

STEM Career Paths



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My own career path.....

Major in Biology
Minor in History
1981-1984

Initially Pre-Med

Then got two
Independent
Research
Experiences.....



W&M Research

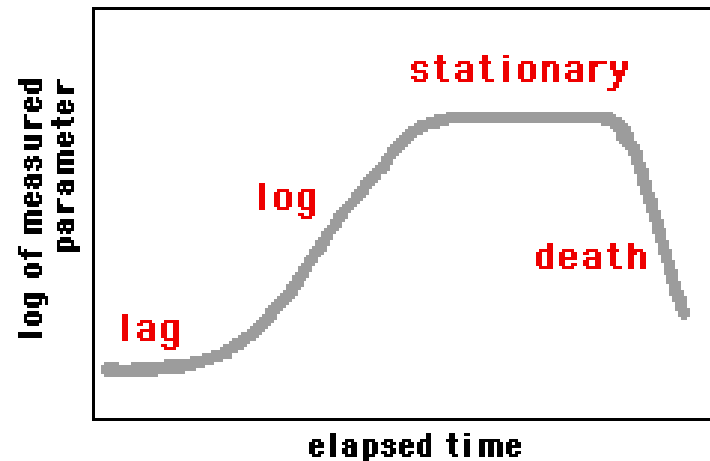
- Effects of Electromagnetic Fields on Mice-High Voltage Power Lines



<http://www.flickr.com/photos/darklordspet/3407652356/>

- RNA levels in E. coli in Steady State → resulted in first publication

PHASES
of the population growth curve



Graduate School

- Applied for Microbiology programs
- Went on a few interviews
- Offered a teaching assistantship and ability to work on interesting project at
- The Pennsylvania State University
- 1984-1989

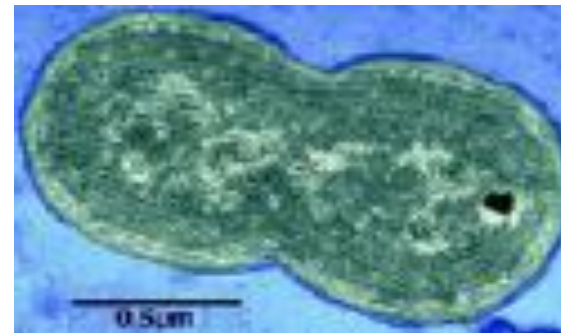


Cyanobacteria: Photosynthetic Microbes

- “The Effects of Various Environmental Stress Conditions on Gene Expression in the Cyanobacterium *Synechococcus* sp. PCC 7002”
- Photosynthetic Gene Expression studies using reporter gene fused to promoter
 - Variable light intensity
 - Nitrogen limitation
 - Carbon limitation
 - Phosphorus, Sulfur and Iron limitation



<http://www.jcu.edu/mcp/Cyano/Cyannot.htm>



<http://www.cs.umd.edu/class/spring2006/cmssc838s/hw2/phillippy/>

Grad School Experience

- Teaching Assistantship (I liked teaching!)
- Research Experience
 - Experimental Design
 - Problem Solving
 - Writing
 - Presentation of Research at Professional meetings (Oral and Poster Sessions)

Post Doctorate Fellowship

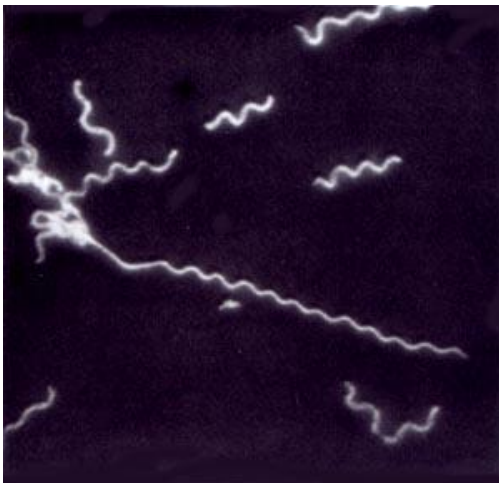
- Research Associate
- Insect Biocontrol Laboratory
- Beltsville Agricultural Research Center
- U.S. Department of Agriculture
- 1990-1996



