Career Opportunities for Physics Majors

building career preparation into the undergraduate physics experience

Toni Sauncy, TLU Department of Physics
Former Director – Society of Physics Students & Sigma Pi Sigma

The Physics Career Pathways Project
American Institute of Physics - Education Division
Figure 1. Physics Bachelor’s Conferred in the US, 1988 through 2013

http://www.aip.org/statistics
Overview

- About the Project
- Motivating Data
- Research & Resources
- Discussion
  - adding to SPIN-UP
Project Personnel

Project Investigators

• Thomas Olsen, former Assistant Director – Society of Physics Students
• Kendra Redmond, Programs Manager – Society of Physics Students
• Roman Czujko, Director – AIP Statistical Research Center
• Toni Sauncy, former Director – Society of Physics Students and Sigma Pi Sigma

Student Contributors-SPS Summer Interns

• Amanda Palchak, University of Southern Mississippi (2011)
• Shouvik Bhattacharya, Minnesota State University (2012)
• Jose “Ro” Avila, King College, SPS Summer Intern (2013)

Work supported by the National Science Foundation Project No. 1011829, “Expanding the STEM Workforce by Equipping Physics Bachelors Degree Recipients and their Departments to Address the Full Range of Career Options”
Goals: AIP Career Pathways Project

• Inform and equip departments that wish to better prepare students to enter the workforce.

• Equip students with tools specific for physics aimed at career development.
Process
(Following the SPIN-UP model)
Identify schools that

- have ‘large’ numbers of students entering the STEM workforce within one year of earning a bachelor’s degree

and

- are intentional about preparing students for careers.
Building in Career Development

- Step 1: Inform Department Leadership
Identified Common Features

**Curricular**
* Varied and high quality lab courses
* Research opportunities for undergraduates
* Curricular flexibility
* Communication skills as part of the physics curriculum

**Extra-curricular**
* Faculty and staff commitment to student success
* Strong community of students
* Connections with alumni
* Relationship with the Career Services Office
* Mentoring/advising in accordance with interests and goals
**SPIN-UP**

**Common Features**

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2/13/15
Interesting (and important)

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How’s your department doing?

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Building in Career Development

- **Step 1:** Inform Department Leadership
- **Step 2:** Inform Faculty (and Students)
Motivational Data

Where do physics students go after graduation?
Research says

Let’s consider 20 Hard Working Physics Students
Evidence

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*20* Hard Working Physics Students

Page 15

40% --Directly into workforce

about the same number who pursue

degrees in Physics/Astronomy!
One year later

Physics BS/BA

Trends in Status One Year After Earning a Physics Bachelor’s, Classes 1995 through 2010

http://www.aip.org/statistics
One year later

Physics BS/BA

Status One Year After Earning a Physics Bachelor’s, Classes of 2009 & 2010 Combined

Graduate Study

<table>
<thead>
<tr>
<th>Physics &amp; Astronomy</th>
<th>Other Fields</th>
<th>Employment</th>
<th>Unemployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>36%</td>
<td>24%</td>
<td>35%</td>
<td>5%</td>
</tr>
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</table>

(N=4,219)

http://www.aip.org/statistics
Employment.

Initial Employment Sectors of Physics Bachelor’s, Classes of 2009 & 2010 Combined

- Private Sector: 53%
- College & University: 13%
- High School: 11%
- Civilian Gov’t, National Lab: 10%
- Active Military: 8%
- Other: 5%

http://www.aip.org/statistics
Private Sector Employment Details

Field of Employment for Physics Bachelor’s in the Private Sector, Classes of 2009 & 2010 Combined

- **Engineering**: 32%
- **Non-STEM**: 26%
- **Computer or Information Systems**: 21%
- **Other STEM**: 8%
- **Other Natural Sciences**: 8%
- **Physics or Astronomy**: 5%

STEM refers to natural Science, Technology, Engineering, and Mathematics.

http://www.aip.org/statistics
Building in Career Development

- Step 1: Inform Department Leadership
- Step 2: Inform Faculty (and Students)
- Step 3: Challenge faculty *(and students)* to think differently
Data is clear, in spite of...

- In many departments, there exists a cultural default focus – i.e., preparing students for entry into advanced physics degree programs.

