

# Department of Chemistry Strategic Plan

**2017 – 2022**

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## Preamble

This document presents the Department of Chemistry's strategic plan for 2017-2022, which builds on the plan developed for 2009-2014. In developing this blueprint, our faculty and staff first participated in a retreat where ideas were exchanged freely and discussed openly. In addition to recognizing and appreciating our areas of excellence, we identified and prioritized areas that could be strengthened in order to further increase our local, national and global prominence. Three thematic areas were identified, *Discovery: Expanding Boundaries*, *Learning: Enhancing the Undergraduate, Graduate and Postdoctoral Experience* and *Engagement: Fostering Tomorrow's Scientists*. We constructed this plan to include discrete sets of action items targeting these three areas. Over the next five years, our faculty, staff and students will work collaboratively to implement this strategic plan. We look forward to integrating our initiatives within larger frameworks established by the College of Science and the University.

### **Mission Statement**

The Department of Chemistry at Purdue University serves the local community, the State of Indiana and the rest of the world through leadership in the chemical sciences, fundamental research that extends the boundaries of scientific knowledge, education of students and commercialization. Our knowledge is further shared widely to enhance the public's understanding of chemistry through community outreach and support of K-12 education. We achieve these goals in accordance with the principles of inclusion, equity and diversity.

### **Vision Statement**

The Department of Chemistry at Purdue University seeks to advance its national and international reputation for both the quality of its undergraduate and graduate instruction and its diverse, dynamic, and innovative research programs. Excellence in core areas will be strengthened in concert with providing opportunities for faculty contributions to interdisciplinary research that addresses global problems. Connections to other research, educational and commercialization efforts will be expanded to increase our visibility and impact within the College of Science, across campus and beyond. Cutting edge and interdisciplinary research efforts will continue to be supported through regular maintenance and upgrades to facilities and instrumentation. The department aims to further distinguish itself through its innovative educational programs for undergraduates, graduate students and postdoctoral fellows in the chemical sciences and outreach activities. A diverse and inclusive student, staff and faculty population will continue to be developed, building on these current strengths in the Department of Chemistry.

## Statement of Shared Beliefs and Values

A shared set of beliefs and values underlies our common sense of mission and provides a foundation for our vision for the future of the department.

### We believe that:

- chemistry is a central science, uniquely positioned to address problems of great importance to our society.
- chemistry plays a crucial role in interdisciplinary and emerging research areas.
- understanding matter and life at the atomic/molecular level is essential for creating a scientifically literate society.
- it is important to provide high quality learning environments for a diverse student body at all levels of education.

### We value:

- excellence in discovery, learning and engagement.
- independence of thought and academic freedom.
- creativity in generating new knowledge and technologies.
- modern, well-maintained facilities and core instrumentation resources that enhance our research, teaching and outreach missions
- a culture of safety that provides a healthy working environment for all students, faculty and staff.
- a working and learning environment that is collegial, where faculty, staff and students work together in a cooperative and collaborative manner and each person is encouraged and motivated to reach their full potential.
- a faculty with diverse research interests that uniquely positions the department to respond to emerging research opportunities.
- a diverse and inclusive working and learning community where all are treated equitably and with the utmost respect.
- integrity and accountability by students, faculty and staff in all aspects of the department's activities that adhere to the highest standards of moral and ethical values.

## Objective 1:

### Discovery: Expanding Boundaries

#### Goals:

- *Promote and pursue a fundamental, atomic and molecular scale understanding of the world and apply our discoveries to create innovative solutions to the world's problems.*
- *Expand connections to research and commercialization efforts to increase our visibility and impact within the College of Science, across campus and beyond.*