Two Projects

- Spiroplasmas as Biocontrol agents
- Characterization
- Phylogeny-evolutionary relationships

- Determine source of Mediterranean Fruit Fly infestations
- DNA Fingerprinting Techniques



http://www.srpv-midi-pyrenees.com/_publique/sante_vgtx/organismes_nuisibles_et_lutte_obligatoire/fiches/spiroplasma_citri.htm

<http://comenius.susqu.edu/bi/202/EUBACTERIA/FIRMICUTAE/aphragmabacteria-frame.htm>



http://www.greenharvest.com.au/pestcontrol/med_fly_intro.html

Postdoctoral Experience

- Grant Writing
- Independent Researcher
- I love research-especially applied research to try to solve problems
- But I also missed teaching
- Time for a career move....

Faculty Position

- Faculty member in the Department of Biological Sciences
 - Assistant Professor
 - Associate Professor with tenure
 - Full Professor
 - 1996-present

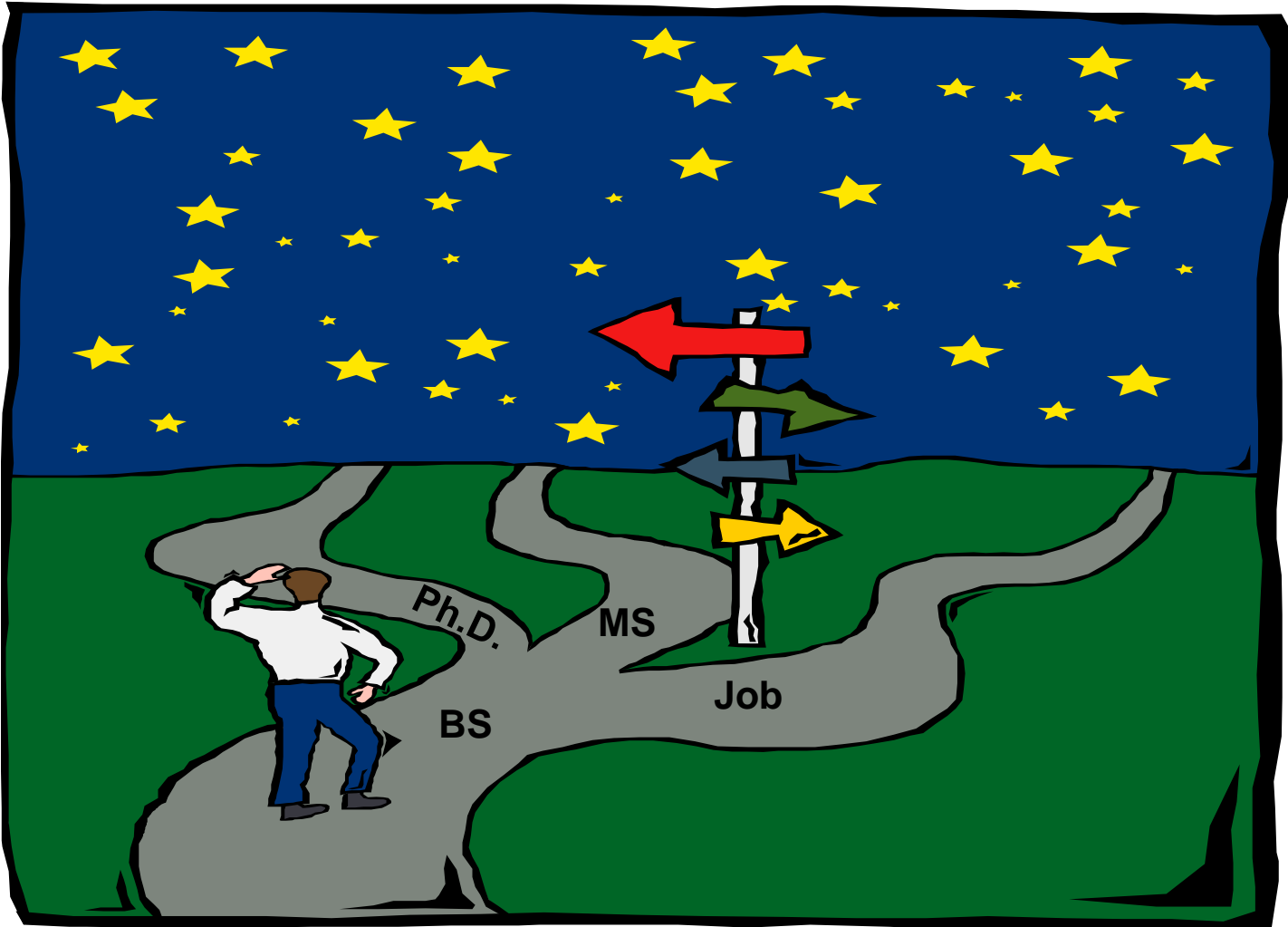


The Best of Both Worlds at

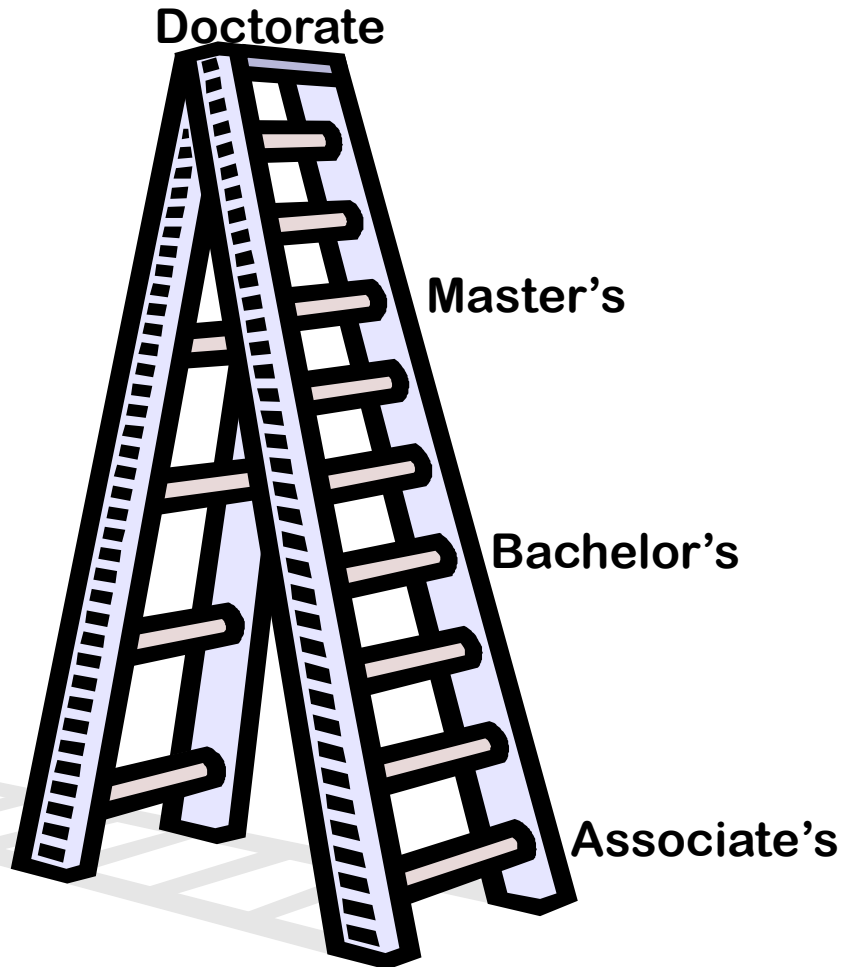


- Teach: Genetics, Bioethics, Molecular Biology and Biotechnology (undergraduate and M.S. graduate level courses)
- Research: Undergraduates and Graduate students
- Other Activities: Curriculum, Women in Science Program, Graduate Program, Bridges Program and Faculty Athletic Representative

What Pathway in STEM is Right for You?



