QUALITY EDUCATION FOR MINORITIES (QEM) NETWORK

MENTORING WORKSHOP FOR UNDERREPRESENTED MINORITY UNDERGRADUATE ENGINEERING STUDENTS AND FACULTY/STAFF ADVISORS

M. Brian Blake, PhD (QEM Consultant)
Professor of Computer Science
Associate Dean of Engineering for Strategic Initiatives
University of Notre Dame

The College of Engineering at the University of Notre Dame

UNIVERSITY OF NOTRE DAME

Maximizing Undergraduate Research & Scholarly Productivity

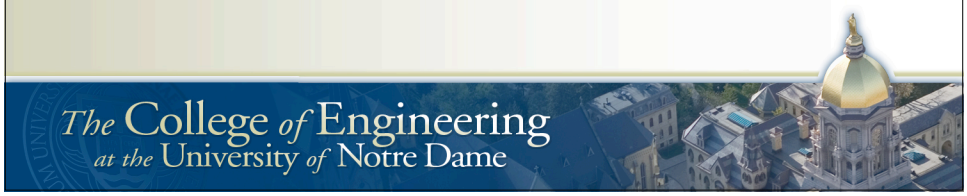
Scholarly Productivity – Conducting Research
- *Identifying STEM-focused Research Opportunities*
- *Conducting Literature Searches*
- *Reading and Preparing Scholarly Articles*
- *Professional Team-Building Exercises*

Friday 1:30pm

The College of Engineering at the University of Notre Dame

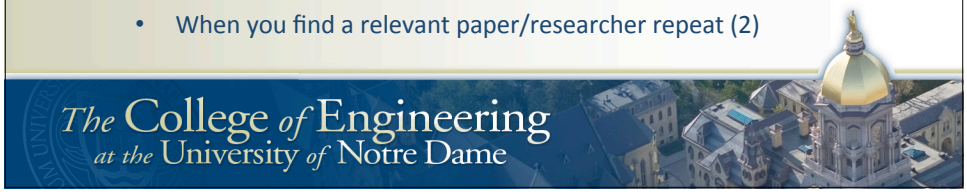
Opportunities for STEM-focused Undergraduate Research

- **Apply your algorithmic training into research this year**
  - Engage in a research project during the school year
  - Full-time research experience during sophomore-end summer
- **Funded Research Opportunities**
  - UROP/SROP (Undergraduate/Student Research Opportunities)
  - REU/REU Site funding
  - NSF SGER projects
  - CRA-CREU Fellowships
  - University-Internal research grant



Conducting a Literature Survey

1. **GoogleScholar, CiteSeer, Web of Science, or even a general Google search**
   - These applications will get you started by locating papers with titles similar to your search area
2. **Follow the leads…**
   - Look for papers that reference this paper
   - Look for papers that this paper references
   - Some websites will recommend similar papers
   - Email authors for help, give them sample papers and ask if the can suggest other papers or other research projects
3. **Iterate!!!**
   - When you find a relevant paper/researcher repeat (2)



Research Opportunities: *A 4-Year Plan*

Freshman Year

Student Guidance:

- *There is very little research in your first-year courses*
- DO WELL IN YOUR FIRST SCIENCE COURSES!!!
- Go to the department's colloquium talks that interest you
- Introduce yourself to the professor that hosted the talk that interests you
- Solicit part-time funded (or non-funded) opportunities in your 2nd semester
- Split your time between home and short research opportunities or conference volunteer assignment during first summer

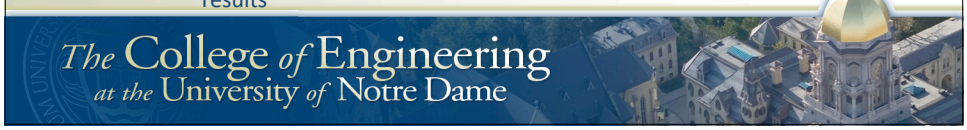
1st Year Developmental Milestone:

- Explain existing research problems and detail how to run existing studies
- Have general background knowledge of a research problem
- Have requisite skills to develop user interfaces, surveys, test protocols, documentation

Research Opportunities: *A 4-Year Plan*

Sophomore Year

- **Apply your algorithmic training into research this year**
  - Engage in a research project during the school year
  - Full-time research experience this summer
- **Funded Research Opportunities**
  - UROP/SROP (Undergraduate/Student Research Opportunities)
  - REU/REU Site funding
  - NSF SGER projects
  - CRA-CREU Fellowships
  - University-Internal research grant
- **2nd Year Developmental Milestone:**
  - Run directed complex experiments
  - Write the motivation for a research project and also provide a preliminary technical explanation of the experimental process and results