- For many, physics is perceived as an academic major with no direct pathways to careers outside of academia – despite evidence that clearly indicates the Physics BS/BA is a marketable degree.
Important facts.

- FACT: At graduation, physics bachelors students have OPTIONS.
- FACT: Many physics students don’t know this.
- FACT: Many physics faculty members don’t know this.
- FACT: Many career services personnel don’t know this.
Choosing the path.

Students should be equipped for the path they choose when they complete their bachelor’s degree.

Departments and programs that provide programs that address a broad range of career trajectories for their undergraduate students tend to be most successful.
Building in Career Development

- Step 1: Inform Department Leadership
- Step 2: Inform Faculty (and Students)
- Step 3: Challenge faculty (and departments and students) to make changes
Building in Career Development

- Step 1: Inform Department Leadership
- Step 2: Inform Faculty (and Students)
- Step 3: Challenge faculty (*and students*) to think differently
- Step 4: Use resources!
Resources for undergraduate Career Development

American Institute of Physics

Report for Faculty & Department Leadership

Tools for Career Services Professionals

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2/13/15
Building in Career Development

- Step 1: Inform Department Leadership
- Step 2: Inform Faculty (and Students)
- Step 3: Challenge faculty (and students) to think differently
- Step 4: Use resources!
  - Facilitating use of the Careers Toolbox for Undergraduate Physics Students
Student Resource: The “Toolbox”

- Eight professional development tools with built in exercises, activities

<table>
<thead>
<tr>
<th>1. Common Job Titles</th>
<th>5. The Job Search</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Informational Interviews</td>
<td>6. Knowledge &amp; Skills-Based Resume</td>
</tr>
<tr>
<td>3. Networking</td>
<td>7. Effective Cover Letter</td>
</tr>
<tr>
<td>4. Knowledge and Skills Assessment</td>
<td>8. Interviewing With Confidence</td>
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</table>
1. Jobs.

What kind of jobs do physics bachelor’s degree holders... hold?
List of Common Job Titles

**Engineering**
- Systems Engineer
- Electrical Engineer
- Design Engineer
- Mechanical Engineer
- Project Engineer
- Optical Engineer
- Manufacturing Engineer
- Manufacturing Technician
- Laser Engineer
- Associate Engineer
- Technical Services Engineer

**Application Engineer**
- Development Engineer
- Engineering Technician
- Field Engineer
- Process Engineer
- Process Technician
- Product Engineer
- Product Manager
- Research Engineer
- Test Engineer
- General Engineer

**Computer Hardware / Software**
- Software Engineer
- Programmer
- Web Developer
- IT Consultant
- Systems Analyst
- Technical Support Staff Analyst

**Education**
- High School Physics Teacher
- High School Science Teacher
- Middle School Science Teacher

**Research and Technical**
- Research Assistant
- Research Associate
- Research Technician
- Lab Technician
- Lab Assistant
- Accelerator Operator
- Physical Sciences Technician

**Statistical Research Center**

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2. Collecting information.

How can I figure out which job might be best for me?
Informational Interview

A new research project: what kind of job do I want?

• What is an “informational interview”?
• How do I do this?
• Who should I contact?
• What do I say?
3. A Professional Network.
How do I build mine?
Networking: Not just for business majors.

- Where/when/how to network
- How to build your list of professional contacts
- Putting together a PERSONALIZED Elevator Speech
4. The key to success. 
Careful consideration of knowledge and skills.
The Missing Link

Assessing and Articulating ... the unique set of knowledge and skills gained in the undergraduate physics experience

- The single most important tool
- Translation of what students know into language that describes desirable and marketable SKILLS
5. Searching.
Finding your opportunity.
Effective Job Searching

• Using powerful online resources
• Efficient use of time to match SKILLS with a THE JOB (that the student WANTS)
6. The Resume.
Putting you on paper.
The effective resume.

What is the goal of the resume?

* How to write a resume that achieves the goal of getting an interview
* What to include (and what not to include)
* Customize resume to job application!
7. Introducing...YOU.
Writing a cover letter that carries impact.
The cover letter.

