

## Scholarship Standards for the Department of Chemistry and Biochemistry (DCB)

### 1) Types of Scholarship

All four types of scholarship as described in section 5.2.2.2 of the faculty handbook may be encountered in research done by the department of chemistry and biochemistry (DCB). In decreasing order of frequency, they are as follows:

**Scholarship of Discovery.** The primary mode of scholarship by DCB is discovery. This type of scholarship typically requires the support provided by internally or externally funded grants, therefore applications for such funding sources play a key role in the scholarship of DCB faculty. Usually the faculty member leads a team of students in novel experiments and reports the results to peers and the public in various settings. A single anonymously peer-reviewed article may require multiple years of research. Because our students are working on small sections of larger projects for limited times, there is often public reporting of results in various settings with different formats of peer review as discussed below.

**Scholarship of Teaching.** Faculty in DCB may pursue pedagogical research directed to enhance student learning that is published in anonymously peer-reviewed journals (e.g., *Journal of Chemical Education* and *Biochemistry and Molecular Biology Education*). Sessions are often devoted to pedagogical topics at the American Chemical Society meetings, and other local conferences are dedicated to pedagogical advances. Papers or presentations in these contexts would be considered scholarship of teaching. Grants may also be written and awarded for pedagogical research on teaching.

**Scholarship of Application.** Sometimes the public product of chemical research is not published in a journal, but as a patent, which is reviewed by the U.S. Patent Office.

**Scholarship of Synthesis.** This would include articles on interdisciplinary topics and philosophical questions, such as astrobiology, faith and science, or history of science. These topics may be discussed in collaboration with scholars from other disciplines, and are often peer-edited rather than peer-reviewed.

### 2) Kinds of Public Scholarship Products

We define scholarship as creative individual work whose significance is validated by external peers and which is communicated outside the University. Sometimes the evaluation will be by an anonymous panel, which we term “peer review,” while other times the evaluation may be by a single peer whose identity is known, which we term “peer editing.”

The most highly valued product for the dissemination of scholarly research results among DCB faculty is the anonymously peer reviewed paper published in an established journal. Articles of this nature typically reflect several years of work by the faculty author. Several other modes of public presentation with varying levels of peer review exist for DCB faculty as discussed below.

**Journal articles.** A public, published article that has undergone peer review and evaluation by an anonymous panel of researchers is the most prominent form of disseminating research results.

Approved by Faculty Affairs Committee February 24, 2009

Less traditional forms of peer review, including publications in the *PLoS One* web journal, which is “peer-edited” by a single researcher and posted for public comment, have been established recently and are considered appropriate forms of peer reviewed dissemination by DSB faculty.

Review articles are usually invited and peer-edited. These do not always contain original research but survey the accomplishments of a field. Being invited to write a review article is a public sign of professional accomplishment in the area being discussed, and recognizes accomplishments in the context of a larger research project or field of specialization.

Members of the DCB faculty recognize that the first and last authors of published reports share primary authorship of the paper and should be considered of equivalent prominence. The first author may be the student author who carried out the research, and the last author is the professor who supervised the research and takes final responsibility for the results and interpretations. This may be reversed for review articles. Second authorship is also a prominent location, and depending on the project and size of the collaboration other authorship positions may be important as well. For authorship that is not first or last, a specific description of the role of the author in the work should be provided.

**Grant applications.** Before a research program can take place, funding for materials and equipment must be secured from internal or external agencies through a competitive peer reviewed process. This process may be the most intense form of peer review in chemistry; often only 10-20% of submitted proposals are chosen for funding. These applications are publicly disseminated through websites such as the NIH CRISP database and notice of award is public and prominently associated with the institution. Because grants are very stringently peer-reviewed and benefit the entire institution with the tangible resources required to complete DCB research, we consider an externally funded major grant proposal to be at least as valuable to scholarship as a peer-reviewed journal article. Because funding can be extremely competitive, even if the final product is ultimately not funded the proposal is considered strong evidence of a positive trajectory to one’s research plan. Funded grants are particularly valuable to the institution because of the public prestige provided by reporting their award and results, and the infrastructure support derived from indirect funds for the college and department.

