Bacteriophage Ecology Group (BEG) News

Dedicated to the *ecology* and *evolutionary biology* of the parasites of unicellular organisms (UOPs)

January 1, 2005 issue (volume 23)

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Editorial

Phage Books Phage T-Shirt

Abedon, S. T. (2004). *BEG News* 23 (www.phage.org/bgnws023.htm#editorial).

As I fish around for a theme each quarter for the *BEG News* editorial, sometimes I get lucky and one falls right into my lap. Such is the case for this issue of *BEG News* and the theme of phage books. If you are willing to include books on phage display, then a whopping eleven phage-themed books either are currently in preparation, are in production as I write (some still shooting for a 2004 copyright), or were published either this year (2004) or last. Newly published phage books (i.e., 2003 or 2004), according to Amazon.com, include :

1. Häusler, T. (2003). *Gesund durch Viren Ein Ausweg aus der Antibiotika-Krise* (German) (Health by Viruses A Way Out of the Antibiotic-Resistance Crisis). Piper. [Google Search]

2. Clackson, T., H. B. Lowman, H. B. (2004). *Phage Display: A Practical Approach*. Oxford University Press. [Google Search]

3. Ptashne, M. (2004). *Genetic Switch: Phage Lambda Revisited* 3/e. Cold Spring Harbor Laboratory Press. [Google Search]

If you are willing to include fiction with a sort-of phage theme, then to the above we might add Michael Crichton:

4. Crichton, M. (2003) *Prey*. Harper Collins. [Google Search]

Two additional phage books still scheduled for 2004 publication are:

5. Catalano, C. (2004). *Bacteriophage Genome Packaging*. Eurekah.Com. [Google Search]

6. Kutter, E., Sulakvelidze, A. (eds) (2004). *Bacteriophages as Antibiotics: Biology and Application*. CRC Press. [Google Search]

Four phage books that are currently in production but which are not scheduled for a 2004 publication are:

7. Calendar, R. (ed). *The Bacteriophages* 2/e. Oxford University Press. [Google Search]

8. Sidhu, S. S. *Phage Display In Biotechnology and Drug Discovery*. Marcel Dekker. [Google Search]

9. Kuchment, A.. *The Forgotten Cure: The Past and Future of Phage Therapies*. Copernicus Books. [Google Search]

10. Waldor, M., Friedman, D., Adhya, S. (eds). *Phage: Role in Bacterial Pathogenesis and Biotechnology*. ASM Press. [Google Search]

On the Calendar book (i.e., *The Bacteriophages* 2/e) I played the role of unofficial associate editor plus am in charge of the associated web site: www.thebacteriophages.org, at which the table of contents and the figures for all 48 chapters may be found. In fact, Steve McQuinn and I (mostly Steve□s doing) have produced a TheBacteriophages.org t-shirt which is available, in limited quantities, just in time for Christmas. To obtain a shirt, go to my newly created PayPal store. If you are interested in getting (or sending) it by Christmas then please get your order to me (via the PayPal store, at least for U.S. orders) by December 10 (2004).

Two more phage books are under contract. The first is a book on methods in phage biology:

11. Clokie, M., Kropinski, A. (eds) *Bacteriophages: Methods and Protocols*. Humana Press, Totowa, New Jersey.

The second is an edited volume on phage ecology:

12. Abedon, S. T. (ed). *Bacteriophage Ecology*. Cambridge University Press.

For the latter I will be soliciting chapters very soon, both via personal e-mails to targeted authors and via a mass call for chapter proposals through the BEG mailing lists. The dominant theme of the book will be to review (and, ideally, to extend) phage ecology, particularly from theoretical and laboratory-experimentation perspectives (i.e., rather than from the perspective of what I like to refer to as environmental microbiology). Please be patient, however, in awaiting those solicitations. I□ve been asked to hold back on soliciting authors until I□ve received the contract from Cambridge, and my understanding is that the contract (no joke) currently is in the mail.

To these many efforts we can add a list of all of those phage-emphasizing volumes and book-like works (a.k.a., monographs) that have been published over the past century or so, including phage-worker biographies or autobiographies as well as works of fiction that contain a healthy dose of phage. Caution: only a fraction of the information in the following references has been verified through my actually having book in hand. Also, I□ve had to make a number of judgment calls as to what does and what does not constitute a "book". Thus, the following list should be viewed as a work in progress. As always, I look forward to receiving your input into how I might improve or add to the presented material. Please send all corrections, additions, and comments to microdude+@osu.edu .

