Integration of authentic research into an undergraduate laboratory course: Design, synthesis and testing of a gene therapy vector

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Undergraduate biology students often graduate without exposure to authentic research experiences. Laboratory courses follow a one or two week fail-proof experiment resembling a cookbook recipe, lacking the uncertainty of genuine research. Techniques in molecular biology cover an array of skills essential to succeed in a biotechnological laboratory today. This lab course is based on the teaching of concepts while imparting the skills and applications of modern techniques, providing students with theoretical concepts and laboratory skills. We prepare students to carry-out scientific protocols that can be applied to a future workforce setting. Students are immersed in a 12-week series of labs with the objective to use molecular cloning to make a gene therapy vector; therapies are designed to inhibit the overexpression of oncogenes in brain tumors. Students use DNA analysis software, Serial Cloner, as an interactive tool to evaluate DNA sequence motifs and visualize the design of an antisense gene therapy. Using a platform system, students generate a vector with a unique therapy. Students transfect into mammalian tissue culture cells and subsequently collect RNA to verify the effect of the therapy vector on the target gene.

Keywords: DNA analysis, genes, therapy vector, RNA

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