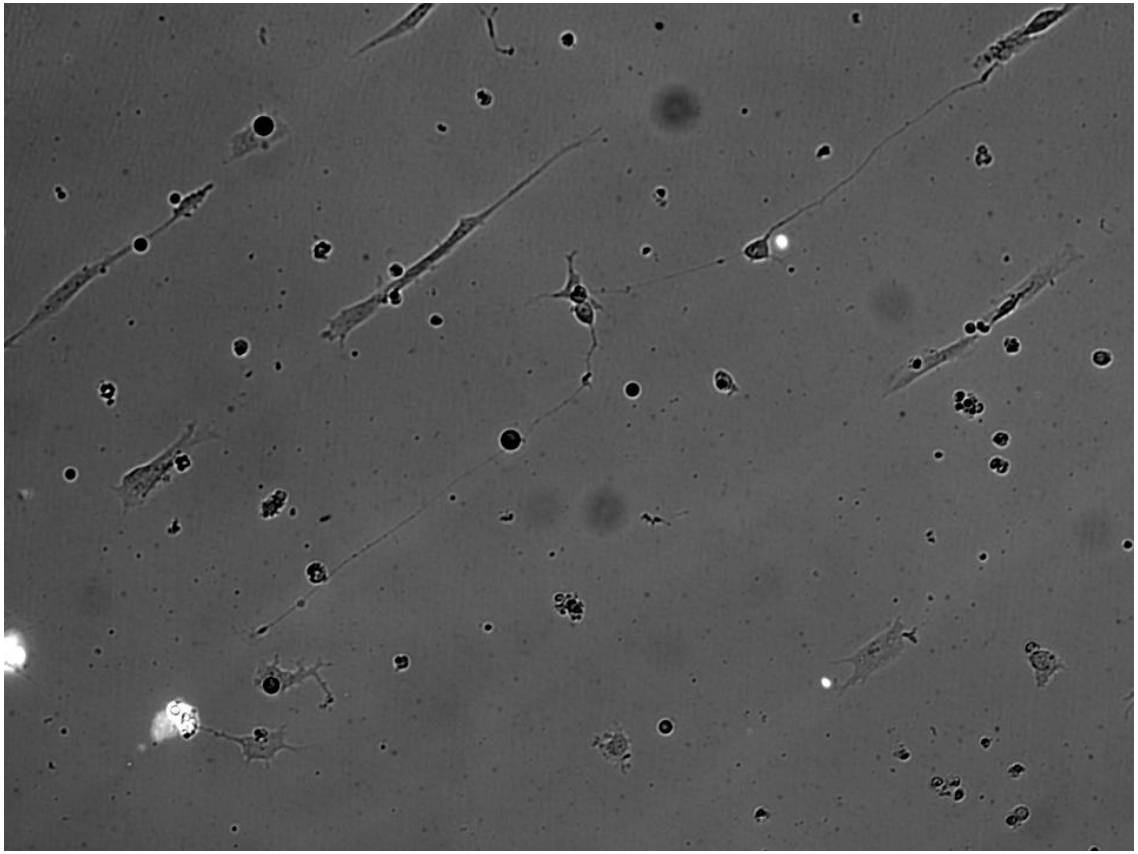


Johnson DM, LaFranzo NA, Maurer, JA. Creating Two-Dimensional Patterned Substrates for Protein and Cell Confinement. J Vis Exp. (55), e3164, DOI: 10.3791/3164 (2011).