#### Strategic Initiatives:

- 1. Maintain excellence in existing disciplinary strength areas through hiring and retaining outstanding faculty.**
  - Hire based on needs and attrition
  - Increase scientific diversity of faculty
  - Increase demographic diversity of faculty
  - Increase faculty awards and recognition – internal and external
  - Regular assessments of needs of existing faculty
  - Publicize faculty achievements
- 2. Excel at hiring & retention of staff**
  - Hire based on needs and attrition
  - Hold periodic department-wide “State of the Department” meetings with updates from Head, Associate Heads, Assistant Head, Business Office, Procurement, Amy Facility, Safety Officer, etc. Include all faculty, staff and co-chairs of GSAB
  - Increase demographic diversity staff
  - Improve staff inclusivity and appreciation through increasing the number of staff awards and recognitions offered departmentally
  - Convene a faculty and staff committee for staff awards and recognitions in the department and College of Science
  - Encourage and offer professional development opportunities for staff
- 3. Formalize materials research in the Department**
  - Create a “Materials” focus area within chemistry and define its mission
  - Faculty self-identification for inclusion
  - Develop materials curricula
  - Create a colloquium lecture and a graduate student-run yearly lecture
  - Explore creation of a “Materials Chemistry Research Center” (MCRC) led by Chemistry, advertise in other departments on campus, and apply for center grant
- 4. Increase leadership and participation in interdisciplinary & collaborative research**
  - **Coalesce around strategic research problems such as, but not limited to:**
    - Health, Human Disease, and Diagnostics
    - National Security
    - Global Sustainability
    - Plant Science
    - Energy

- **Actively engage in Life Science Institutes (PI4D, Neuroscience and Drug Discovery) and College of Engineering initiatives**
    - Encourage faculty to take on leadership roles
    - Provide departmental incentives for faculty to participate in or lead collaborative research and training grants
    - Establish a mechanism for informing our faculty about research and hiring initiatives through e-mail updates or faculty meetings.
  - **Clearly define the value of interdisciplinary and collaborative research at the department level in terms of tenure and promotion:**
    - Review departmental and university documents and guidelines. Modify departmental documents if necessary.
  - **Better utilize institutional mechanisms for assistance**
    - Professional grant writing help available on campus
    - University incentives available for obtaining and submitting center and training grants
    - Updates on campus initiatives from the Dean each year
- 5. Upgrade and publicize departmental shared resources & facilities**
- Capitalize on instrumentation grants within the university and with outside agencies
  - Better coordinate core resource initiatives and funding across departments and colleges
  - Provide incentives and rewards for successful instrumentation grant proposals
  - Promote staff professional development to meet emerging research needs within facilities
  - Evaluate and prioritize departmental resources and facilities for upgrade or repair
  - Annual facilities committee meeting to evaluate emerging research needs and deficiencies within facilities
- 6. Create a stronger culture of safety in the department**
- Re-evaluate and revise chemical safety course
  - Provide more rigorous ongoing yearly safety training
  - Start an undergraduate safety course or integrate safety issues into existing courses
  - Evaluate need for a safety TA each semester
  - Establish a safety recognition award program
  - Build an external reputation for producing safety-conscious graduates
  - Form and empower a student-led safety group who will work with REM and chemistry staff and faculty on improving our safety culture
  - Appoint faculty member to act as liaison for student-led group
- 7. Monitor and manage renovation, repair and replacement of facilities**
- Regularly upgrade fume hoods (12 per year on a 20 year schedule)
  - Advocate for undergraduate teaching laboratories renovation
  - Advocate for renovation of research laboratories consistent with best safety practices
  - Advocate for library space renovation
  - Create a faculty and staff "Space Committee" to help identify needs in Department
    - Meet quarterly to review space needs and make recommendations to the head regarding changes and priorities for repair
  - Evaluate need for full-time departmental painter as part of Chemistry Shop staff
  - Modernize and maintain public spaces and manage storage areas
  - Renovate and modernize Chemistry Resource Room
  - Remodel and upgrade technology in conference rooms

## Objective 2:

### Learning: Enhancing Undergraduate, Graduate & Postdoctoral Experiences

#### Goals:

- *Instill a passion for lifelong learning for chemistry and its connections to the world in students with diverse career objectives.*
- *Create a dynamic learning environment for undergraduates, graduate students and postdoctoral fellows as they acquire skills and competencies enabling them to become successful in their respective careers.*
- *Develop and Integrate best practices for student success*

