

- Types of research activities:
  - People contribute to research at different ways at different points in their career
    - contributing to experiment, computation, and calculations prepares you to ultimately direct research yourself.
  - Experiment
    - Develop, design, build apparatus and procedures
    - Easy for undergrad to get started in!
  - Computation
    - Run simulations
    - Analyze data
    - Solve numerical problems
    - Easy for undergrad to get started in!
  - Calculations
    - Use a hypothesis to predict the answers to a question.
    - Usually requires related coursework.
    - Start toward end of undergrad, start of grad school.
  - Directional
    - Choose what questions to ask ( identify which ones are important! )
    - Choose what hypothesis to test ( or develop a new one! )
    - Choose what methods to use ( calculational, computational, experimental, etc. )
    - Requires a broad understanding of the research field and the work of others.
    - Start toward middle of grad school, continue to develop.
- Useful skills for undergraduate research!
  - Experimental – often can learn useful skills over a few weeks
    - Running, maintaining, and building machinery (e.g. physics or engineering lab)
    - Running / improving procedures ( e.g. chemistry or biology lab )
      - Usually involves carrying out specific steps developed by your advisor
      - Can require skills you learn in lab courses
  - Computational – very useful for both experimental and theoretical work
    - People look for these skills when taking students for summer research programs!
    - coding, - C/C++, Python, Java, Fortran
      - often will use other people's programs, need to be able to understand and modify someone's code
      - even if you don't know the specific language you need for a project, it will be a huge help to have some programming experience
    - scientific computer programs
      - -anyone have experience?
      - spreadsheets
      - numerical analysis: MATLAB, R, etc.
      - mathematica
        - find out what's useful for what you want to do!

- Calculation
  - Usually requires advanced coursework
  - Relevant to theoretical and experimental work
  - Generally useful for everyone:
    - statistics
- Opportunities to do research
  - Summer NSF REUs
    - Occur during the summers
    - [http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=5517&from=fund](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&from=fund)
    - list of REUs: [http://www.nsf.gov/crssprgm/reu/reu\\_search.cfm](http://www.nsf.gov/crssprgm/reu/reu_search.cfm)
    - Good idea to look into what types of projects there are even if you don't apply this year!
    - Applicants can be competitive even after only their freshman and sophomore years.
  - Other similar programs:
    -
  - Industry
    - Lots of companies do research in engineering, physics, chemistry, biosciences, etc...
    - Look for summer internships and co-ops during the year
  - Faculty at your university
    - Almost all faculty (even the ones who teach your classes) are involved in research ( note: a “lecturer” usually does not run a research program, all professors do. ). Ask them about it! Ask specifically about opportunities for undergraduates.
    - Good idea to start contributing to a research project during the academic year by your junior year ( and the earlier the better! )