Cell-permissive/Protein-resistant Surfaces

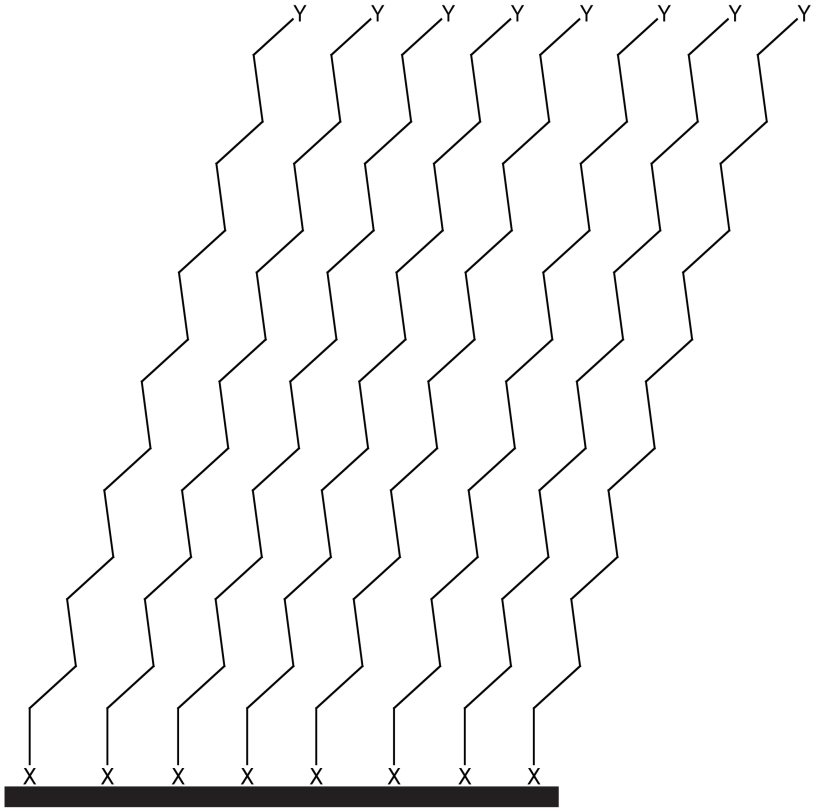
Collaboration with Heuckeroth Lab @ WU School of Medicine (enteric nervous system)

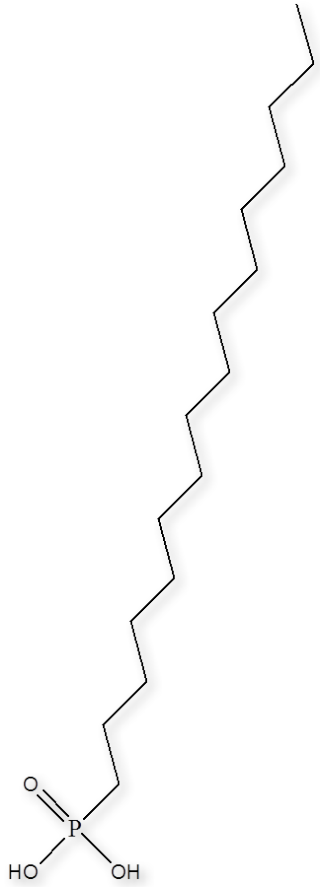


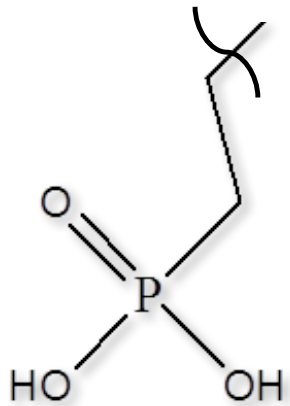


Protein structure image from RCSB Protein Data Bank

Gold is expensive – can we use a different substrate?

