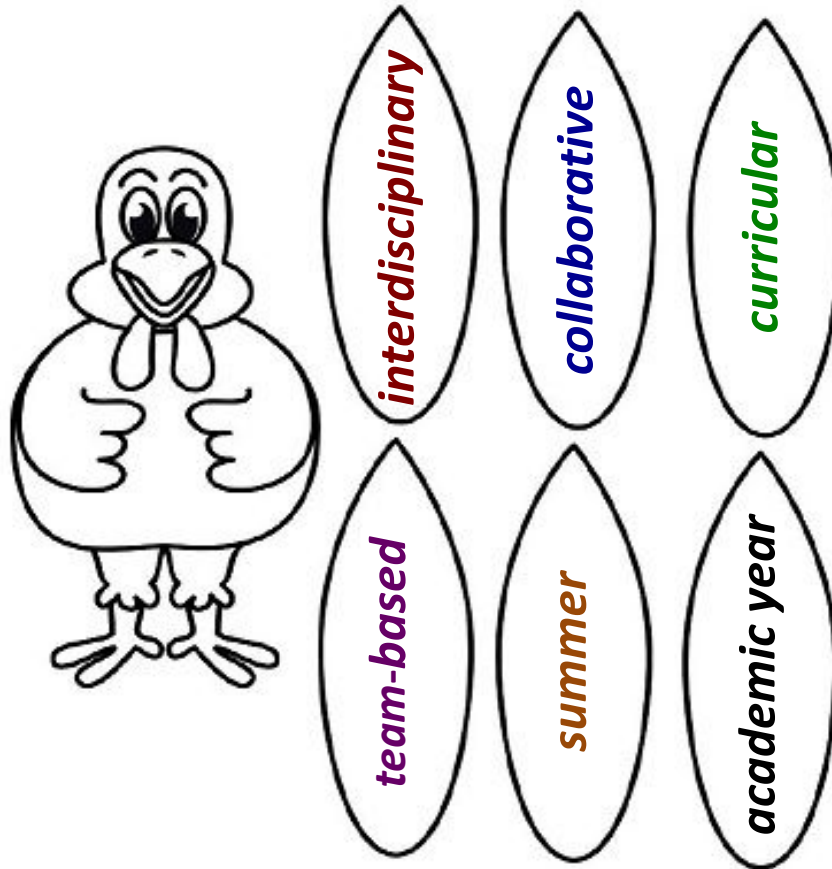


Conducting Research with Undergraduate Colleagues: A Bird of Many Feathers

John Wheeler, Furman University



***HAPPY NATIONAL
UNDERGRADUATE
RESEARCH WEEK!***

April 2-7, 2017

Undergraduate Research at My Institution:

- **Started in 1940's (John Sampey – Furman Chemistry, 1934 - 1965)**
 - *included regular student – faculty publications
- **By 1960's, annual summer research program**
- **With institutional/NSF support, Chemistry research program grew through the 70's, 80's, 90's; other science disciplines became more active (e.g., REUs in *Psychology, Earth Sciences*)**

Furman's Chemistry Summer Undergraduate Research Program (2016)



- **50-60 undergrads/summer (10 weeks including *Introduction to Research May-X courses*)**
- **Students and faculty from other regional institutions (HBCUs) supported by NSF-REU**
- **Single investigator awards, EPSCoR/IDeA, subawards, industry, alumni, institutional**
- **Model for “Engaged Learning” paradigm; adopted campus-wide mid-90's**
- **18 NSF GRFP/Goldwater Awards in last decade**

Where Are We Now?

FURMAN
ENGAGED!

A university-wide celebration of engaged learning.

University-wide celebration of research & creative endeavors held annually (classes suspended full day, ~ 600 presentations)

OCTOBER 5, 2016

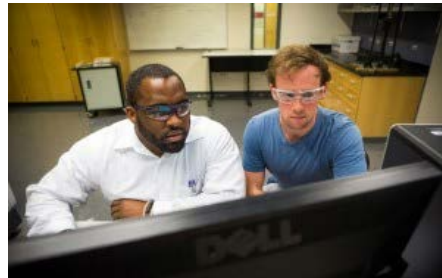
UNIVERSITY LAUNCHES

'THE FURMAN ADVANTAGE'

Furman University today announced an ambitious effort to transform the student experience and address critical community issues. The new strategic vision—called The Furman Advantage—will guarantee every incoming student the opportunity for an engaged learning experience that is tracked and integrated with their academic and professional goals.

New initiative:

- **Guarantees every student an engaged learning experience**
(Ex. *Research, Internships, Study Away*)
- Holistic educational model, includes advising, tracking, assessment, student portfolios, alternative transcripting, etc.



****Life in College Matters for Life After College:***

New Gallup-Purdue study looks at links among college, work, and well-being

***Julie Ray and Stephanie Kafka.
ECONOMY, May 6, 2014**

The odds of being engaged at work are:

2.6x

Higher if ... [College] prepared me well for life outside of college.

2.4x

Higher if ... [College] passionate about the long-term success of its students.

2.2x

Higher if ... I had a mentor who encouraged me to pursue my goals and dreams.

2.0x

Higher if ... I had at least one professor at [College] who made me excited about learning.

1.9x

Higher if ... My professors at [College] cared about me as a person.

2.3x

Higher if ... graduates experience all three

2.0x

Higher if ... I had an internship or job that allowed me to apply what I was learning in the classroom.

1.8x

Higher if ... I was extremely active in extracurricular activities and organizations while attending [College].

1.8x

Higher if ... I worked on a project that took a semester or more to complete.