Research Opportunities: *A 4-Year Plan*

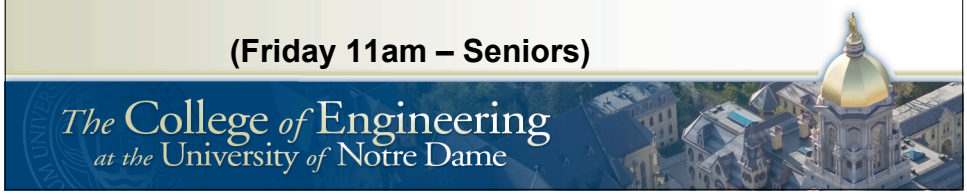
Junior/Senior Year

- **Start forming a research opinion**
  - Either craft your electives to build a specialization or take junior year to investigate a different area at dept
  - Internship at a corporation during summer after junior year
  - Do a senior thesis or capstone project in your senior year
- **3rd Year Developmental Milestone:**
  - Suggests variations in complex experiments
  - Write a technical explanation of the experimental process/results and co-author a paper or three..
- **4th Year Developmental Milestone:**
  - Suggest new studies (*independent thoughts*… ahhh yes!!)
  - Lead the authorship of a workshop/conference paper and co-author a journal article

Graduate School Planning And Other Topics

- Mentoring Younger Students (no slides)
- Networking
- Graduate School Planning
  - *Processes and Timelines*
  - *Creating Materials for Letter Writers*
  - *Writing a Strong Research Statement*
- *Portfolio and Personal Profile Development*

(Friday 11am – Seniors)



Networking (potential letter writers)

- Do well in your courses related to your discipline
  - Ask questions, ask questions, ask questions…
  - Suggest projects that extend course requirements
- Schedule a meeting with multiple faculty within the target department
- Volunteer at research conferences
  - Develop your *"academic stalking"* technique
- Visit faculty at schools in your hometown who are close to your area (easy way to increase your network)
- Attend mentoring workshops (…like this one) and speak to *everyone*

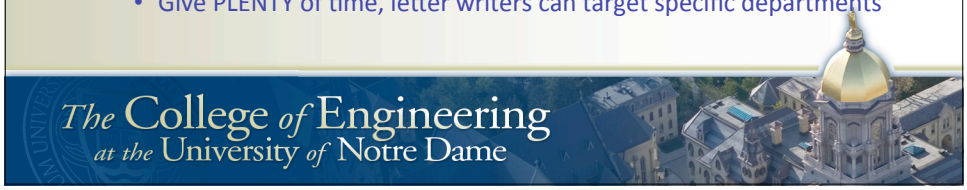
Process and Deadlines

- Start early….
  - Choose your target schools in the summer before senior year, at the latest
  - Speak to professors about your target schools
- Work on applications in the late Summer or early Fall
  - Then visit if you can, some programs will invite
- Financial Support (drop-dead) Deadline is typically mid-February
- Notifications are typically Mid-March

Creating Materials for Letter-Writers

- Meet with your letter writers
- If you like a course, go over and above the call of duty, so the faculty member will get to know you
- Participate in undergraduate research
- Do a senior thesis

- ***After the letter-writer agrees, be courteous and..***
  - Provide a career plan for your letter to put your work in context
  - Give PLENTY of time, letter writers can target specific departments

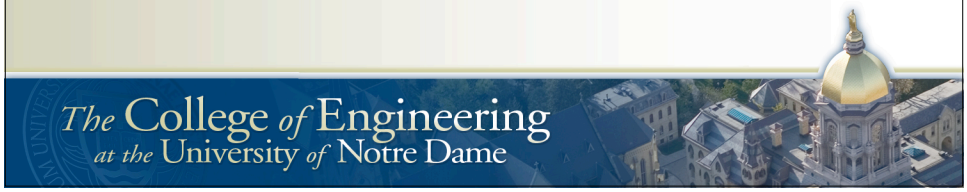


Writing a Strong Research Statement

- Avoid writing a resume in text form
  - Your application already includes a resume
  - Faculty members ultimately have to read a lot already
- Write a persuasive essay
  - What don't you like about world? How can you fix?
  - What do you think is unexpectedly interesting about the world?
  - When did you come to your epiphany?
- Now, cheat!!
  - Sneak in your autobiographical bullets to substantiate your findings

Profile of a Competitive Graduate Candidate

- **Competitive GPA and GRE**
  - Unfortunately, most schools rely heavily (perhaps too much) on these two measures as an predictor for success
- **Research or Industry experience (perhaps both)**
  - Undergraduate research, internships, or externships
- **Course that support ambitions**
- **Extracurriculars that support leadership AND teaming ability**
- **Good rapport with faculty who can write the most compelling letters**
- **Clear communication skills, confident, and energetic**
- **A resume and statement that is clear and free of errors**



Profile and Personal Profile Management and Other Topics

- *Portfolio and Personal Profile Development (no slides)*
- *Global Research Opportunities (no slides)*
  - *e.g., NSF's Developing Global Scientists and Engineers (International Research Experiences for Students - IRES)*
- *Writing a Research Abstract*

(Friday 4:15pm – Seniors)

- *Test-taking Strategies (no slides)*
- *Writing a Research Plan (previous slide)*
- *Making Effective Presentations at Meetings/Conferences (no slides)*
- *Developing a Career Portfolio*

(Saturday 10:45am – Seniors)

Writing a research abstract

- **Consider 5 aspects of the abstract…**
  - High-level challenge in society or motivation for the research
  - Description of a problem that anyone can understand
  - Identify your specific problem
  - Quick description of your approach to solve the problem
  - Description of what you will show that suggests that your approach is better than other existing approaches.

Your research abstract is meant to attract readers to the paper, so keep it engaging!