- Putting it together
- A formal introduction of yourself...on paper
- Format, content, how to make sure you stand out as a candidate for the position you want and are qualified to have!
Making the most of interview opportunities.
Interviewing *with confidence.*

- Making the interview count!
- Face-to-face or on the phone

Another opportunity to demonstrate knowledge and skills
Concerns

- Most faculty know little about getting a job outside academe
  - How can we teach something we don’t know much about?
- No room in the curriculum
- Timing – when to start providing training on career pathways?
Facilitating Career Development

• First steps: Inform!
  – Focus on facts, research results
  – Introduce career options EARLY.

• Use the Toolbox as a guide for students
  – Find a spot to introduce tool box
  – Use the SPS chapter meetings as a venue
  – Introduce components across the curriculum

• In facilitating sessions, encourage group work!
  – Encourage individual self driven continuation of the work...
SPS Careers Toolbox Workshops

- Focus on Tool#4
- Groups create "super student"
Example: Facilitating/mentoring a meaningful knowledge and skills assessment

Tool#4 – Knowledge and skills assessment

SHAPING YOUR OWN KEY TO SUCCESS.
WHO ARE YOU?

- Self reflection
- Serious consideration of life experience
- Nothing off limits
- Should take time, serious thought, and be revisited OFTEN
Consider this exercise to be a comprehensive life experience brainstorming!
Put it ALL down on paper! Consider this exercise to be a comprehensive life experience brainstorming!
Put it ALL down on paper!
BRAINSTORMING (example)

**My classes / training**
- Math double major
- AFM, SEM training
- Intro Physics (made B's)
- LaTeX training class
- Labview Tutorial
- Advanced Lab – through advance calc
- CPR certified
- Machine Shop safety training
- Cryogenics handling safety
- Advanced Physics classes (thermal, EM, Quantum, Mechanics) C's & B's
- Intro Physics (made B's)
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**My leadership experiences / group activities / professional associations**
- Learning assistant (1yr)
- Tutor for freshman physics (2yrs)
- Helped organize campus research symposium
- SPS member-outreach presenter
- Drum major – marching band (2 yrs)
- Tutor in language lab (spanish)
- International Student Union-member
- Error analysis training

**My jobs / research experiences / internships**
- Worked in research lab as a sophomore (mostly data reduction)
- Part time cashier at Lowe's
- Paid tutor at the YMCA after school program
- Summer research assistant in professor’s lab (responsible for interfacing spectrometer)
- Workshop on gravitational wave astronomy
- Summer research assistant in professor’s lab (responsible for interfacing spectrometer)

**My hobbies / others**
- Accomplished knitter
- Sing in community choir
- Attended comicon
Now, carefully examine the collection of experiences that **describe YOU**.

**Carefully examine your experiences.** Identify one of the commonly used skills that appears in your experiences. Write this skill at the top of the “Identifying My Skills” page:

- working with laboratory equipment
- conducting research
- communicating complex ideas
- proficiency with computer hardware and software
- analysis and quantitative thinking
- working with others
- problem solving
- critical thinking
## Physics – Common skills

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<td>Conducting research</td>
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<td>Communicating complex ideas</td>
<td>Working with others</td>
</tr>
<tr>
<td>Problem solving and critical thinking</td>
<td>Others??</td>
</tr>
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BRAINSTORMING (example)

My classes / training
- Math double major-through advance calc
- Advanced Physics classes (thermal, EM, Quantum, Mechanics) C's & B's
- Advanced Lab – Experimental techniques/Error analysis training

Math double major through advance calc
- AFM, SEM training
- LaTeX training class
- CPR certified
- Machine Shop safety training
- Certified Camp counselor
- Cryogenics handling safety training
- Labview Tutorial
- International Student Union-member
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My leadership experiences / group activities / professional associations
- Learning assistant (1yr)
- Tutor for freshman physics (2yrs)
- SPS member-outreach presenter
- Drum major – marching band (2 yrs)

My jobs / research experiences / internships
- Improving Interconnects in a CMOS PA chip (APL Instrumentation group)
- Research assistant in professor’s lab (responsible for interfacing spectrometer)
- Workshop on gravitational wave astronomy
BRAINSTORMING (example)

My classes / training
- Math double major
- AFM, SEM training
- Certified Camp counselor
- Intro Physics (made B's)
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My hobbies / others
- Accomplished knitter
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Get to the point.

Narrow it down. Draft a bullet point related to this skill like one you might use on a resume.
⇒ Keep this short and to the point.

