

Pharmacoengineering: Delivery of Large Molecules for Genetic Engineering

Ph.D. Student Qualifying Exam

*Issued: **January 25 at 0800***

Please register your intent to take the exam by 5PM January 24 to mike_sano@ncsu.edu

*Return Completed Exam to mike_sano@ncsu.edu By: **January 27 at 0800** Expected Time It*

*Will Take to Complete the Exam: **3-5 hrs.***

Genetic engineering is at the forefront of biomedical engineering. This engineering approach has the potential to change the way we study and address biological and medical challenges across disciplines. Fundamental to this process are the engineering of new genetic material, positioning of or deletion of genetic material at specific locations within the genome, and delivery of genetic editors/payloads to target cells. This exam will focus on the CRISPR / cas9 genetic engineering toolset, techniques for delivering this machinery to cells, and an introduction to the complexity of a single specific technique for large molecule delivery.

Goals and Learning Objectives:

- Demonstrate fundamental understanding of CRISPR, gene transfection, and electroporation.
- Identify the advantages and disadvantages of different transfection approaches.
- Appreciate the complexity of a single approach within the broader scientific context.

Format:

- Combination of multiple choice and short answer questions.
- Student may use all resources for completion.
- Students must work individually.
- Exam must be submitted as a PDF named: "LastName_ Qualifer_ Jan2021"

References Covered:

1. Delivering CRISPR: a review of the challenges and approaches - DOI: 10.1080/10717544.2018.1474964
2. Single-cell transfection technologies for cell therapies and gene editing – DOI: 10.1016/j.jconrel.2020.10.068
3. A brief overview of electroporation pulse strength–duration space: A region where additional intracellular effects are expected – DOI: 10.1016/j.bioelechem.2012.02.007

*** References 1-3 should be read and understood in full.

*** Students may wish to do additional reading that reinforces their understanding of the systems, techniques, and approaches described above.