13. *Antibody Phage Display: Methods and Protocols* (2002), edited by P. M. O□Brien, R. Aitken. Humana Press. [Google Search]

14. *DNA Damage and Repair: Advances from Phage to Humans* (2001) by J. A. Nickoloff, M. F. Hoekstra. Humana Press. [Google Search]

15. *Phage Display: A Laboratory Manual* (2001) by C. F. Barbas, D. R. Burton, J. K. Scott, G. J. Silverman. Cold Spring Harbor Laboratory Press. [Google Search]

16. *Phage Therapy: Bacteriophage as Natural, Self-limiting Antibiotics* (2001) by E. Kutter. AstraZeneca Research Foundation India. [Google Search]

17. *Bacterial and Bacteriophage Genetics* 4/e (2000) E. A. Birge. Springer-Verlag. [Google Search]

18. *We can sleep later: Alfred D. Hershey and the Origins of Molecular Biology* (2000), edited by F. W. Stahl. Cold Spring Harbor Press. [Google Search]

19. *Felix D'Herelle and the Origins of Molecular Biology* (1999) by W. C. Summers. Yale University Press. [Google Search]

20. *Darwin□s Radio* (1999) by Greg Bear. DelRey Book/Ballantine Publishing. [Google Search]

21. *Model Organisms: Phage Lambda* (1997), edited by I. Herskowitz, H. F. Lodish. Academic Press. [Google Search]

22. *Phage Display of Peptides and Proteins: A Laboratory Manual* (1996) by B. K. Kay, J. Winter, J. McCafferty. Academic Press. [Google Search]

23. *Seminars in Virology: Recent Developments in Bacteriophage Virology* (1995) by L. Rothman-Denes, R. Weisberg. Academic Press. [no Google hits]

24. *Molecular Biology of Bacteriophage T4* (1994), edited by J. D. Karam *et al*. ASM Press. [Google Search]

25. *Bacterial and Bacteriophage Genetics* 3/e (1994) by E. A. Birge. Springer-Verlag. [Google Search]

26. *In Focus, Out of Step: A Biography of Frederick William Twort F.R.S. 1877-1950* (1993) by A. Twort. Sutton. [Google Search]

27. (Bacteria Viruses) *Bakterienviren* (German) (1992) by S. Klaus, D. H. Krüger, J. Meyer. Gustav Fischer-Verlag. [Google Search]

28. *A Genetic Switch: Phage λ and Higher Organisms* 2/e (1992) by M. Ptashne. Cell Press. [Google Search]

29. *Phage and the Origins of Molecular Biology*, Expanded Edition (PATOOMB) (1992), edited by J. Cairns. Cold Spring Harbor Laboratory Press. [Google Search]

30. *Bacteriophages from China: An Electron Microscopical Atlas* (1991) by N. B. Ho, Z. T. Si, M. X. Yu. Science Press, Beijing. [Google Search]

31. *Practical Phage Control (1991) by the International Dairy Federation*. [Google Search]

32. *Bacterial and Bacteriophage Genetics* 2/e (1988) by E. A. Birge. Springer-Verlag. [Google Search]

33. *The Bacteriophages*, vol. 1 (1988), edited by R. Calendar. Plenum Press. [Google Search]

34. *The Bacteriophages*, vol. 2 (1988), edited by R. Calendar. Plenum Press. [Google Search]

35. *The Molecular Biology of Bacterial Virus Systems* (1988) by G. Hobom, R. Rott. Springer-Verlag. [Google Search]

36. The Statue Within: An Autobiography (1988) by F. Jacob (translated by F. Philip). Cold Spring Harbor Laboratory Press. (apparently was republished with 1995 copyright). [Google Search]

37. *Thinking About Science: Max Delbrück and the Origins of Molecular Biology* (1988) by E. P. Fischer, C. Lipson. W. W. Norton & Co. [Google Search]

38. *A Genetic Switch: Gene Control and Phage λ* (1987) by M. Ptashne. Blackwell Science. [Google Search]

39. *Phage Ecology* (1987), edited by S. M. Goyal, C. P. Gerba, G. Bitton. John Wiley & Sons. [Google Search]