**Conference presentations: oral or poster, by the professor or a student-professor team.** A DCB professor may personally present discovery scholarship in an invited talk at a conference. Similarly, scholarship may be presented in a poster session, a mode of presentation in which all reasonable abstracts are generally accepted, and one’s peers discuss the research in public. These are not considered fully “peer-reviewed,” but they are a valuable indication of trajectory for the intermediate states of a long research project. Often the poster abstracts are published and publicly disseminated at the conference in a conference booklet or after the conference in a supplemental journal issue. Of these two possibilities, publication in a journal supplement afterwards is of greater prominence. Authorship roles for posters are similar to those for papers.

Students may also be invited to speak or present posters at national or regional conferences, which are not strictly peer-reviewed but are public indications of a project’s trajectory. The close collaboration

between professor and student in DCB requires that the professor work closely with the students in the weeks before the conference. The professor shares responsibility and co-authorship.

**Patents.** Patents are submitted by a team of researchers to the U.S. Patent Office, reviewed by the agents of that office who evaluate the significance and originality of the work, and made publicly available as a result. These fit our definition of scholarship above.

**Textbooks.** Established professors may be invited to write chemistry textbooks, in which each chapter would be similar in scope to a review article, or the entire collection comparable to a book published by faculty in other departments. The evaluation would be reviewed by an editor or panel of editors, and given the levels of editing and fact-checking involved, a textbook is considered to have undergone standard peer-review.

**Book reviews and non-research articles.** These are important, public results of the scholarship of teaching and synthesis instead of discovery. Book reviews are generally short (1 printed page), peer-edited, and invited. Other articles on topics such as faith-and-science will be peer-edited but not peer-reviewed, will be interdisciplinary not methodological, and generally can be judged on importance by their length. A collection of several such articles can cumulatively be considered significant scholarly output, not of discovery but of synthesis.

**3) Types of Peer-Review.** These are described for each format in section 2 above.

**4) Trajectory of a Productive Scholar.** The active scholarship that is expected in the DCB consists first and foremost of the team-based process of discovery in the laboratory, directly trained and led by the individual faculty member. Dissemination of results can take many forms, written or oral, the most professionally prized being the anonymously peer-reviewed article but other formats being appropriate for other stages of a research project. Grant writing is an important and integral part of this process. A project may require many years to reach the endpoint of a published journal article.

In the DCB, a question will typically be disseminated in several forms over many years. Because of this, we find the description of research as “a succession of major projects,” variously disseminated and reviewed, to be most appropriate. Each project is built around a central question of scholarship, usually discovery or teaching. The ultimate endpoint of a project may be a single prominent journal article, or a major externally funded grant, which is as valuable to chemistry scholarship as a major publication and is treated as a full scholarly product for evaluation purposes.

The faculty member is also expected to present evidence of an ongoing plan for research and scholarship. Evidence of this ongoing activity is provided not only by the faculty member’s PDP but by a list of completed scholarly projects and interim reports, and a description of projects planned and in process that can be incorporated into the faculty member’s vita whenever they are being evaluated.

Minimum evidence of continuing scholarship consists of:

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- a. A well-thought-out written research plan that articulates project questions and goals, articulated in the form of the Professional Development Plans and/or grant proposals; and
- b. Authorship of a significant peer-reviewed journal article or major externally funded grant for promotion to associate professor, and two more significant peer-reviewed journal articles and/or major externally funded grants, published or completed since promotion to associate, for promotion to full professor; and
- c. Additional evidence that the faculty member has made sustained progress and will continue to make progress in the future toward achieving the goals described in the research plan, including conference presentations, unfunded, internal, or small grant proposals, papers currently under review for publication in a peer-reviewed journal, patents, invited talks at national or international conferences, invited book chapters, and textbooks.