

brought to you by [www.thebacteriophages.org](http://www.thebacteriophages.org) and [www.phage.org](http://www.phage.org)

## References

1. Alberts, B., and R. Miake-Lye. 1992. Unscrambling the puzzle of biological machines: the importance of the details. *Cell* **68**:415-20.
2. Aubrey, K. L., S. R. Casjens, and G. J. Thomas, Jr. 1992. Secondary structure and interactions of the packaged dsDNA genome of bacteriophage P22 investigated by Raman difference spectroscopy. *Biochemistry* **31**:11835-42.
3. Backhaus, H. 1985. DNA packaging initiation of *Salmonella* bacteriophage P22: determination of cut sites within the DNA sequence coding for gene 3. *J Virol* **55**:458-65.
4. Bertani, E., and E. W. Six. 1988. The P2-like Phages and Their Parasite, P4, p. 73-143. *In* R. Calendar (ed.), *The Bacteriophages*, vol. 2. Plenum, New York.
5. Bijlenga, R. K., D. Scraba, and E. Kellenberger. 1973. Studies on the morphopoiesis of the head of T-even phage. IX. *Tau*-particles: their morphology, kinetics of appearance and possible precursor function. *Virology* **56**:250-67.
6. Bjornsti, M. A., B. E. Reilly, and D. L. Anderson. 1981. *In vitro* assembly of the *Bacillus subtilis* bacteriophage phi29. *Proc Natl Acad Sci U S A* **78**:5861-5.
7. Bjornsti, M. A., B. E. Reilly, and D. L. Anderson. 1983. Morphogenesis of bacteriophage phi29 of *Bacillus subtilis*: oriented and quantized *in vitro* packaging of DNA protein gp3. *J Virol* **45**:383-96.
8. Black, L. W. 1989. DNA packaging in dsDNA bacteriophages. *Annu Rev Microbiol* **43**:267-92.
9. Black, L. W., W. W. Newcomb, J. W. Boring, and J. C. Brown. 1985. Ion etching

- bacteriophage T4: support for a spiral-fold model of packaged DNA. Proc Natl Acad Sci U S A **82**:7960-4.
10. Black, L. W., and D. J. Silverman. 1978. Model for DNA packaging into bacteriophage T4 heads. J Virol **28**:643-55.
  11. Bowden, D. W., and R. Calendar. 1979. Maturation of bacteriophage P2 DNA *in vitro*: A complex, site-specific system for DNA cleavage. J Mol Biol **129**:1-18.
  12. Bowden, D. W., and P. Modrich. 1985. *In vitro* maturation of circular bacteriophage P2 DNA. Purification of ter components and characterization of the reaction. J Biol Chem **260**:6999-7007.
  13. Casjens, S., and M. Hayden. 1988. Analysis *in vivo* of the bacteriophage P22 headful nuclease. J Mol Biol **199**:467-74.
  14. Casjens, S., W. M. Huang, M. Hayden, and R. Parr. 1987. Initiation of bacteriophage P22 DNA packaging series. Analysis of a mutant that alters the DNA target specificity of the packaging apparatus. J Mol Biol **194**:411-22.
  15. Casjens, S., E. Wyckoff, M. Hayden, L. Sampson, K. Eppler, S. Randall, E. T. Moreno, and P. Serwer. 1992. Bacteriophage P22 portal protein is part of the gauge that regulates packing density of intravirion DNA. J Mol Biol **224**:1055-74.
  16. Catalano, C. E. 2003. Viral Genome Packaging. Landes Publishing, Georgetown, Texas.
  17. Catalano, C. E., D. Cue, and M. Feiss. 1995. Virus DNA packaging: the strategy used by phage lambda. Mol Microbiol **16**:1075-86.
  18. Cerritelli, M. E., N. Cheng, A. H. Rosenberg, C. E. McPherson, F. P. Booy, and A. C. Steven. 1997. Encapsidated conformation of bacteriophage T7 DNA. Cell