### Strategic Initiatives for Enhancing the Undergraduate Experience:

1. **Modernize the majors' and non-majors' undergraduate laboratory curricula** and create a system to provide regular evaluation and improvement
2. **Hire a "Director of Undergraduate Laboratory Curricula"** to oversee the operation and development of all undergraduate teaching laboratories
3. **Investigate implementation of fee for all undergraduate laboratory courses**
4. **Evaluate undergraduate majors' curricula and modernize where needed**
  - Identify and clearly articulate what is unique about a Purdue undergraduate chemistry degree
  - Assess how our curricula align with ACS Committee on Professional Training guidelines.
  - Clearly articulate the purposes, practices and syllabi of CHM294 and CHM494 and establish best practices.
  - Rebrand CHM499 as our Undergraduate Research Opportunity Program (UROP) and increase participation by 10%
  - Explore creation of on-line chemistry course offerings
4. **Evaluate undergraduate non-majors' curricula and modernize where needed**
  - Engage stakeholder departments and units in decision-making
  - Coordinate general chemistry and organic courses to create cohesive curricula
5. **Improve recruitment and retention of undergraduates to Chemistry**
  - Initiate a formal program for faculty advising of upper division junior and senior students apart from undergraduate research advisor.
  - Increase number of majors by 20%
  - Create interdepartmental degree programs to bridge interests (e.g. chemical biology; chemical engineering; materials; CS + Chem)
  - Evaluate and improve "Discoveries in Chemistry" Learning Community
  - Establish mechanism for faculty to be involved in recruiting high school students as chemistry majors in cooperation with the College of Science recruiting staff.
  - Establish best practices for recruitment and retention of underrepresented minority students in cooperation with the College of Science.

- 6. Expand capabilities of the general chemistry office to include all lower division (100-200 level) chemistry courses**
- 7. Improve the Quality of Student Learning in all courses**
  - Promote the Scholarship of Teaching and Learning (SoTL)
  - Develop and implement more informative approaches to student assessment that yield better measures of student learning and understanding
  - Develop and implement new ways of evaluating the quality of courses and instruction to supplement the existing course and instructor evaluations
- 8. Create a culture of safety among undergraduate students**
  - Improve the safety education for undergraduate students involved in research by establishing an independent safety course or integrating safety training into existing courses

### **Strategic Initiatives for Enhancing the Graduate Student Experience:**

- 1. Improve graduate student requirements and experience**
  - Create new template for annual research reports that includes an individual development plan (IDP) and CV
  - Evaluate and modernize cumulative exam system
  - Evaluate and improve first year students' advisor selection process
  - Appoint graduate student representative to graduate studies committee
  - Appoint faculty liaison to GSAB
  - Conduct yearly meeting with graduate students and department head to discuss initiatives and issues
- 2. Expand CHM 695 course to include both teaching and professional skills**
  - Transition from 8-week course to full semester course
  - Enhance TA teaching training for first year graduate students
- 3. Improve graduate student recruiting, admission and retention**
  - Improve recruiting of high quality graduate students through fellowships and early admission
  - Increase recruitment and retention of women students
  - Increase the number of underrepresented minority students in collaboration with the DTA team
  - Increase the retention of underrepresented minority students
  - More effectively use Big 10 Grad Expo as a recruitment tool
- 4. Develop and promote graduate student professional development opportunities**
  - Develop new and encourage participation in existing workshops and seminars
  - Engage alumni for mentoring of undergraduate and graduate students
  - Facilitate internship opportunities, job fair, Krannert MBA program
  - Work to increase number of Krannert MBA program slots available
  - Improve networking communication among graduate students
- 5. Create a culture of safety among graduate students**
  - Improve the safety education for graduate students

### **Strategic Initiatives for Enhancing the Postdoctoral Fellow Experience:**

- 1. Establish a post-doctoral studies faculty committee**
- 2. Incorporate best practices for postdoctoral training**
- 3. Evaluate and improve departmental Postdoctoral Fellow Association with active leadership**
- 4. Include post-doctoral fellows in departmental activities**
- 5. Require each postdoctoral fellow to give a seminar during their stay at Purdue**
- 6. Encourage fellows to participate in College of Science postdoctoral activities**
- 7. Create a culture of safety among postdoctoral fellows**
  - Require safety training and improve the safety education for postdoctoral fellows

### Objective 3:

#### **Engagement: Fostering Tomorrow's Scientists**

Share our knowledge to enhance the public's understanding of chemistry through community outreach, support of K-12 education, commercialization and alumni relations.