40. *Phage Mu* (1987), edited by N. Symonds, A. Toussaint, P. Van Putte, M. M. Howe. Cold Spring Harbor Laboratory Press. [Google Search]

41. *Viruses of Prokaryotes*, vol. 1 (1987) by H. -W. Ackermann and M. S. Dubow. [Google Search]

42. *Viruses of Prokaryotes*, vol. 2 (1987) by H. -W. Ackermann and M. S. Dubow. [Google Search]

43. (Cyanophages) *Tsianofagi: Virusy Tsianobakterii* (Russian) (1985). Naukova dumka. [no Google hits]

44. *A Slot Machine, a Broken Test Tube: An Autobiography* (1984) by S. E. Luria. Harper Collins. [Google Search]

45. *Bacteria, Plasmids, and Phages: An Introduction to Molecular Biology* (1984) by E. Lin. Harvard University Press. [Google Search]

46. *Bacteriophage T4* (1983), edited by C. K. Mathews *et al*. ASM Press. [Google Search]

47. *Cloning with Bacteriophage* (1983) by J. Karn. Elsevier Scientific. [no Google hits]

48. *Lambda II* (1983), edited by R. W. Hendrix, J. W. Roberts, F. W. Stahl, R. A. Weisberg. Cold Spring Harbor Laboratory Press. [Google Search]

49. *Bacterial and Bacteriophage Genetics: An Introduction* (1981) by E. A. Birge. Springer-Verlag. [Google Search]

50. *Bacteriophage Assembly* (1981), edited by M. S. Dubow. A. R. Liss. [Google Search]

51. *Virus Receptors part 1 Bacterial Viruses* (1980), edited by L. L. Randall, L. Philipson. Chapman & Hall. [Google Search]

52. *Genetic Recombination: Thinking About it in Phage and Fungi* (1979) by F. W. Stahl. W. H. Freeman. [Google Search]

53. (Mathematical Models of Molecular Genetic Regulatory Systems) *Matematicheskie Modeli Molekuliarno-Geneticheskikh Sistem Upravleniia* (Russian) (1979) by V. A. Ratner. Akademiia nauk SSSR, Sibirskoe otd-nie, In-t tsitologii i genetiki (Soviet Academy of Sciences, Siberian Division, Institute of Cytology and Genetics). [no Google hits]

54. *Phage-Typing of Coagulase-Negative Staphylococci* (1979) by G. Pulverer, P. B. Heczko, G. Peters. Gustav Fischer-Verlag. [Google Search]

55. (Bacteriophages and Their Utilization in Veterinary Practice) *Bakteriofagi i Ikh Ispol'zovanie v Veterinarnoi Praktike* (Russian) (1978) by I. P. Revenko. Urozhai. [no Google hits]

56. *The Single-Stranded DNA Phages* (1978) by D. T. Denhardt, D. Dressler, D. S. Ray. Cold Spring Harbor Laboratory Press. [Google Search]

57. *Regulation and Genetics: Bacterial DNA Viruses* (1977), edited by H. Fraenkel-Conrat, R. R. Wagner. Plenum Press. [Google Search]

58. *Reproduction: Bacterial DNA Viruses* (1977), edited by H. Fraenkel-Conrat, R. R. Wagner. Plenum Press. [Google Search]

59. *Bacterial, Phage, and Molecular Genetics: An Experimental Course* (English Translation) (1976) by U. Winkler, W. Rèuger, , W. Wackernagel. Springer-Verlag. [Google Search]

60. *Bacteriophages* (1975) by J. Douglas. Chapman & Hall. [Google Search]

61. *RNA Phages* (1975) by N. D. Zinder. Cold Spring Harbor Laboratory Press. [Google Search]

62. (Bacteria. Bacteriophages) *Bactéries. Bactériophages* (French) (1974) F. Gasser. Ediscience : McGraw- Hill. [Google Search]

63. *Morphology and ultrastructure of Shigella and Klebsiella phages* (Polish and English). (1974) T. Krzywy, S. Slopek. Polish Medical Publishers. [Google Search]

64. *Phage* (1974) by S. P. Champe. Dowden, Hutchinson & Ross. [Google Search]