Refine the language. Refine your bullet point, focusing on what you know how to do and how well you know how to do it. You may want to do a few drafts and get feedback from others on which is most clear, concise, and meaningful.

Tell it. Write down a few specific anecdotes that demonstrate your experiences related to this skill.
Skill category:

Brainstorming: My experiences related to this skill category

Tell it: Draft a bullet point related to this skill

Refine the language: Refine your bullet point, focusing on what you know how to do and how well you know how to do it

Show it: Write down a few anecdotes that demonstrate your experiences related to this skill
<table>
<thead>
<tr>
<th>Skill category:</th>
<th>Working with others</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brainstorming:</strong> My experiences related to this skill category</td>
<td>Camp counselor, tutor (in Spanish and in freshman physics, and for math at YMCA), learning assistant, working with lab group (research), sing in choir and helped organize a research conference for my peers</td>
</tr>
<tr>
<td><strong>Tell it:</strong> Draft a bullet point related to this skill</td>
<td>Good at working in teams and cooperating in group situations</td>
</tr>
<tr>
<td><strong>Refine the language:</strong> Refine your bullet point, focusing on <em>what you know how to do</em> and <em>how well you know how to do it</em></td>
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<td><strong>Show it:</strong> Write down a few anecdotes that demonstrate your experiences related to this skill</td>
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Refine the language: Refine your bullet point, focusing on what you know how to do and how well you know how to do it

Good at working in teams and cooperating in group situations.
Team work and group skills — really good at it.
Strong teamwork skills; demonstrated comfort in a variety of group dynamics.

Show it: Write down a few anecdotes that demonstrate your experiences related to this skill
Your set of strengths.
YOUR skills

- Aim for about 5-10 skill sheets
- Should be revised regularly as your experiences grow and change
- Practice on-going self assessment to continuously update skills/knowledge list

List your “Tell it” bullet points below

Hard work DONE.

List your “Show it” stories below
The AIP Career Pathways Project

The Career Pathways Project (CP*) was designed to identify common features among physics departments with a strong record of preparing physics bachelors for the sciences, technology, engineering, and mathematics (STEM) workforce and to disseminate that information to the physics community. By equipping physics departments and their students with tools for effective career preparation, CP* aims to increase the overall number and diversity of physics graduates, and of those joining the STEM workforce after the bachelor's degree.

Project Outcomes

Equipping Physics Majors for the STEM Workforce

This report for physics faculty and administrators describes the project findings and, for each finding, suggests specific activities that faculty members can initiate or expand in their departments. This report concludes with a brief discussion about several ways to develop strategies for change.

- Download the report (pdf)

Careers Toolbox for Physics Students

The Careers Toolbox for Undergraduate Physics Students is a set of tools and exercises designed to help undergraduate physics students prepare to enter the sciences, technology, engineering, and mathematics workforce. Tools range from exploring the common job titles of physics bachelor's to preparing for interviews, and are all geared specifically for physics students.

- Visit the Careers Toolbox website
- Download the Careers Toolbox (pdf)

Fact Sheet for Career Professionals

This guide, created by the Career Pathways Project, is a resource designed to enhance the work being done by career services professionals with physics undergraduates and faculty. The Fact Sheet includes information on the common career paths of physics bachelor's recipients, resume and career advising tips, suggested resources for finding physics-related internships and jobs, and more. The Fact Sheet may also be useful for high school guidance counselors and college admissions staff.

- Download the Fact Sheet (pdf)
Tool #2: Informational Interviews

Once you have a list of job titles that sound interesting, the next step is to gather information about what each job really entails. An excellent way to do this is through informational interviews, professional meetings with individuals who have jobs that interest you.

Learn More

Tool #3: Networking

Having great credentials is important when you begin searching for a job, but networking—making professional contacts—can expand your access to opportunities and provide valuable advice and guidance all throughout your career journey.

Learn More
Small pieces or all at once

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Roll up your Sleeves

- The basic concept
- Why do information interviews?
- Setting up information interviews
- Preparing for informational interviews
- Following up after the informational interview

Get to Work

- Download the Informational Interviews exercise (PDF File)
- Download the full tool (includes background information and exercise) (PDF File)
Resources

www.spsnational.org/cup/careerpathways/

Toni Sauncy - tsauncy@tlu.edu

Kendra Redmond – sps-programs@aip.org.