Climbing the Academic Ladder



- Each step provides increased specialization

- Each step requires more time and energy to complete

- Each step provides more opportunity

Associates Degree

- For most students, 1st step towards higher education
- Prepares students for transfer into 4-year college/university
- Provide students with fast (~ 2 years) preparation for entry-level STEM jobs
 - Lab Technicians
 - Computer Support Specialist
 - Engineering technician
 - “10 Best-Paying Jobs for Associate Degrees”
<http://www.cnn.com/2006/US/Careers/05/04/cb.associates/>

10 Best-Paying Jobs for Associate Degrees

1. **Computer specialist -- \$59,480**
2. **Nuclear technician -- \$59,200**
3. **Dental hygienist -- \$58,350**
4. **Radiation therapist -- \$57,700**
5. **Nuclear medicine technologist -- \$55,840**
6. **Fashion designer -- \$55,840**
7. **Aerospace engineering and operations technician -- \$52,500**
8. **Diagnostic medical sonographer -- \$52,490**
9. **Registered nurse -- \$52,330**
10. **Engineering technician -- \$49,440**

Bachelor's Degree

- Time to completion ~ 4 years (less time for students w/AA degrees)
 - Completion of AA degree not required to obtain BS degree
- Opportunity to do on-going undergraduate research
- Prepares student for (1) entry-level STEM career or (2) graduate school
 - Scientist (Microbiologist, Chemist)
 - High School Teacher
 - Computer Scientist
 - Engineer

Master's Degree

- Post graduate degree, ~2-3 years to completion
- Typically contingent on having a bachelor's degree, some programs offer dual bachelor's and master's degree
- Non-thesis based vs thesis based master's
 - Non-thesis based: coursework with examinations
 - Thesis based: coursework, examinations, and research project with formal thesis and defense
- Prepares students for mid-level STEM careers or doctoral study
 - High School/College teacher
 - Research Associate
 - Engineer

Doctorate Degree

- **Terminal degrees in STEM include:**
 - **Doctor of Philosophy (Ph.D.)**
- **Degree of ‘skilled teacher, scholar, and researcher’**
 - **Requirement for master’s degree depends on program**
 - **Requirements vary from school to school, but all involve high degree of specialization**
- **Long-term commitment (~6 years), prepares student for:**
 - **College/university professors**
 - **Industry/government researchers**
 - **Host of other ‘non-traditional’ careers in science**

Graduate School

- Complete switch from undergraduate experience
 - focused study on one subject area (bio, chem, physics)
 - No “electives” and other general ed. requirements
 - Within that area, focus on one category
 - (analytical chemistry, physical chemistry, organic chemistry...)
 - In essence, you are a professional student
 - No summer break, spring break, etc.
- Very close relationship with faculty
 - Take trips, go to their homes, watch their kids, speak in their absence, teach their courses when in their absence, etc....
- **INDEPENDENT LEARNING!!!!** (no hand holding)
 - You have to show that you can survive in the field on your own
 - A LOT of individual study so YOU need to LOVE WHAT YOU ARE DOING... OTHERWISE, DON'T DO IT!!!!
 - Don't be afraid to “not know”—the more you learn the more you realize how much you do not know

Where should I go to school?

- It's not where you go..It's who you work with—check out their publication record, grant support, time to graduate students, and talk with grad students in the lab when you interview
- Find a place you will be happy living in for 6 years
- Be open to different research opportunities (laboratory rotations first year)

- The best researchers in each field are not necessarily at the “best” institutions
- Select school based on what programs are available and quality of faculty
 - Can judge faculty by looking at # of citations
 - <http://www.ncbi.nlm.nih.gov/PubMed>

Most schools require:

- General GRE (Graduate Record Examination) test scores
 - pretty much equivalent to the SAT/ACT
 - English/vocabulary, mathematics, writing sample
- Take GRE subject test
 - chemistry
 - biology
 - physics
- Letters of recommendation (3)
 - Why it is important for faculty to know about you

How much does it cost to earn a PhD or a Masters Degree in most STEM disciplines?

IT'S FREE!

- Your tuition is waived
- You actually get PAID to get a Masters (Thesis Track) or PhD

“A graduate assistant (quarter-, half-, or three-quarter time) receives a stipend commensurate with the percentage time and grade level. Stipends are raised on an annual basis equivalent to the average University increase for that year. University-wide the median stipend is \$14,175 for this academic year. When in-state tuition is added to a grade 12, half-time assistantship, the package increases in value to \$25,857. When out-of-state tuition is added, the value of the package is \$36,031. Many of our students also receive additional financial support during the summer.”

