

Bioengineering Day Poster Addendum (ABET questions)

1. List two to four **Desired Needs** of your project that led to your final design objectives.

- saRNA was required to amplify
- saRNA needed to have longer half life than traditional mRNA

2. List the major **Constraints** on your design/project

- Safety/Regulatory Affairs
 - saRNA is highly immunogenic to cells and can have cytotoxic effects.
- Risks
 - saRNA is a new and untested therapeutic technology
- Global Impact
 - saRNA has numerous potential applications such as in RNA vaccine and protein therapeutics but must get through expensive testing stages.
- Manufacturability
 - RNA is much easier to manufacture than standard protein therapeutics, but procedures for manufacture must still be made.
- Quality Control/Marketability
 - Each batch must be tested to ensure no contaminants are present.

3. List the major **Engineering Standards** on your design/project

Standards for saRNA dosage, lifespan, and protein production can be developed from this project and extensions of the project. Standard delivery mechanisms of RNA into cells were used, such as lipid nanoparticles (LNPs) or lipofectamine reagents because these technologies are well proven and offer reproducible results.

4. Explain **Ethical, Environmental, or Societal concerns** for practical applications of your project. Protein therapeutics are expensive to manufacture due to strict guidelines on purity and the correct post-translational modifications produced by an in vitro cell. This naturally increases the price of these therapeutics and necessitates constant monitoring of cell lines. saRNA therapeutics have the potential to simplify these therapies by turning a patient's own cells into a factory to make these required proteins, increasing accessibility.

5. Describe **Active Teamwork and Leadership** in your design group

Our team excelled at collaboration and inclusion throughout the entire senior design process. Members were communicative and responsible for their assigned tasks, and generous with assistance when asked. Group members were also always respectful of one another's opinions and availability throughout the project, and successfully met all deadlines and project goals.

6. What were the most significant motivating factors that led you to

Every member of the group was eager to learn new skills and techniques which furthered their abilities as a bioengineer, and took full advantage the opportunity a hands-on wet lab senior design offered. When resistance was encountered, group members were remarkably able to frame the friction as a learning opportunity and bettered themselves from the experience of failure.

7. What are your most **innovative and/or entrepreneurial ideas** for this project?

The most innovative part of this project was the decision to combine circRNA technologies and self-amplifying RNA together in RACER, which accomplishes remarkable improvements in expression of a gene of interest over previous designs.