65. (Regulatory Mechanisms Involved in the Replication of Bacteriophages Containing Ribonucleic Acid) *Reguliatornye Mekhanizmy Replikatsii RNK-Soderzhashchikh Bakteriofagov* (Russian) (1974) by E. Grens. Zinatne. [no Google hits]

66. (Lysotypie and Other Special Epidemiological Laboratory Methods) *Lysotypie und Andere Spezielle Epidemiologische Laboratoriumsmethoden* (German & English) (1973) by Z. Buczowski, H. Rische. Gustav Fischer-Verlag (indicated only as "Fischer" in WorldCat). [Google Search]

67. *Morphogenesis of T-Even Bacteriophages* (1973) by B. F. Poglazov. Karger. [Google Search]

68. *Ultrastructure of Animal Viruses and Bacteriophages. An Atlas* (1973) by A. J. Dalton. Academic Press. [Google Search]

69. (Bacteria-, Phage- and Molecular Genetics) *Bakterien-, Phagen- und Molekulargenetik* (German) (1972) by U. Winkler, W. Rèuger, W. Wackernagel. Springer-Verlag. [Google Search]

70. (Experimental Methods in Bacteriophage Genetics) *Saikin Faji Iden Jikkenho* (Japanese) (1972), edited by H. Uchica. Kyoritsu Shuppan. [no Google hits]

71. *Bacteriophage Biochemistry* (1971) by C. K. Mathews. American Chemical Society. [Google Search]

72. *Bacterial Genetics and Temperate Phage* (1971), edited by J. Tomizawa. University Park Press. [Google Search]

73. *The Bacteriophage Lambda* (1971), edited by A. D. Hershey. Cold Spring Harbor Laboratory Press. [Google Search]

74. *Genetics Experiments with Bacterial Viruses* (1971) by D. P. Snustad. W. H. Freeman. [Google Search]

75. *Virulent Phage* (1971) by J. Tomizawa. University Park Press. [Google Search]

76. *The Genetics of Bacteria and their Viruses* 3/e (1970) by W. Hayes. John Wiley & Sons. [Google Search]

77. *Ultrastructure of Bacterial Viruses* (English translation) (1970) by A. S. Tikhonenko. Kluwer Academic Publishers. [Google Search]

78. *The Genetics of Bacteria and their Viruses* 2/e (1968) by W. Hayes. John Wiley & Sons. [Google Search]

79. (Bacterial Virus Ultrastructure) *Ultrastruktura Virusov Bakterii* (Russian) (1968) by A. S. Tikhonenko. Izdadelstvo 'Nauka'. [Google Search]

80. *Bakteriophagie 1957-1965 (Bacteriophagy 1957-1965)* (German & English) (1967) by H. Raettig. Gustav Fischer-Verlag. [Google Search]

81. *Phage and the Origins of Molecular Biology* (PATOOMB) (1966), edited by J. Cairns. Cold Spring Harbor Laboratory Press. [Google Search]

82. *Stochastic Models for Bacteriophage* (1965) by J. Gani. Methuen. [Google Search]

83. *The Genetics of Bacteria and their Viruses* (1964) by W. Hayes. John Wiley & Sons. [Google Search]

84. (Phage-Typing Bacteria) *Fagotipirovanie Bakterii* (Russian) (1963) M. D. Krylova. [no Google hits]

85. *Molecular Biology of Bacterial Viruses* (1963) by G. S. Stent. W. H. Freeman & Co. [Google Search]

86. (Bacteriophages, Objects of the Modern Genetics) *Bakteriophagen, Objekte der Modernen Genetik* (German) (1962) by E. Geissler. Akademie-Verlag. [Google Search]

87. (Electron Microscopic Study of Bacteria and Phage) *Elektronnomikroskopicheskoe Issledovanie Bakterii i Fagov* (Russian) (1962) by A. P. Pekhov. [no Google hits]

88. *Papers on Bacterial Viruses* (1960) by G. S. Stent. Little, Brown & Co. [Google Search]

89. *Bacteriophages* (1959) by M. H. Adams (and others). Interscience Publishers. [Google Search]

90. (Biophysics of Bacteriophages) *Biophysik der Bakteriophagen* (German) (1959) by F. Hercik. VEB Deutscher Verlag der Wissenschaften, Berlin. [Google Search]

91. (Bacteriophagy 1917 to 1956) *Bakteriophagie 1917 bis 1956* (German) (1957) by H. Raettig. Gustav Fischer-Verlag. [Google Search]

