

## Effect of nucleases on bacteria infected with bacteriophages

Sharipova M., Balaban N., Mardanova A., Toymentseva A., Baranova D.  
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

---

### Abstract

© 2017, Pleiades Publishing, Inc. The effect of bacterial nucleases on bacteria infected by DNA- or RNA-containing bacteriophages with different serogroups was studied. Bacillary RNases have a strong inhibitory effect on RNA-containing bacteriophages. It was shown that nucleases suppressed the infection process of bacteria by bacteriophages M12, f2, PP7, and QB. The minimal inhibitory concentration ranged from 0.6 to 6 µg/mL. Bacterial ribonucleases have no impact on the development of DNA-containing bacteriophages PZ-A, PZ-B, P3k, P118, and a lysogenic culture of *Escherichia coli* (λ) and *Bacillus subtilis* 168 (phi105). RNase from *Bacillus pumilus* did not inactivate bacteriophages Qβ and f2 in vitro and did not influence the adsorption on bacteriophages on the cell wall of the bacteria host *E. coli* AB301. The enzyme effect was shown at the level of bacteriophage infection of the host bacteria. Presumably, the phase between the adsorption and penetration of phage RNA into bacterial pili is the most sensitive to the effect of RNases.

<http://dx.doi.org/10.1134/S1062359017020170>

---

### References

- [1] Filimonova, M.N., Balaban, N.P., Sharipova, F.R., and Leshchinskaya, I.B., Isolation and physicochemical properties of homogenous nuclease from *Serratia marcescens*, *Biokhimiya*, 1980, vol. 45, no. 11, pp. 2096-20103.
- [2] Fleck, W., A new microbiological screening method for the search for potential carcinostatic and virostatic agents with action on the nucleic acid metabolism, *Z. Allg. Mikrobiol.*, 1968, vol. 8, no. 2, pp. 139-144.
- [3] Guttman, B., Raya, R., and Kutter, E., Basic phage biology, in *Bacteriophages: Biology and Applications*, Kutter, E. and Sulakvelidze, A., Eds., Boca Raton, FL: CRC Press, 2005, pp. 29-66.
- [4] Hartley, R.W., BaRNase-barstar interaction, *Methods Enzymol.*, 2001, vol. 341, pp. 599-611.
- [5] Hartley, R.W. and Rogerson, D.L., Production and purification of the extracellular ribonuclease of *Bacillus amyloliquefaciens* (baRNase) and its intracellular inhibitor (barstar). I. BaRNase, *Prep. Biochem.*, 1972, vol. 2, no. 3, pp. 229-242.
- [6] Kushkina, A.I. and Tovkach, F.I., Lysogenesis in bacteria and its implications for biotechnology, *Biotechnologiya*, 2011, vol. 4, no. 1, pp. 29-40.
- [7] Leshchinskaya, I.B., Balaban, N.P., Kapranova, M.N., and Golubenko, I.A., *Sovremennyye metody izucheniya nukleinovykh kislot i nukleaz mikroorganizmov: Metody opredeleniya nukleaz i rodstvennykh fermentov (Modern Methods for Studying Nucleic Acids and Nucleases Microorganisms: Methods for Determination of Nucleases and Related Enzymes)*, Kazan: Izd. KGU, 1980.
- [8] Leshchinskaya, I.B., Kleiner, G., Volkova, T.I., Balaban, N.P., and Sharipova, F.R., Method for isolation and purification of alkaline ribonuclease from *Bacillus intermedius*, *Prikl. Biokhim. Mikrobiol.*, 1981, vol. 17, no. 2, pp. 241-246.

- [9] McGrath, S., Fitzgerald, G.F., and van Sinderen, D., Bacteriophages in dairy products: pros and cons, *Biotechnol. J.*, 2007, vol. 2, no. 4, pp. 450-455.
- [10] Pererva, T.P., Miryuta, A.Yu., and Miryuta, N.Yu., Interaction of RNA-containing bacteriophages with host cell: MS2-induced mutants of *E. coli* and the occurrence of DNA-containing derivatives of the bacteriophage MS2, *Tsitol. Genet.*, 2008, vol. 42, no. 1, pp. 60-74.
- [11] Raya, R.R. and Hébert, E.M., Isolation of phage via induction of lysogens, in *Bacteriophages: Methods and Protocols*, Vol. 1: Isolation, Characterization, and Interaction, 1st ed., Clokie, M.R.J. and Kropinski, A.M., Eds., New York: Humana Press, 2009, vol. 501, pp. 23-32.
- [12] Sharipova, M.R., Lopukhov, L.V., Vershinina, O.A., and Leshchinskaya, I.B., Some secretion characteristics of bacterial ribonuclease, *Microbiology (Moscow)*, 2005, vol. 74, no. 1, pp. 27-31.
- [13] Stenz, E. and Menzel, G., Effect of 1,3,5-triazines on various bacteriophages and their hosts, *Z. Allg. Mikrobiol.*, 1978, vol. 18, no. 2, pp. 115-121.
- [14] Stenz, E., Menzel, G., and Schuster, G., Effect of triazoles on DNA- and RNA-containing bacteriophages and their hosts, *Mikrobiol. Zh.*, 1980, vol. 42, no. 2, pp. 239-242.
- [15] Zsigray, R.M., Miss, A.L., and Landman, O.E., Penetration of a bacteriophage into *Bacillus subtilis*: blockage of infection by deoxyribonuclease, *J. Virol.*, 1973, vol. 11, no. 1, pp. 69-77.