- 91:271-80.**
19. Chai, S., R. Lurz, and J. C. Alonso. 1995. The small subunit of the terminase enzyme of *Bacillus subtilis* bacteriophage SPP1 forms a specialized nucleoprotein complex with the packaging initiation region. *J Mol Biol* **252:386-98.**
  20. Chow, L. T., and A. I. Bukhari. 1978. Heteroduplex electron microscopy of phage Mu mutants containing IS1 insertions and chloramphenicol resistance transposons. *Gene* **3:333-46.**
  21. Conway, J. F., R. L. Duda, N. Cheng, R. W. Hendrix, and A. C. Steven. 1995. Proteolytic and conformational control of virus capsid maturation: the bacteriophage HK97 system. *J Mol Biol* **253:86-99.**
  22. Cummings, D. J., V. A. Chapman, S. S. DeLong, and N. L. Couse. 1973. Structural aberrations in T-even bacteriophage. 3. Induction of "lollipops" and their partial characterization. *Virology* **54:245-61.**
  23. Dannenberg, R., and G. Mosig. 1983. Early intermediates in bacteriophage T4 DNA replication and recombination. *J Virol* **45:813-31.**
  24. de Beer, T., J. Fang, M. Ortega, Q. Yang, L. Maes, C. Duffy, N. Berton, J. Sippy, M. Overduin, M. Feiss, and C. E. Catalano. 2002. Insights into specific DNA recognition during the assembly of a viral genome packaging machine. *Mol Cell* **9:981-91.**
  25. Dube, P., P. Tavares, R. Lurz, and M. van Heel. 1993. The portal protein of bacteriophage SPP1: a DNA pump with 13-fold symmetry. *Embo J* **12:1303-9.**
  26. Duffy, C., and M. Feiss. 2002. The large subunit of bacteriophage lambda's terminase plays a role in DNA translocation and packaging termination. *J Mol*

- Biol **316**:547-61.
27. Earnshaw, W. C., and S. R. Casjens. 1980. DNA packaging by the double-stranded DNA bacteriophages. *Cell* **21**:319-31.
  28. Earnshaw, W. C., J. King, S. C. Harrison, and F. A. Eiserling. 1978. The structural organization of DNA packaged within the heads of T4 wild-type, isometric and giant bacteriophages. *Cell* **14**:559-68.
  29. Eickbush, T. H., and E. N. Moudrianakis. 1978. The compaction of DNA helices into either continuous supercoils or folded-fiber rods and toroids. *Cell* **13**:295-306.
  30. Eiserling, F. A., E. P. Geiduschek, R. H. Epstein, and E. J. Metter. 1970. Capsid size and deoxyribonucleic acid length: the petite variant of bacteriophage T4. *J Virol* **6**:865-76.
  31. Feiss, M., R. A. Fisher, M. A. Crayton, and C. Egner. 1977. Packaging of the bacteriophage lambda chromosome: effect of chromosome length. *Virology* **77**:281-93.
  32. Feiss, M., S. Frackman, and J. Sippy. 1985. Essential interaction between lambdoid phage 21 terminase and the *Escherichia coli* integrative host factor. *J Mol Biol* **183**:239-46.
  33. Franklin, J. L., D. Haseltine, L. Davenport, and G. Mosig. 1998. The largest (70 kDa) product of the bacteriophage T4 DNA terminase gene 17 binds to single-stranded DNA segments and digests them towards junctions with double-stranded DNA. *J Mol Biol* **277**:541-57.
  34. Fujisawa, H., and M. Morita. 1997. Phage DNA packaging. *Genes Cells* **2**:537-

- 45.
35. George, M., and A. I. Bukhari. 1981. Heterogeneous host DNA attached to the left end of mature bacteriophage Mu DNA. *Nature* **292**:175-6.
36. Golz, S., and B. Kemper. 1999. Association of holliday-structure resolving endonuclease VII with gp20 from the packaging machine of phage T4. *J Mol Biol* **285**:1131-44.
37. Grimes, S., and D. Anderson. 1997. The bacteriophage phi29 packaging proteins supercoil the DNA ends. *J Mol Biol* **266**:901-14.
38. Grimes, S., P. J. Jardine, and D. Anderson. 2002. Bacteriophage phi29 DNA packaging. *Adv Virus Res* **58**:255-94.
39. Guasch, A., J. Pous, B. Ibarra, F. X. Gomis-Ruth, J. M. Valpuesta, N. Sousa, J. L. Carrascosa, and M. Coll. 2002. Detailed architecture of a DNA translocating machine: the high-resolution structure of the bacteriophage phi29 connector particle. *J Mol Biol* **315**:663-76.
40. Guo, P., S. Grimes, and D. Anderson. 1986. A defined system for *in vitro* packaging of DNA-gp3 of the *Bacillus subtilis* bacteriophage phi29. *Proc Natl Acad Sci U S A* **83**:3505-9.
41. Hamada, K., H. Fujisawa, and T. Minagawa. 1986. A defined *in vitro* system for packaging of bacteriophage T3 DNA. *Virology* **151**:119-23.
42. Hang, J. Q., B. F. Tack, and M. Feiss. 2000. ATPase center of bacteriophage lambda terminase involved in post-cleavage stages of DNA packaging: identification of ATP-interactive amino acids. *J Mol Biol* **302**:777-95.
43. Hershey, R. M. 1988. Phage Mu, p. 193-234. *In* R. Calendar (ed.), *The*