92. (Lysogenic Bacteria and the Concept of the Provirus) *Les bactéries lysogènes et la notion de provirus* (French) (1954) by F. Jacob. Masson. [Google Search]

93. (Bacteriophage: First International Conference) *Le Bactériophage: Premier Colloque International* (French) (1953), edited by International Union of Biological Sciences. Institut Pasteur. [no Google hits]

94. *Biochemical Studies of Bacterial Viruses* (1952) by E. A. Evans. University of Chicago Press. [Google Search]

95. *Studies of the infection of E. coli B with the bacteriophage T2* (1951) by C. -G. Hedén. Munksgaard. [Google Search]

96. *Phage-Typing of Shigella sonnei* (1949) by E. Hammarstrom. Appelbergs Boktr. [Google Search]

97. *Typing of Salmonella typhimurium by means of bacteriophage* (English translation) (1948) by K. Lilleengen (translated by G. Sargeant). I. Haeggströms boktr. [Google Search]

98. (Bacteriophage: Its Nature and its Therapeutic Employment) *Le Bacteriophage: Sa Nature et son Emploi Therapeutique* (French) (1946) by J. Steinmann. Karger. [no Google hits]

99. *The Bacteriophage: A Historical and Critical Survey of 25 Years Research* (1946) by P. C. Flu. (I m unsure of the publisher) [Google Search]

100. (The phenomenon of the Cure in the Infectious Diseases) *Le Phénomène de la Guérison dans les Maladies Infectieuses* (French) (1938) by F. d Hérelle. Masson. (I am only inferring that this is a phage book) [Google Search]

101. (Bacteriophage and its Therapeutic Applications) *Le bactériophage et ses applications thérapeutiques* (French) (1933) by F. d Hérelle. Doin and/or La Science médicale pratique. [no Google hits]

102. *Bacteriophage in the Treatment and Prevention of Cholera* (1932) by J. Morison. H. K. Lewis. [Google Search]

103. *Microbes and ultramicrobes: An Account of Bacteria, Viruses and the Bacteriophage* (1931) by A. D. Gardner. Dial Press and Methuen & Co. [Google Search]

104. *The Bacteriophage and its Clinical Application* (English translation) (1930) by F. d□Hérelle (translated by G. H. Smith). C. C. Thomas. [Google Search]

105. (Contribution to the Study of the Treatment of the Staphylococcic Dermatoses by the Bacteriophage of Hérelle in Local Applications) *Contribution à l'étude du Traitement des Dermatoses Staphylococciques par le Bactériophage de d'Hérelle en Applications Locales* (French) (1930) by E. Fischer.□Le François. [no Google hits]

106. *Arrowsmith* (1926) by S. Lewis. Harcourt, Brace & Co. [Google Search]

107. (Bacteriophage and its Behavior) *Le Bactériophage et son Comportement* (French) (1926) by F. d□Hérelle. Masson. [Google Search]

108. *The Bacteriophage and Its Behavior* (English translation) (1926) by F. d□Hérelle (translated by G. H. Smith). Williams & Wilkins. [Google Search]

109. (Of Bacteriophage Lysis in Vloeibaar Medium) *De Bactériophage Lysis in Vloeibaar Milieu* (French) (1926) J. B. Drenth. M. de Waal. [no Google hits]

110. (Bacteriophage of Hérelle) *Le bactériophage de d'Hérelle* (French) (1925) by P. Hauduroy. Librairie Le François. [no Google hits]

111. (Three presentations concerning the phenomenon of the bacteriophage) *Drie voordrachten over het verschijnsel der bacteriophagie* (Dutch) (1924) by F. d□Hérelle. J. B. Wolters. [Google Search]

112. *Immunity in Natural Infectious Disease* (English translation) (1924) by F. d□Hérelle (translated by G. H. Smith). Williams & Wilkins. (I am assuming that this phage book has some sort of a phage theme, but I could be wrong.) [Google Search]

113. (Defenses of the Organism) *Les défenses de l'Organisme* (French) (1923) by F. d□Hérelle. Flammarion. (I am assuming that this phage book has some sort of a phage theme, but I could be wrong.) [Google Search]

114. (The Bacteriophage and its Meaning for Immunity) *Der Bakteriophage und seine Bedeutung für die Immunität* (German) (1922) by F. d□Hérelle. F. Vieweg & Sohn. [no Google hits]