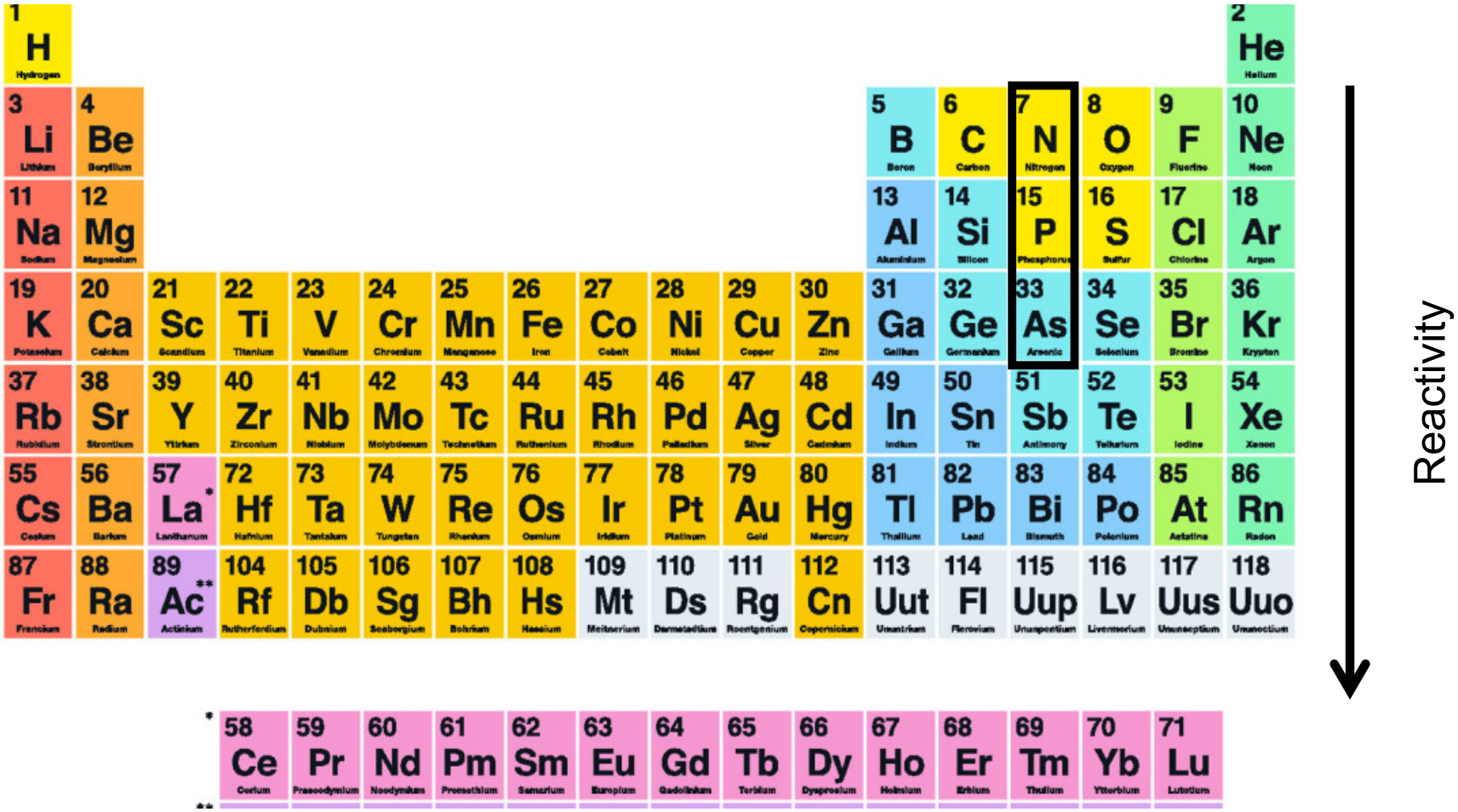




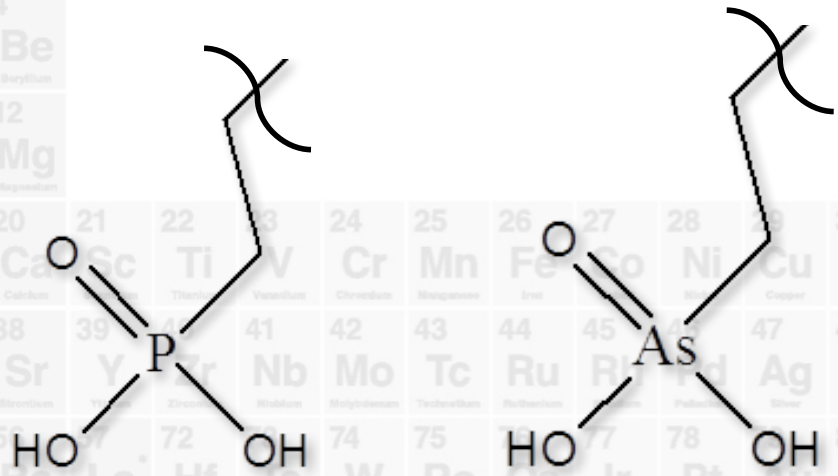


Phosphonate

Basic Chemistry - Reactivity



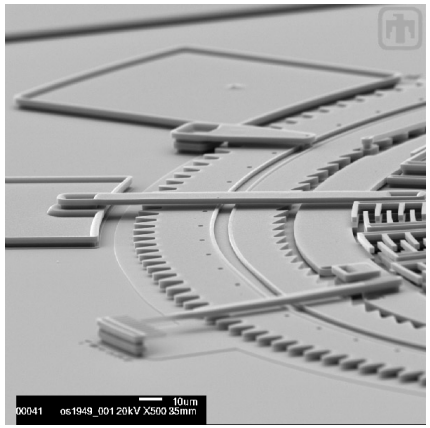
It works!