- Bacteriophages, vol. 1. Plenum, New York.
44. Hendrix, R. W. 1978. Symmetry mismatch and DNA packaging in large bacteriophages. *Proc Natl Acad Sci U S A* **75**:4779-83.
  45. Hendrix, R. W. 1985. Shape Determination in Virus Assembly: The Bacteriophage Example, p. 169-203. *In* S. Casjens (ed.), *Virus Structure and Assembly*, vol. 1. Jones and Bartlett, Boston.
  46. Hendrix, R. W., and S. R. Casjens. 1975. Assembly of bacteriophage lambda heads: protein processing and its genetic control in petit lambda assembly. *J Mol Biol* **91**:187-99.
  47. Hohn, T. 1976. Packaging of genomes in bacteriophages: a comparison of ssRNA bacteriophages and dsDNA bacteriophages. *Philos Trans R Soc Lond B Biol Sci* **276**:143-50.
  48. Hud, N. V. 1995. Double-stranded DNA organization in bacteriophage heads: an alternative toroid-based model. *Biophys J* **69**:1355-62.
  49. Hud, N. V., and K. H. Downing. 2001. Cryoelectron microscopy of lambda phage DNA condensates in vitreous ice: the fine structure of DNA toroids. *Proc Natl Acad Sci U S A* **98**:14925-30.
  50. Hwang, Y., and M. Feiss. 1995. A defined system for *in vitro* lambda DNA packaging. *Virology* **211**:367-76.
  51. Jardine, P. J., and D. H. Coombs. 1998. Capsid expansion follows the initiation of DNA packaging in bacteriophage T4. *J Mol Biol* **284**:661-72.
  52. Jardine, P. J., M. C. McCormick, C. Lutze-Wallace, and D. H. Coombs. 1998. The bacteriophage T4 DNA packaging apparatus targets the unexpanded prohead.

- J Mol Biol **284**:647-59.
53. Kellenberger, E. 1980. Control mechanisms in the morphogenesis of bacteriophage heads. *Biosystems* **12**:201-23.
  54. Kellenberger, E., E. Carlemalm, J. Sechaud, and A. Ryter. 1986. Considerations on the condensation and the degree of compactness in non-eukaryotic DNA-containing plasmids, p. 11-25. *In* C. O. Gualerzi and C. L. Pon (ed.), *Bacterial Chromatin*, vol. 1. Springer-Verlag, Berlin.
  55. Keppel, F., O. Fayet, and C. Georgopoulos. 1988. Strategies of Bacteriophage Replication, p. 145-262. *In* R. Calendar (ed.), *The Bacteriophages*, vol. 2. Plenum, New York.
  56. Kindt, J., S. Tzlil, A. Ben-Shaul, and W. M. Gelbart. 2001. DNA packaging and ejection forces in bacteriophage. *Proc Natl Acad Sci U S A* **98**:13671-4.
  57. King, J., and S. Casjens. 1974. Catalytic head assembling protein in virus morphogenesis. *Nature* **251**:112-9.
  58. Kinoshita, K., Jr., R. Yasuda, H. Noji, S. Ishiwata, and M. Yoshida. 1998. F1-ATPase: a rotary motor made of a single molecule. *Cell* **93**:21-4.
  59. Laemmli, U. K. 1970. Cleavage of structural proteins during the assembly of the head of bacteriophage T4. *Nature* **227**:680-5.
  60. Laemmli, U. K., and M. Favre. 1973. Maturation of the head of bacteriophage T4. I. DNA packaging events. *J Mol Biol* **80**:575-99.
  61. Lepault, J., J. Dubochet, W. Baschong, and E. Kellenberger. 1987. Organization of double-stranded DNA in bacteriophages: a study by cryo-electron microscopy of vitrified samples. *Embo J* **6**:1507-12.

