

Activity 1A: Primary Literature and Naming of Restriction Enzymes Answer Key

Primary Literature

- 1) Students will read the journal article that explains the naming and classification of restriction enzymes.

- a) Primary Reference for naming enzymes: (Smith & Nathans 1973) Hamilton O. Smith, Daniel Nathans, A Suggested nomenclature for bacterial host modification and restriction systems and their enzymes, Journal of Molecular Biology, 1973, 81(3), 419-423.

[https://doi.org/10.1016/0022-2836\(73\)90152-6](https://doi.org/10.1016/0022-2836(73)90152-6)

- b) For advanced classes this reference can also be added: (Roberts et al 2003) Roberts RJ, Belfort M, Bestor T, Bhagwat AS, Bickle TA, Bitinaite J, Blumenthal RM, Degtyarev SKh, Dryden DT, Dybvig K, Firman K, Gromova ES, Gumpert RI, Halford SE, Hattman S, Heitman J, Hornby DP, Janulaitis A, Jeltsch A, Josephsen J, Kiss A, Klaenhammer TR, Kobayashi I, Kong H, Krüger DH, Lacks S, Marinus MG, Miyahara M, Morgan RD, Murray NE, Nagaraja V, Piekarowicz A, Pingoud A, Raleigh E, Rao DN, Reich N, Repin VE, Selker EU, Shaw PC, Stein DC, Stoddard BL, Szybalski W, Trautner TA, Van Etten JL, Vitor JM, Wilson GG, Xu SY. A nomenclature for restriction enzymes, DNA methyltransferases, homing endonucleases and their genes. Nucleic Acids Res. 2003 Apr 1;31(7):1805-12. doi: 10.1093/nar/gkg274. PMID: 12654995; PMCID: PMC152790.

Students will answer the following questions following reading of the article Smith & Nathans 1973.

- 1) What do the authors mean by the R-M system?

R - is for restriction enzymes

M - is for modification enzymes such as methyltransferases

- 2) Where do R-M enzymes come from?

These enzymes are found in different types of bacteria.

- 3) When naming an enzyme what 3 letters are used to signify where the enzymes originated from? Give 2 examples of enzymes that were mentioned on the first 2 pages of the paper.

The enzyme first letter is from the genus and the second and third are from the species name. EcoRI and HindIII.

4) What does the 4th letter in some R-M enzyme names mean or stand for? Give an example of one.

The 4th letter comes from the strain name of the organism as in the R in EcoRI.

5) What does the Roman numeral at the end of the R-M naming system mean?

This represents the particular enzyme number. It is used when there is more than one enzyme isolated from the same organism. Two examples are EcoRI and EcoRV (these are two different restriction enzymes that were both isolated from E. coli).

Activity 1B: Restriction Enzyme Naming Answer Key

Part 1: Restriction enzyme matching game: This activity is meant for students to understand the naming of enzymes. Students will match the restriction enzyme with the organisms (genus and species) that it was isolated from using an assignment made through educaplay. Students will have 2 tries on this matching game. Provide the following link for your students:

https://www.educaplay.com/learning-resources/9969603-enzyme_matching.html

Part 2: Enzyme cut sites: Below is a list of the most common restriction enzymes used for Bacteriophage in the SEA-PHAGES project. Find the cut sites for all of the following enzymes.

1) HaeIII - GGCC

2) HindIII - AAGCTT

3) NspI - RCATGY

4) SacII - CCGCGG

5) SalI - GTCGAC

6) ClaI - ATCGAT

7) EcoRI - GAATTC