Reactivity

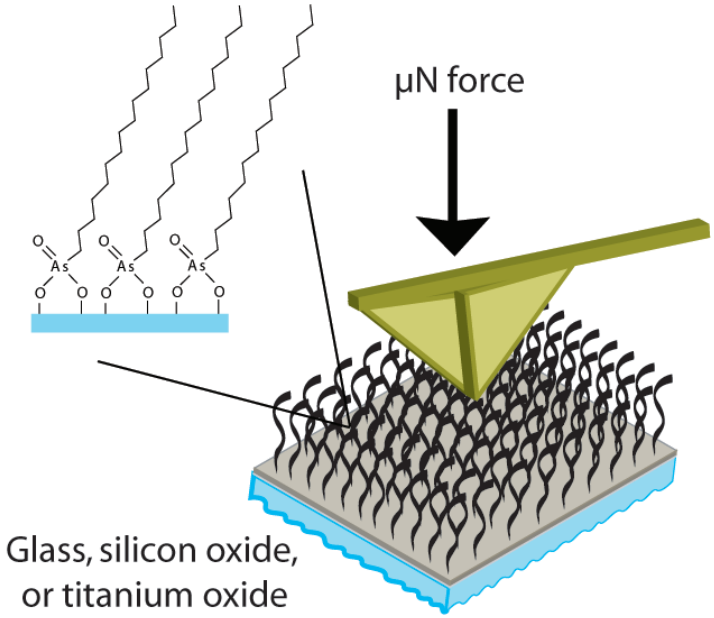
Throwback to USDA

- **Potential application as microelectromechanical system (MEMS) device lubricant**
  - Highly hydrophobic
  - Covalently attached to multiple substrates including metal oxides, silicon and glass
- **Evaluated feasibility using <u>nanotribology</u>**
  - Home-built contact angle meter
  - Contact-mode AFM
- **Don't forget to protect your technology**



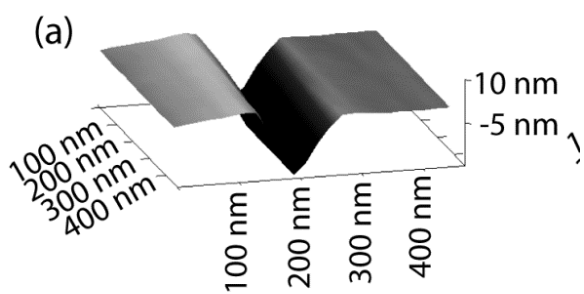
www.mems.sandia.gov

Tribology on the nanoscale

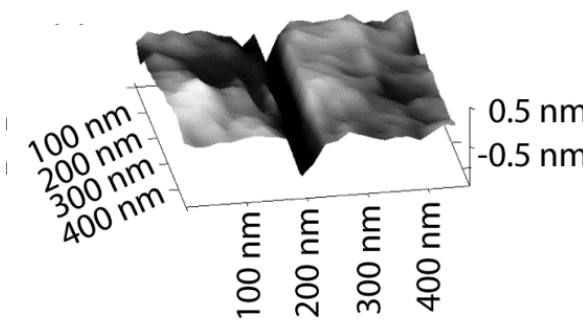


- **Diamond-tipped cantilever**
- **Evaluate ability to protect surface from micronewton nanomechanical forces**

