Lesson Objectives:

1. Create cheese and clone a "rennin gene" into E.coli following standard protocols
2. Analyze DNA electrophoresis and communicate results to peers.
3. Design and distribute an infographic that advertises the cheese made, and later in the lesson, the chymosin product produced by gene cloning.
4. Evaluate cheese products and assign a ranking to the product, based on taste, smell, and overall attractiveness.

Materials Required:

- Various biotechnology lab supplies (Detailed list provided on website).
- An Internet connection and computers for each student, or group of students.

Photo and reference credit:


Lesson Summary

Students are placed in a team of “original product designers” at a local, and until recently, profitable and beloved cheese factory. The company is faced with a dilemma of bankruptcy unless a new and interesting cheese product can be brought to the market. Students first work in teams to create a uniquely flavored cheese, and do so under the direction of a culinary microbiologist.

After students’ cheeses are finished, students use Google drawing to create a graphic to illustrate their recipe and showcase their cheese. Students then play the role of quality control and product assessment, and provide rankings for their peers’ new product. Cheese is enjoyed, and learning reflection takes place. After the cheese product has “hit the market”, another problem arises at the factory. The provider of rennet for the factory has bought out other rennet providers and raised the prices. Students are tasked with taking a "mammalian chymosin gene" (an important part of the rennet complex), derived from unweaned dairy calves, and inserting the gene into E.coli in an attempt for the cheese company to have its own supply of “in-house” chymosin.

Following the gene cloning activity, students verify the presence of correct genetic modification by using blue/white screening method. Finally, students use their previously developed Google drawing skills to construct a graphic used to advertise the new chymosin product as a way to sell excess product and save the locally heralded Cheese Shop. Detailed lesson plans and supplemental materials are available at: https://sites.google.com/a/dowlingcatholic.org/schneider-s-science-page/biotechnology
Activity Details

**Cheese making:** Students are tasked with making a novel cheese. Basic cheese making kits are available for order off of Amazon. There are a wide variety of kits available, some as inexpensive as $20, and others up to $100 or more. Teacher discretion is necessary when choosing a cheese kit. Some kits require weeks to make the cheese, while Mozzarella, for instance, can be made in a day. Flavorings can be added at student discretion to make the cheese unique.

**Gene Cloning:** Competent HB10B cells, LacZ cloning vector, and a soybean gene “Ripley”, is used for the gene cloning protocol. The protocol and detailed materials list is accessible from the website included above. The appropriate soybean gene, LacZ cloning vector, and HB10B cells are received from Bhattacharyya lab at Iowa State University. The remaining ligation enzymes and buffers can be ordered from New England Biolabs. Agar and media adjuvants can be purchased from MidSci in Illinois at the cheapest prices.

**Teaching Tips**

Provide time for students to search the web and become familiar with the cheese making and gene cloning processes at the appropriate times. Providing an engaging question prior to these explorations and then a check for understanding is suggested as a means of monitoring learning. If a scientist is available for your lab, make sure to bring them in for the cheese making and gene cloning process, to aide in student guidance.

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