Course Code: ABS-938 CRISPR Gene Editing 3(3-0) CHs

Learning Objectives

1. Gains advanced subject and methodological knowledge regarding genome editing technology,

learns the history of CRISPR/Cas9 technology development, knows different genome editing strategies and examples of their applications

Outcomes

2. Upon finishing the course, the student should:
   a. design sgRNA and predict its specificity
   b. know the experimental methods to evaluate the CRISPR/Cas efficiency and specificity
   c. determine applicative goals for the application of selected genome engineering methods
   d. critically evaluate safety and ethical issues of genome editing technology

3. **Content**

   a. **The history of CRISPR/Cas technology development**
   b. **Rapid and efficient gene deletion by CRISPR/Cas9**
   c. **DNA repair mechanisms**
   d. **CRISPR-gRNA Design**
   e. **Tracking CRISPR's footprints**
   f. **Fast and Quantitative Identification of ex vivo precise genome targeting-induced indel events by IDAA**
   g. **Functional evaluation of CRISPR activity by the dual-fluorescent surrogate systems**
   h. **Methods used in genome editing technology**

      CRISPR-Cas9 delivery by artificial virus (RRHPC)

      Production and Validation of lentiviral vectors for CRISPR/Cas9 delivery

      Screening of CRISPR guide RNAs (gRNAs) in cultured cells using adeno-associated viral vectors

Electroporation-based CRISPR/Cas9 gene editing using Cas9 protein and chemically modified sgRNAs

- **Modifications and orthologs of Cas9 protein**
- **Examples of CRISPR/Cas technology applications**
- **Next generation sequencing**

  First, second and third generation sequencing technologies

  Ion Torrent and illumina methods
- **CRISPRi and RNA editing**
- **CRISPR/Cas9-mediated gene tagging**
- **CRISPR-based lentiviral knockout libraries for functional genomic screening and identification of phenotype-related genes**
- **Ethical aspects and safety of genome editing technology**

g. Details of lab work (if applicable)

Not applicable

h. Recommended Readings

Text Book

Genome engineering using the CRISPR-Cas9 system. Ran FA, Hsu PD, Wright J, Agarwala V, Scott DA, Zhang F. Nat Protoc. 2013;8(11):2281-2308

Reference Books

1. A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. Jinek M, Chylinski K, Fonfara I, Hauer M, Doudna JA, Charpentier E. Science. 2012;337(6096):816-21.

2. The Heroes of CRISPR. Eric S. Lander, Cell Volume 164, Issues 1-2, p18–28, 2016.

3. CRISPR interference (CRISPRi) for sequence- specific control of gene expression. Larson, M. H.; Gilbert, L. A.; Wang, X; Lim, W. A.; Weissman, J. S.; Qi, L. S. (2013) Nature Protocols. 8 (11): 2180–96.