Unfunctionalized Glass



Functionalized Glass



One more example…

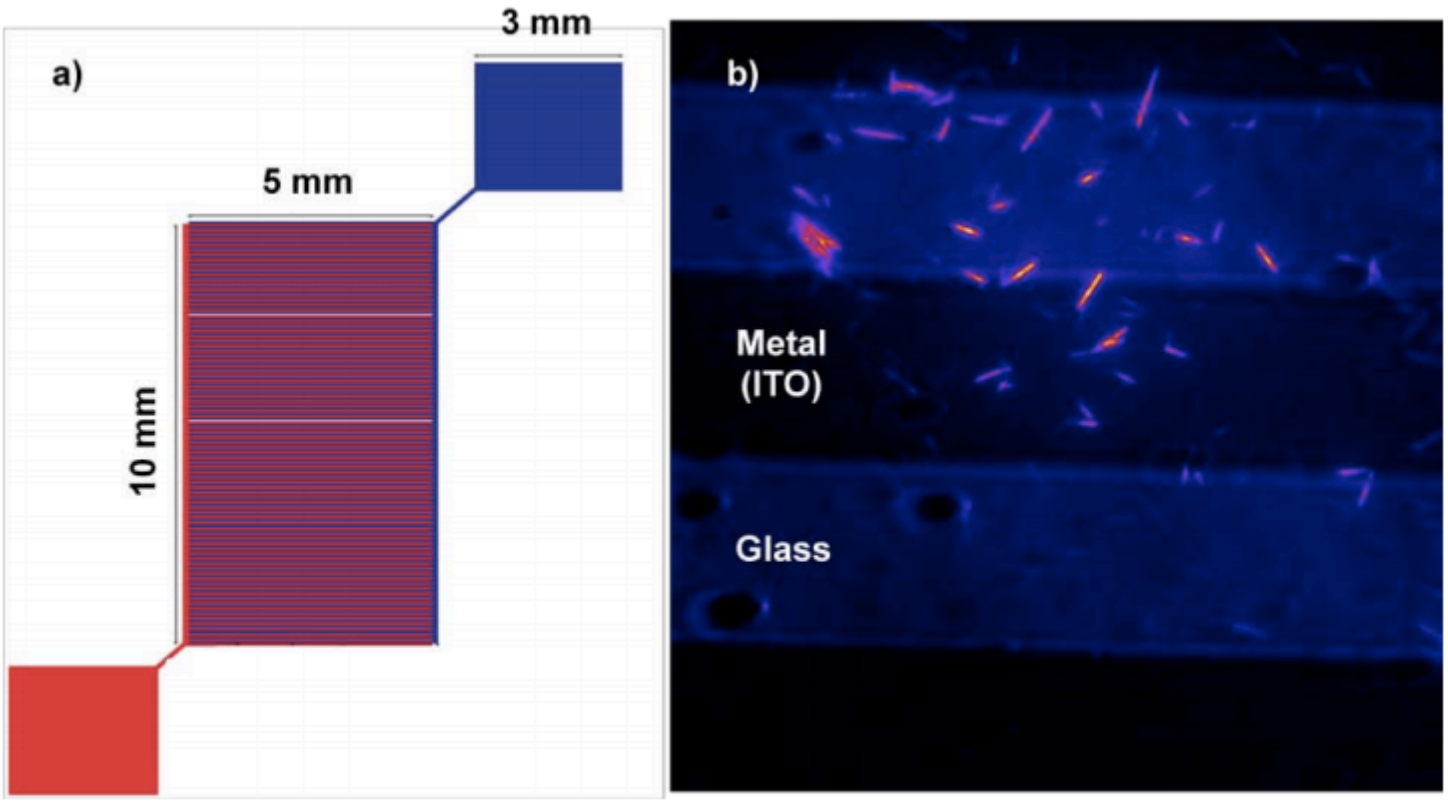


Figure S2. a) The mask pattern used to make the ITO electrodes on glass coverslips. b) A wide-field image of CdSe QWs spin coated on a patterned coverslip.

Wayman, et al. Journal Of Physical Chemistry Letters, 2012 Sep 20, Vol.3(18), pp.2627-2632

Don’t lose your personal passions

Consider all paths

nlafranzo@bradley.edu 8/10/12

to nlafranzo

nlafranzo@bradley.edu has forwarded you this craigslist.org posting.

Please see below for more information.

Visit the posting at http://stlouis.craigslist.org/sci/3195159259.html to contact the person who posted this.

Project Scientist

Date: 2012-08-09, 5:10PM

Cofactor Genomics is a growing and rapidly evolving company seeking talented individuals to help support our next-generation sequencing operations. A privately held biotechnology company based in St. Louis, Cofactor employs experimental design, next-generation sequencing, and proprietary analysis technology and pipelines to accelerate its partners' biological research, discovery and product development in a number of scientific areas worldwide.

We're looking for a talented, ambitious scientist to help us apply and present our molecular, sequencing, and analysis solutions to our client's interesting and challenging questions. The scientist will be expected to utilize their own diverse scientific experience as well as the experience of others on their team to design solutions. The position calls for technical aptitude and the ability to work with our library, sequencing, and analysis teams.