2.4x

Higher if ... graduates experience all three

GALLUP - PURDUE INDEX REPORT

Web surveys conducted Feb. 4-March 7, 2014

Random sample of 29,560 respondents with a bachelor's degree or higher

- ***The type of schools attended*** -- public or private, small or large, very selective or less selective - ***hardly matters to their workplace engagement and current well-being.***
- ***Support and experiences in college had more of a relationship to long-term outcomes.*** If graduates recall having ***a professor who cared about them as a person, made them excited about learning, and encouraged them to pursue their dreams,*** ***their odds of being engaged at work more than doubled,*** as did their odds of thriving in all aspects of their well-being.
- ***If graduates had an internship or job in college where they were able to apply what they were learning in the classroom, were actively involved in extracurricular activities and organizations, and worked on projects that took a semester or more to complete, their odds of being engaged at work doubled as well.***
- ***Only 14% of graduates strongly agree they were supported by professors who cared, who made them excited about learning, and who encouraged their dreams.***
- ***Just 6% of graduates strongly agree they had an internship or job that allowed them to apply what they were learning, worked on a long-term project, and were actively involved in extra-curricular activities.***

Opportunities for Faculty to Engage in Research with Undergraduates (Feathers)

- **Summer Research on home campus**
- **Summer Research on regional campuses**
 - Ex. Furman REU program: *Faculty + Students*
- **Research during academic year**
 - Ex. Credit-bearing OR Non-credit bearing/hourly wage
- **Research conducted as a part of a Major course**
- **Project-Based, Student Teams**
 - Ex. Clemson's *Creative Inquiry* Program
- **Collaborative with Project Teams at Other Institutions**
 - Ex. EPSCoR, NSF CCI: Center for Chemical Evolution (Georgia Tech), Working with former PhD or Postdoc Advisor (subawards), working with local industry or federal agencies, etc.

Managing Undergraduate Research: Developing Infrastructure

- **Scholarship begins with the *faculty*.**
 - Undergraduate Research cannot be *mandated* and be successful!
- **Administrative buy-in and support is **CRUCIAL** for success**
 - *Student Funding, Faculty Credit/Release, Faculty Development, External Matching Commitments/Sustainability, Faculty Start-Up, Infrastructure* (Ex. Facilities, Grants Office, IACUC/IRB, etc.)
 - If developing a new UR culture, engage with organizations such as CUR (*Council on Undergraduate Research*), attend a national event, and **TAKE AN ADMINISTRATOR WITH YOU!**
 - *CUR Dialogues* February 15-17, 2018
 - *NCUR Conference* April 6-8, 2017 (University Memphis)
 - *Transforming Undergraduate Research Culture and Curricula*
 - April 21-23, 2017, New Jersey City
 - *Proposal Writing Institute*
 - July 13-17, 2017, Concordia College (Moorehead, MN)



Identifying Sources of Funding

- ***Single-Investigator Grants:***

NSF-RUI, NSF-CAREER, NIH-AREA, ACS-PRF, Foundations (e.g. *SC Spinal Cord Injury Research Fund*), SC-EPSCoR, SC Space Grant Consortium (12 SC PUI/HBCUs), SCICU, subawards to R1 grants, etc.

- ***Programmatic Awards:***

NSF-REU/iREU, NSF-MRI, NSF-INCLUDES, NSF LSAMP, SC-INBRE, SC-EPSCoR (NSF, DOE, NASA), HHMI, Foundations, etc.

- ***Local/Institutional Support:***

Research/Professional Growth Funds, Internal Student Stipends, Local Companies, Alumni, Instrument Manufacturers, etc.

Take home messages....

- *Undergraduate research comes in all **shapes** and **Sizes**, and there's outstanding pedagogical evidence for why we should participate*
- *Not everyone on campus has to participate for it to be successful (Ex. select departments, faculty, etc.)*
- *Administrative support/buy-in is the most important single ingredient*
- *Depending on program size/scope, funding is available from many different **institutional, private, federal stakeholders***
- *There are excellent **networking** and **mentoring** opportunities available locally, regionally, and nationally*



MERCURY

Molecular **E**ducation and **R**esearch **C**onsortium In
Undergraduate computational chemist**RY**

- NSF-funded consortium - 27 computational chemistry faculty from 25 PUIs

- Resources:

- ✧ **MARCY** (Furman)

- Master/login node: 16 Intel E5-2660 cores, 64GB RAM, 1 TB mirrored disk

- Storage (I/O) node: 16 Intel E5-2660 cores, 64GB RAM, 17 TB disk array

- Bigmem compute nodes (1-8): 16 Intel E5-2660 cores, 128GB RAM, 2 TB striped disk

- Thin compute nodes (9 – 20): 16 Intel E5-2660 cores, 32 GB RAM, 1 TB disk

- GPU node (node22) : 16 Intel E5-2660 cores, 64GB RAM, 2 Nvidia Tesla K20 GPU

- Software: Gaussian09 A.02 + D.01, Gaussian03 A.01, NWchem 6.5, 6.3, PSI 4, Gamess 2013(+cuda), 2011, Cfour 1.0, AMBER 9, 12 (+cuda), NAMD 2.9 (+cuda), GROMACS 5.0 LAMMPS, OpenMM, ORCA 3.0.2/3.0.3, Openbabel 2.3.2, libEFP, Espresso, Siesta 3.2 cp2k 2.5, cpmd 3.17, cluster 1.0/1.1, dftb+

- ✧ **New Cluster** (Funded via 2016 NSF-MRI, added at Furman Spring '17)

- **MERCURY** Undergraduate Research Conference

- **Furman University July 20-22, 2017**

- Six plenary speakers (Cornell, ORNL, Iowa State, SUNY-Buffalo, LSU, Merck)

- Undergraduate Poster Session

- Post conference **MoISSI Coding Workshop** for Faculty and Undergrads

<https://mercuryconsortium.org>