62. Lin, H., V. B. Rao, and L. W. Black. 1999. Analysis of capsid portal protein and terminase functional domains: interaction sites required for DNA packaging in bacteriophage T4. *J Mol Biol* **289**:249-60.
63. Luftig, R. B., and C. Ganz. 1972. Bacteriophage T4 head morphogenesis. IV. Comparison of gene 16-, 17-, and 49-defective head structures. *J Virol* **10**:545-54.
64. Luftig, R. B., and N. P. Lundh. 1973. Bacteriophage T4 head morphogenesis. Isolation, partial characterization, and fate of gene 21-defective *tau*-particles. *Proc Natl Acad Sci U S A* **70**:1636-40.
65. Luftig, R. B., W. B. Wood, and R. Okinaka. 1971. Bacteriophage T4 head morphogenesis. On the nature of gene 49-defective heads and their role as intermediates. *J Mol Biol* **57**:555-73.
66. Lurz, R., E. V. Orlova, D. Gunther, P. Dube, A. Droge, F. Weise, M. van Heel, and P. Tavares. 2001. Structural organisation of the head-to-tail interface of a bacterial virus. *J Mol Biol* **310**:1027-37.
67. Malys, N., D. Y. Chang, R. G. Baumann, D. Xie, and L. W. Black. 2002. A bipartite bacteriophage T4 SOC and HOC randomized peptide display library: detection and analysis of phage T4 terminase (gp17) and late sigma factor (gp55) interaction. *J Mol Biol* **319**:289-304.
68. Mellado, R. P., M. A. Penalva, M. R. Inciarte, and M. Salas. 1980. The protein covalently linked to the 5' termini of the DNA of *Bacillus subtilis* phage phi29 is involved in the initiation of DNA replication. *Virology* **104**:84-96.
69. Mellado, R. P., and M. Salas. 1983. Initiation of phage phi29 DNA replication by the terminal protein modified at the carboxyl end. *Nucleic Acids Res* **11**:7397-



- 407.
70. Mitchell, M. S., S. Matsuzaki, S. Imai, and V. B. Rao. 2002. Sequence analysis of bacteriophage T4 DNA packaging/terminase genes 16 and 17 reveals a common ATPase center in the large subunit of viral terminases. *Nucleic Acids Res* **30**:4009-21.
  71. Mizuuchi, K., B. Kemper, J. Hays, and R. A. Weisberg. 1982. T4 endonuclease VII cleaves holliday structures. *Cell* **29**:357-65.
  72. Mullaney, J. M., and L. W. Black. 1998. Activity of foreign proteins targeted within the bacteriophage T4 head and prohead: implications for packaged DNA structure. *J Mol Biol* **283**:913-29.
  73. Muller, D. J., A. Engel, J. L. Carrascosa, and M. Velez. 1997. The bacteriophage phi29 head-tail connector imaged at high resolution with the atomic force microscope in buffer solution. *Embo J* **16**:2547-53.
  74. Odijk, T. 1998. Hexagonally packed DNA within bacteriophage T7 stabilized by curvature stress. *Biophys J* **75**:1223-7.
  75. Oster, G., and H. Wang. 2003. Rotary protein motors. *Trends Cell Biol* **13**:114-21.
  76. Overman, S. A., K. L. Aubrey, K. E. Reilly, O. Osman, S. J. Hayes, P. Serwer, and G. J. Thomas, Jr. 1998. Conformation and interactions of the packaged double-stranded DNA genome of bacteriophage T7. *Biospectroscopy* **4**:S47-56.
  77. Pruss, G. J., and R. Calendar. 1978. Maturation of bacteriophage P2 DNA. *Virology* **86**:454-67.
  78. Raman, C. S., S. J. Hayes, B. T. Nall, and P. Serwer. 1993. Energy stored in the