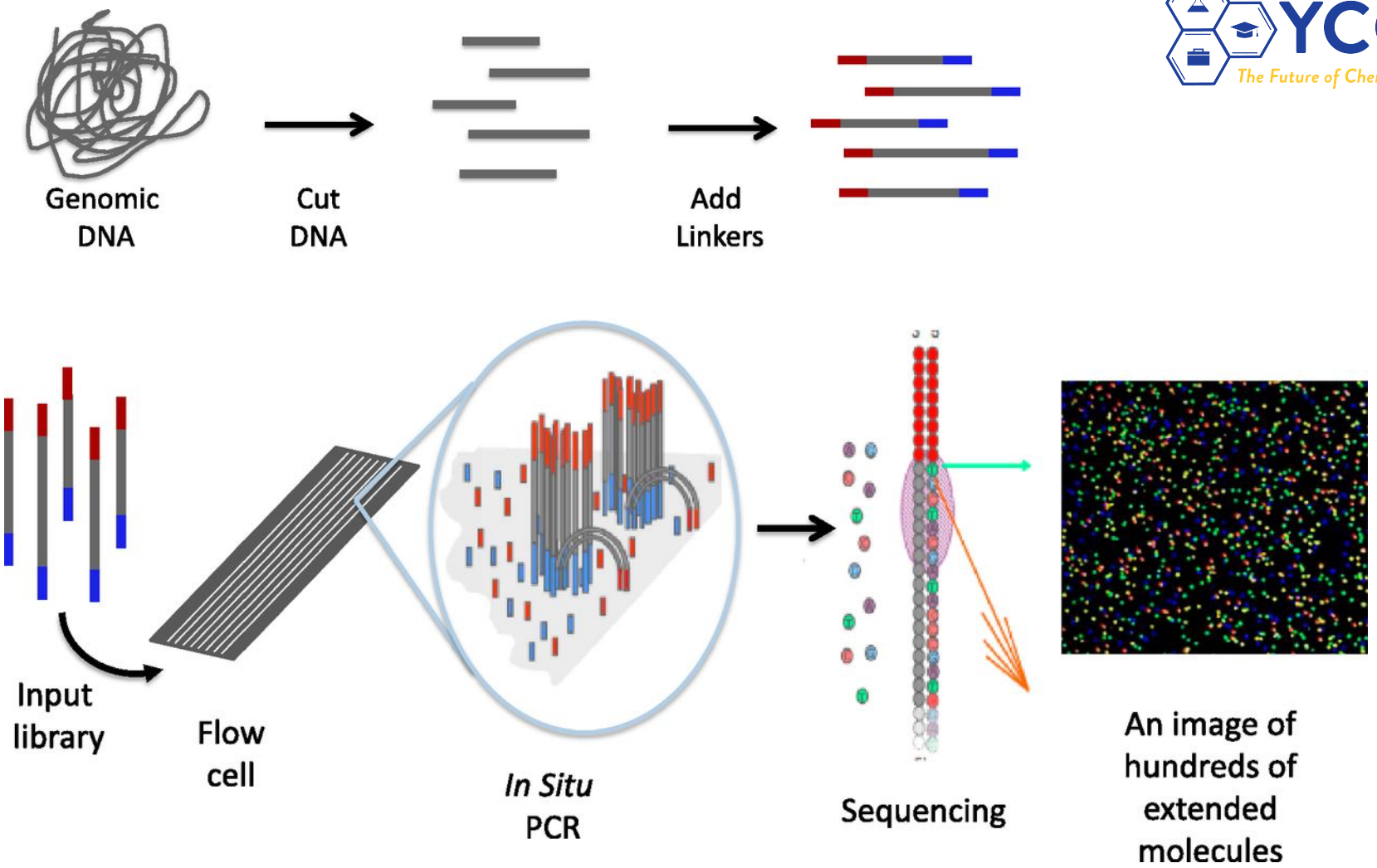
Communications skills are a must for this scientist, as it is a key component in experimental design at Cofactor. This position has exposure to some of the most interesting and exciting applications in genomic science today. While this is a technical position, the performance of the position is measured by meeting sales process goals and numbers.

This is a full-time position. To apply, please send a cover letter and CV to careers@cofactorgenomics.com.

- Location: Saint Louis City
- Compensation: Commensurate with experience
- This is a contract job.
- OK to highlight this job opening for persons with disabilities
- Principals only. Recruiters, please don't contact this job poster.
- Please, no phone calls about this job!
- Please do not contact job poster about other services, products or commercial interests.

