What works for women in undergraduate physics?

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Why worry about undergraduates?

• That’s where graduate students come from.
• This is the biggest leak in the academic ‘pipeline,’ according to Rachel Ivie, AIP.
  – 50% of high school physics students are female.
  – Less than 25% of physics bachelor’s degrees go to women.
• It’s our last chance to recruit new students into physics.
• Look for advice to those who specialize in undergraduate students, especially women’s colleges and Historically Black colleges.
General ideas

• Work on recruiting majors
• Pay special attention to first year students (also important for graduate students)
• Attractive and research-rich curriculum
• Interactive and cooperative pedagogy
• Friendly and inclusive department culture
Female-friendly curriculum
Can we recruit into the physics major?

• Pay particular attention to the introductory course.
  – Choose a charismatic and effective teacher.
  – Create an attractive curriculum with interesting contemporary topics.
  – Emphasize interactive classes and labs.
  – Encourage a cooperative learning environment.
  – Consider a “Day in the Lab” for introductory students to introduce department research opportunities.

• Be sure first year students are well advised.
• Be sure first year students are included in department culture.
Use Astronomy to Recruit into the Physics Major

- Historically, and at present, the participation of women in astronomy is higher than in physics.
- Topics and applications are attractive to women (and men).
- There are many undergraduate research opportunities.
- Astronomy lends itself to outreach and other activities that help build department culture.
Female-friendly pedagogy
What does it mean to teach physics to women?

• It doesn’t mean “watering down” courses (Uri Treisman)
• High expectations and goals
• Confidence-building atmosphere
• Female leadership, especially in lab
• Spirit of cooperation
  – Working in groups deepens student understanding of physics
  – Participatory classes
  – Group work encouraged in and out of class
Female-friendly department culture

Many small factors—no “silver bullets”
Some important elements

• Student Lounge
  – Spin Up found this to be an important marker of a healthy department culture.
  – Space where students can hang out, study, and be part of the department.
  – Attractive room (not a scary basement corner), comfortably furnished with study tables, computers, comfy chairs, fridge and microwave.
Female-friendly department culture

Hire majors as tutors and lab assistants for introductory physics

- Benefits for majors
  - Physics related job.
  - Practice explaining physics concepts.
- Benefits for intro students
  - Less intimidating place to go for help.
- Benefits for department culture
  - Creates relationships between older and younger students
  - Allows opportunities for informal mentoring and recruiting.
Female-friendly department culture

SPS chapter or Physics Club

• Provide a mix of social and professional activities.
• Informal departmental activities (picnics, softball games, holiday parties) give students a chance to get to know faculty and other students under casual circumstances.
• Outreach activities for younger students “put a human face on physics.”
• Allow students to see themselves as role models and members of the physics community.
Female-friendly department culture

Relationships with Alumni

• Most students would like more advice about career opportunities and paths. (Graduate students also say this.)

• Alumni are a useful resource for career advising and recruiting
Female-friendly department culture
Some Elements

- Departmental seminars (at least some) should be at undergraduate level.
- Monitor department culture to be sure it’s inclusive.
- It’s not necessary for faculty to do all these things.
  - Faculty provide continuity and modest resources.
  - Students create their own culture.
Women Students Want and Need Adult Female Role Models

- Many women students speak affectionately and respectfully of male mentors.
- Male faculty can and do effectively mentor women students.
- But women faculty (and other women in leadership positions) are important role models for women students.
- Recruitment and retention of women faculty are important to the recruitment and retention of women students.
- The single most important career barrier for women scientists is family/career conflict.
Conclusions

• Female-friendly departments also benefit male students.
• Pay attention to the first year. (This is important for graduate students, too.)
• Consider the introductory course as a recruiting tool.
  – Attractive curriculum
  – Interactive pedagogy
  – Atmosphere of cooperation
• Department culture is many small factors, not just one thing. Try lots of things and don’t be discouraged if just one doesn’t immediately change the culture. Persist and be patient.
• Men can and do mentor women students, but adult female role models are important.
• Career-family conflicts are an important barrier for women in science.
References

• SPIN-UP report
Consider the range of introductory students

- Many students come to college with two years of high school physics, including a calculus based introductory course. What becomes of these students?
  - Do they repeat their high school experience and become bored?
  - Do they intimidate other students?
  - Do they flounder in advanced courses for which they are not prepared?
- What about underprepared students? Do they have a chance to major in physics?
  - HBCUs treat poor high school physics preparation as a barrier to be overcome rather than evidence that students should not major in physics.
  - This strategy might also work to recruit students who came to college not intending to major in science, and to increase the diversity of physics majors.