(From The Pennsylvania State University Graduate Catalog)

Stipend

- During your 1st year (and maybe longer)
 - You will have to teach a class (TA) to earn your stipend
 - Most of the time lab sections
 - Sometimes “discussion” sections
- After passing comprehensive exams (usually after 2 years), you will be paid by your faculty advisor to do research
 - Choose a faculty member with adequate funding
 - So you can focus on research/studying and not teaching

Financial Aid

- You are still eligible to receive financial aid
 - Even though tuition is waived, you can still apply and get financial aid as if you did have tuition
 - Use this option responsibly because you do have to pay it all back

Financial Aid

Talk to current graduate students to find out about cost of living in the area (e.g. rent, food)

May want to take out maybe 1 or 2 semesters worth of loans as a “safety precaution” and then make due with the stipend (depending on your family situation of course)

Time

- MA, MS → 2 years
 - Take course work
 - Do small amount of research
 - Write Master's Thesis (30 – 50 pages)
 - Thesis Defense
- PhD → 4-6
 - Take course work (1st 2 years)
 - Pass written qualifying exams (end 2nd year)
 - Pass oral qualifying exams (summer 2nd early 3rd)
 - Do HUGE amount of research (3-4)
 - Write dissertation (100 – 500 pages) (5)
 - Dissertation Defense (5)

Anything you invent while at the school, is property of the school

- Dr. Robert Cade
 - U of Florida researcher
 - Football coach wanted to know why the football players did not have to urinate after a game even though they were drinking a lot of water
 - He researched it and invented sports drink
 - Got little to no \$ from it
 - Do you know what the product name is for what Dr. Cade invented?

After Graduate School

- Most PhD's have to do a “postdoc”
 - Move to another school (laboratory) and do 1-2 more years of research (30-35K, if you're lucky)
 - Gives you time to publish more papers
 - Develop more skills as a scientist

Salary Ranges

- In general, private industry is highest paying sector
 - 90K+ PhD, 60K MS
 - Procter and Gamble, Pharmaceutical industry
 - Pros/cons
- Government
 - 80K+PhD, 50K+ MS
 - Federal research labs (Army, NIH, NIST)
 - NSF
 - Pros/cons
- Teaching
 - 40-50K to start
 - Pros/cons

What can you do with your _____ degree?

- Chemistry
 - Forensics
 - Human Nutrition
 - Environmental Chemistry
 - Biotechnology
 - Cosmetic Industry
 - Industrial Quality Control
 - Waste Management
- Computer Science
 - Computer Programmer
 - Information Scientist
 - Network Administrator
 - Software Engineer
 - Simulation and Modelling
 - Web Developer

What can you do with your _____ degree?

- Mathematics
 - Statistician
 - Systems Analyst
 - Actuary
 - Cryptology
 - Forecast Modeler
 - Financial Auditor
 - Investment Manager
- Physics
 - Astronomer
 - Engineering
 - Instrumentation Development
 - Medical Imaging
 - Earthquake studies
 - Nuclear physics
 - Optics
 - Impact/ballistics tests

What can you do with your _____ degree?

- Biology
 - Botanist
 - Animal Care (Zoos/Aquariums)
 - Genetic Counseling
 - Biotech Industry
 - Pharmaceutical Company
 - Hospital Laboratory
 - Fish and Wildlife Services
 - Environmental Assessment
 - Air pollution analyst
 - Hazardous Waste Manager
 - Public Health
 - Forensic Science
 - Genetic Research
 - Bioinformatics
 - Allied Health Careers

Alternative STEM Careers

- Patent/Environmental Law
- Pharmaceutical Sales
- Consulting
- Air Traffic Controller
- Non-profit Organizations
- Web/Graphic Design
- Science Illustrator
- Science Writer
- Accountant/Banker
- Federal Regulatory Agencies
- Government Science Policy
- Law Enforcement
- Management (Biotech/Pharma companies)

Things To Remember

- It's not where you go, it's who you work with
- Advanced STEM degrees are mostly FREE
- HUGE time/effort commitment
- You have to love what you are doing
- Many Career Options Open to you



Questions