Original URL: http://stlouis.craigslist.org/sci/3195159259.html

Finding a connection



http://www.bloodjournal.org/content/bloodjournal/122/19/3268/

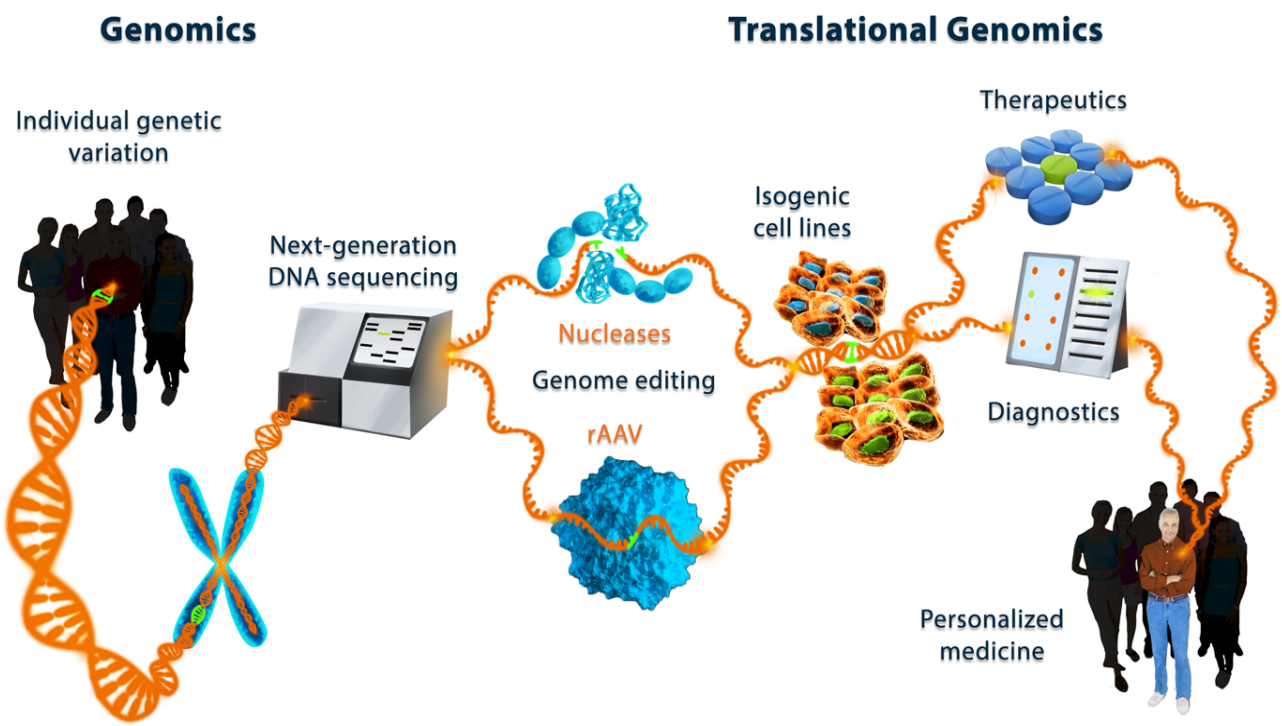
Consider all paths

- "Boutique" next-generation sequencing (NGS) contract research organization

Consider all paths

- "Boutique" next-generation sequencing (NGS) contract research organization
- Position: Project Scientist (1 of 10 employees)

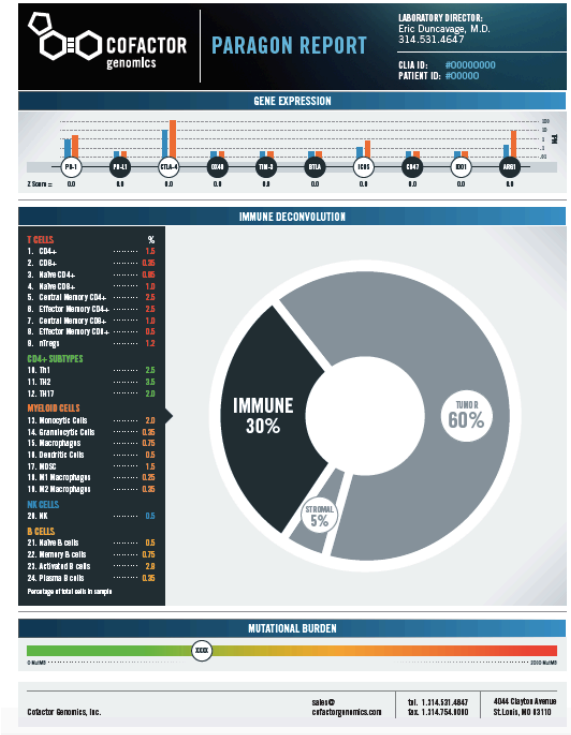
The Next Step – Horizon Discovery



Horizon's mission is *to be a fully integrated life science company that provides enabling products, services and research programs to clients engaged at every stage of the healthcare continuum from sequence to treatment.*