- packaged DNA of bacteriophage T7. *Biophys J* **64**:A12 (suppl.).
79. Rao, V. B., and L. W. Black. 1985. DNA packaging of bacteriophage T4 proheads *in vitro*. Evidence that prohead expansion is not coupled to DNA packaging. *J Mol Biol* **185**:565-78.
80. Rekosh, D. M., W. C. Russell, A. J. Bellet, and A. J. Robinson. 1977. Identification of a protein linked to the ends of adenovirus DNA. *Cell* **11**:283-95.
81. Roeder, G. S., and P. D. Sadowski. 1977. Bacteriophage T7 morphogenesis: phage-related particles in cells infected with wild-type and mutant T7 phage. *Virology* **76**:263-85.
82. Schmutz, M., D. Durand, A. Debin, Y. Palvadeau, A. Etienne, and A. R. Thierry. 1999. DNA packing in stable lipid complexes designed for gene transfer imitates DNA compaction in bacteriophage. *Proc Natl Acad Sci U S A* **96**:12293-8.
83. Serwer, P. 1975. Buoyant density sedimentation of macromolecules in sodium iothalamate density gradients. *J Mol Biol* **92**:433-48.
84. Serwer, P. 1986. Arrangement of double-stranded DNA packaged in bacteriophage capsids. An alternative model. *J Mol Biol* **190**:509-12.
85. Serwer, P. 1988. The source of energy for bacteriophage DNA packaging: an osmotic pump explains the data. *Biopolymers* **27**:165-9.
86. Shibata, H., H. Fujisawa, and T. Minagawa. 1987. Characterization of the bacteriophage T3 DNA packaging reaction *in vitro* in a defined system. *J Mol Biol* **196**:845-51.
87. Simpson, A. A., Y. Tao, P. G. Leiman, M. O. Badasso, Y. He, P. J. Jardine, N. H. Olson, M. C. Morais, S. Grimes, D. L. Anderson, T. S. Baker, and M. G.

- Rossmann. 2000. Structure of the bacteriophage phi29 DNA packaging motor. *Nature* **408**:745-50.
88. Smith, D. E., S. J. Tans, S. B. Smith, S. Grimes, D. L. Anderson, and C. Bustamante. 2001. The bacteriophage straight phi29 portal motor can package DNA against a large internal force. *Nature* **413**:748-52.
89. Son, M., S. J. Hayes, and P. Serwer. 1989. Optimization of the *in vitro* packaging efficiency of bacteriophage T7 DNA: effects of neutral polymers. *Gene* **82**:321-5.
90. Steven, A. C., E. Couture, U. Aebi, and M. K. Showe. 1976. Structure of T4 polyheads. II. A pathway of polyhead transformation as a model for T4 capsid maturation. *J Mol Biol* **106**:187-221.
91. Steven, A. C., H. L. Greenstone, F. P. Booy, L. W. Black, and P. D. Ross. 1992. Conformational changes of a viral capsid protein. Thermodynamic rationale for proteolytic regulation of bacteriophage T4 capsid expansion, co-operativity, and super-stabilization by soc binding. *J Mol Biol* **228**:870-84.
92. Stroud, R. M., P. Serwer, and M. J. Ross. 1981. Assembly of bacteriophage T7. Dimensions of the bacteriophage and its capsids. *Biophys J* **36**:743-57.
93. Tao, Y., N. H. Olson, W. Xu, D. L. Anderson, M. G. Rossmann, and T. S. Baker. 1998. Assembly of a tailed bacterial virus and its genome release studied in three dimensions. *Cell* **95**:431-7.
94. Tavares, P., M. A. Santos, R. Lurz, G. Morelli, H. de Lencastre, and T. A. Trautner. 1992. Identification of a gene in *Bacillus subtilis* bacteriophage SPP1 determining the amount of packaged DNA. *J Mol Biol* **225**:81-92.
95. Turnquist, S., M. Simon, E. Egelman, and D. Anderson. 1992. Supercoiled DNA

- wraps around the bacteriophage phi29 head-tail connector. Proc Natl Acad Sci U S A **89**:10479-83.
96. Valpuesta, J. M., and J. L. Carrascosa. 1994. Structure of viral connectors and their function in bacteriophage assembly and DNA packaging. Q Rev Biophys **27**:107-155.
97. Watson, J. D. 1972. Origin of concatemeric T7 DNA. Nat New Biol **239**:197-201.
98. Widom, J., and R. L. Baldwin. 1980. Cation-induced toroidal condensation of DNA studies with  $\text{Co}^{3+}(\text{NH}_3)_6$ . J Mol Biol **144**:431-53.
99. Widom, J., and R. L. Baldwin. 1983. Tests of spool models for DNA packaging in phage lambda. J Mol Biol **171**:419-37.
100. Wiczorek, D. J., and M. Feiss. 2001. Defining cosQ, the site required for termination of bacteriophage lambda DNA packaging. Genetics **158**:495-506.
101. Yap, N. L., and V. B. Rao. 1996. Novel mutants in the 5' upstream region of the portal protein gene 20 overcome a gp40-dependent prohead assembly block in bacteriophage T4. J Mol Biol **263**:539-50.