#### **Goals and Strategies for Engagement:**

- 1. Increase technology transfer & commercialization efforts**
  - Encourage faculty/staff/students to use ample university resources to get patents and launch companies.
  - Develop strategies for corporate interactions and research collaborations
- 2. Improve communication of research breakthroughs, awards and outreach activities**
  - Include information more prominently on departmental website
  - Interface with College of Science communications staff
- 3. Enhance alumni relations and interactions**
  - Provide opportunities for undergraduate, graduate and postdoctoral career mentoring
  - Facilitate graduate student internships
- 4. Promote value and importance of outreach activities**
  - Appoint a faculty/staff outreach advisory committee
  - Encourage faculty, student and staff participation in outreach activities
  - Provide workshops or experiences for 6<sup>th</sup>-12<sup>th</sup> grade teachers for both chemistry content and current research areas
  - Continue support for participation in National Chemistry Week and yearly Chemistry Show
  - Reward development and implementation of outreach activities
  - Facilitate access for chemistry teachers and high school students access to research groups to bridge the gap between high school and college chemistry
- 5. Support enlargement of *Science Express* program and increase its national recognition through greater publicity efforts**
  - Develop labs that relate to current research in our department using *Science Express* equipment.
  - Collaborate with faculty on research project implemented by the *Science Express* program
  - Assign a TA to work with *Science Express*
  - Work to secure yearly funding from companies who have an interest in chemistry education
  - Purchase new equipment and update current equipment in the project
  - Encourage use of core instrumentation facilities into *Science Express* programs.
- 6. Create an award that provides unrestricted funds to the faculty member who has done the best job of engagement in each year**
- 7. Explore involvement with National Center for Drug Discovery**

## **Metrics:**

### **Discovery: Expanding Boundaries**

We will track the following for our faculty and staff and compare to previous data if available:

1. Number of disciplinary and interdisciplinary hires made
2. Research grant dollars
3. Affiliations with other departments through courtesy and joint appointments
4. Participation in campus-wide grants
5. Affiliations with campus-wide initiatives
6. Chemistry-led large, collaborative research grant proposals that are submitted or awarded
7. Training grants submitted or awarded
8. Center grants submitted or awarded
9. Publications

We will track the following safety metrics and compare to previous data if available:

1. Track number of safety awards and commendations
2. Track type and number of inspections
3. Compile and publish a list of violations and remediations annually
4. Track type and number of accidents annually

### **Learning: Enhancing the Undergraduate, Graduate & Postdoctoral Experience**

#### **Undergraduate Education:**

We will track the following and compare with previous data if available:

1. Recruitment and retention numbers – total, women and underrepresented minority students
2. 4, 5 and 6-year graduation rates – total, women and underrepresented minority students
3. DFW rates
4. CODO rates and student comments
5. Placement of chemistry majors immediately following graduation
6. Participation in and outcomes of CHM499 research – Chemistry majors and others
7. Student response to faculty advising program

#### **Graduate and Postdoctoral Education:**

We will track the following and compare with previous data if available:

1. Recruitment and retention of Ph.D. students – total, women, international and underrepresented minority students
2. Number of students leaving with Masters' degrees
3. Job placement following Ph.D.
4. Graduation rates – total, women, international and underrepresented minority students
5. Number of NSF pre-doctoral fellowships applied for and obtained
6. Papers and presentations by graduate students

## **Engagement: Fostering Tomorrow's Scientists**

We will track the following and compare with previous data if available:

1. External funding for outreach activities
2. Number of outreach events facilitated by chemistry department members
3. Number of participants present at outreach events
4. Participation by faculty, staff and students in outreach activities
5. The impact of the Purdue Science Express Project according to research done to characterize experiences reported by alumni and current students
6. Numbers of patents, and licenses obtained

**Implementation:**

The goals outlined in this plan will be achieved through successful implementation of our strategic initiatives. We believe that change is best enacted through a strong and informed committee system where all members feel empowered and their opinions valued. Therefore, many of these initiatives will be led by standing or *ad hoc* committees comprised of faculty, staff and students, where appropriate. We will form groups of faculty in each interdisciplinary and collaborative research area who will come together and develop a plan of action in collaboration with the College's New Research Directions Taskforce. Other initiatives will be led by individuals or teams with strengths in germane areas. We will develop a timeline for implementation in the near future.