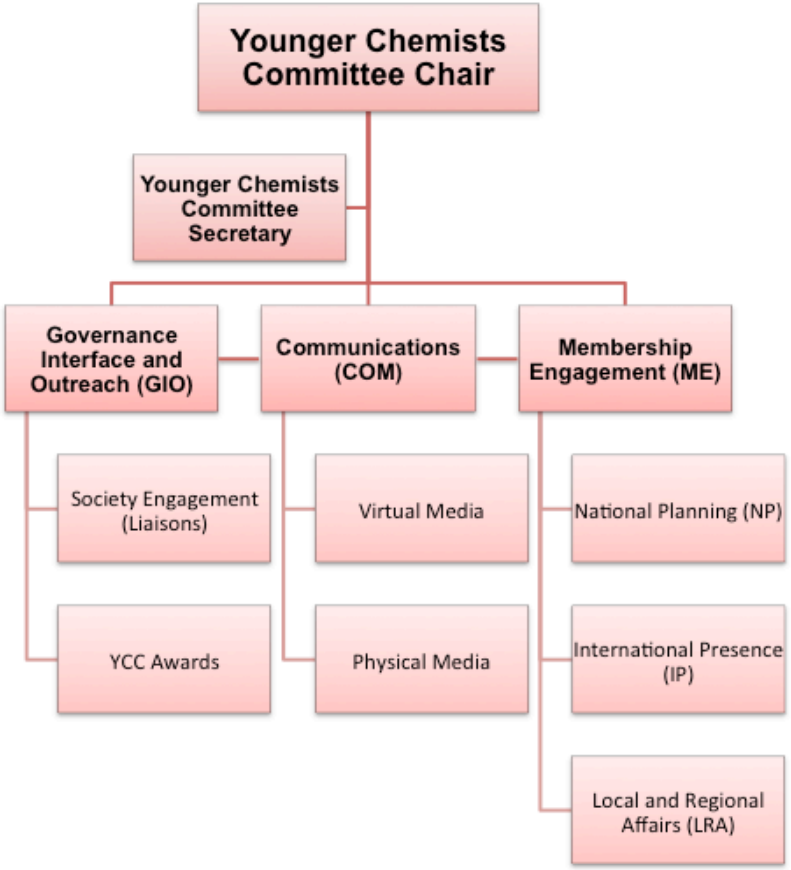
Don’t burn bridges… my return to Cofactor

- Transition/grow human health focus
- Career advancement
- Apply new skill sets from Horizon; take on larger responsibilities



Professional Development American Chemical Society

- Local Section – St. Louis ACS
  - Leadership Development
- National Younger Chemists Committee
  - Resources
    - Awards
      - Travel and Leadership Development
    - Programming at National Meetings
    - Networking
    - Domestic and International
    - Engagement with the larger Society and Global Societies



Professional Development American Chemical Society

- What you give will be returned many times over
- Meet mentors and colleagues who influence your career path
- Remain grounded in your identity as a chemist and scientist
- Find employers who value this; learn how to sell your involvement

My personal story and advice

1. **Follow (and expand and nurture) your passions**
   - Scientific and personal

2. **Learn how to work with people who see things differently than you**
   - Seek and relish in these experiences

3. **Be open to trying new things**
   - Don’t question your ability to learn

4. **Science is not static**
   - Know when to pivot and how to add value

Acknowledgements

- USDA – NCAUR – ARS
  - Dr. Girma Biresaw
- Dr. Joshua Maurer and Washington University in St. Louis
  - Graduate Advisor
  - NIMH
    - Graduate funding
- Cofactor Genomics
  - Current employer
- American Chemical Society Younger Chemists Committee
- IUPAC Organizers

Hard work does not necessarily guarantee success, but no success is possible without hard work.

- Dr T.P.Chia