115. *The Bacteriophage: Its Rôle in Immunity* (1922) by F. d□Hérelle. Williams & Wilkins. [Google Search]

116. (Bacteriophage: Its Role in Immunity) *Le Bactériophage; Son Rôle dans l'Immunité* (French) (1921) by F. d□Hérelle. Masson. [Google Search]

Editorial Archive

- BEG: What we are, Where we are, Where we're going by Stephen T. Abedon
- When Grown *In Vitro*, do Parasites of Multicellular Organisms (MOPs) become Unicellular Organism Parasites (UOPs)? by Stephen T. Abedon
- Bacteriophages as Model Systems by Stephen T. Abedon
- 2000 and Sun: A Phage Odyssey by Stephen T. Abedon
- Lytic, Lysogenic, Temperate, Chronic, Virulent, Quoi? by Stephen T. Abedon
- Which Ecology are You? by Stephen T. Abedon
- *Science* NetWatch October 13, 2000
- The Best of Times, the Worst of Times by Ry Young
- Naming Bacteriophages by Hans-Wolfgang Ackermann and Stephen T. Abedon
- The Bacteriophage Rise by Stephen T. Abedon
- Mathematics for Microbiologists by Stephen T. Abedon
- Shipping Phages by Hans-Wolfgang Ackermann
- Calling a Phage a "Phage" by Stephen T. Abedon
- Phage or Phages by Hans-Wolfgang Ackermann
- The Phage Manifesto by Ry Young
- The Félix d'Hérelle Phage Center Changes Hands by Hans-Wolfgang Ackermann
- Phage T4 Meets Microbial Diversity by Jim D. Karam
- Phage T1: A lambdoid phage with attitude? by Andrew Kropinski
- ASM Conference on the New Phage Biology by Stephen T. Abedon
- A Brief History of Phage Art by Stephen T. Abedon
- Declining Electron Micrscopy by Hans-Wolfgang Ackermann
- The Bacteriophage Literome Part I by Stephen T. Abedon
- Phage Books Phage T-Shirt by Stephen T. Abedon

Editorials should be written on subjects relevant to The Bacteriophage Ecology Group as an organization, to *BEG News* (either the concept or a given issue of *BEG News*), or the science of Bacteriophage Ecology. While my assumption is that I will be writing the bulk of these editorials, I wish to encourage as many people as possible to seek to relieve me of this duty, as often as possible. Additionally, I welcome suggestions of topics that may be addressed. Please address all correspondences to microdude+@osu.edu or to "Editorials," *Bacteriophage Ecology Group News*, care of Stephen T. Abedon, Department of Microbiology, The Ohio State University, 1680 University Dr., Mansfield, Ohio 44906. Please send all submissions as Microsoft Word documents, if possible (I'll let you know if I have trouble converting other document formats), and in English.

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New BEG Members

Please welcome our newest members

name (home page links)	status	e-mail	address
Dilip Bandyopadhyay	PI	dilip.bandyopadhyay @gmail.com	Biotekk, Mumbai India
	interests:	Phage display as applied to cancer research. (contents | BEG members | top of page)	
M. R. Djobedar	PI	djobedar @hotmail.com	no1 2nd floor 15th st., takhti st., fereshte st., valie-asr ave., Tehran 1965836351 IRAN
	interests:	The unicellular microalgea *Chlorella* (*vulgaris*). (contents | BEG members | top of page)	
Mariam Khvedelidze	PI	mkhvedelidze @ictsu.tsu.edu.ge or mkhvedelidze @yahoo.com	Iv. Javakhishvili State University of Tbilisi, Department of Physics, Chair of Physics of Macromolecules, 3, Chavchavadze Av., 0128, Tbilisi, Rep. of Georgia
	interests:	Biophysical investigation of the early stage of the infection process in a model system using the fragments of bacterial membrane and bacteriophage; development of physical methods for realization the study of effective substitute for antibiotics; injection of phage DNA into liposomes.	

		(contents | BEG members | top of page)	
Tamaz Mdzinarashvili	PI	mdz @mserver.ictsu.tsu.edu.ge	Iv. Javakhishvili State University of Tbilisi, Department of Physics, Chair of Physics of Macromolecules, 3, Chavchavadze Av., 0128, