

Lux Genes / National Science Foundation Funding: New Light and Life in Biology Teaching Laboratories

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The phenomenon of bioluminescence provides an exciting avenue for introducing molecular genetics to biology students. In 1992, a collaborative effort at Auburn University between two colleagues working in separate teaching and research laboratories resulted in an introductory level molecular biology teaching exercise using *lux* genes and *E. coli* cells. This exercise "Transformation of *E. coli*" was presented as a mini workshop at the 1994 ABLE meeting at Emory University. As a participant in the Emory meeting, the author attended a mini workshop on grant writing presented by a representative from the National Science Foundation. The enthusiasm and suggestions garnered from this workshop stimulated the author to return to Auburn University determined to complete an equipment grant proposal to NSF for the continuation, expansion, and improvement of this work. The NSF grant proposal (R. Lishak, C. Corsby, J. Shaw) which was submitted in November, 1994 was funded in August, 1995.

Based on the positive reviews of this proposal, there were several factors which facilitated funding. The author's preparation for development of this work was rather extensive. In 1991, she attended lectures in the course, *Introduction to Molecular Biology*, which is taught by Dr. Joe Shaw. After this course was completed, she attended a Chautaugua Workshop at San Francisco State University in California for the purpose of learning how to introduce molecular biology laboratories to introductory biology students. In 1992, she worked with Dr. Shaw in his research laboratory to learn more about the use of molecular biology techniques and to gain hands-on experience. As a result of this training, she wrote a transformation exercise for use with introductory biology students. This exercise was introduced into *BIO 101, Principles of Biology*, in Fall Quarter, 1992, and, as mentioned above, was presented as a mini workshop at the ABLE meetings in 1994.

There are many problems associated with the use of an exercise of this kind in laboratories containing large numbers of introductory biology students. Each year, at Auburn University, approximately 1500 students complete *Principles of Biology*. Several quarters of using the exercise were necessary to work through the technical problems. Some problems were due to the physical distance between the General Biology teaching labs and the research labs where cells and DNA were prepared. The General Biology Program did not have the equipment necessary to prepare cells and plasmids for this exercise; therefore, it was necessary to move sterile cultures and frozen samples from one side of a large campus to the other without losing viability and competency.

Another problem was one of personnel. Many of the faculty and graduate students teaching in the biology labs were not trained in molecular genetics techniques. Training for this work had to be added to the laboratory prep sessions which were taught each year. Other problems had to do with the lack of money to purchase needed equipment. This is where the NSF grant entered the picture. The grant provided funds to purchase equipment to continue the transformation exercise

and expand the work to include gel electrophoresis. Goals of the grant include the addition of these exercises to the introductory course for non-science majors as well as the development of more advanced experiments for use with honors biology students. NSF reviewers commented on the fact that the first stages of this work already had been implemented, that the team had proven that they knew how to work out the problems which might develop, and that the introductory work already had been presented at a national meeting. Other positive factors included the large number of students served in the General Biology Program (approximately 4500 each year) and the fact that among these students are many future pre-college teachers. In addition, Dr. Shaw and the author have prepared a kit which is available to other institutions at cost. This kit contains cultures and instructions which are needed to use the transformation exercise in teaching programs around the country.

The NSF grant provided a two-year period for the purchase of equipment. This phase of the proposal was completed in July, 1997. We were able to stretch the grant dollars to cover almost all needed equipment. In addition to matching the NSF funds, Auburn University provided funding for one item of basic equipment which NSF would not allow as part of the grant and paid to renovate a lab to house the new equipment. Work can now continue toward implementation of the remaining goals of the grant.

Additional information on the grant writing process (as we did it), equipment purchasing processes, protocols for preparation of cells and plasmids, copies of the exercise, and kits are available upon request.

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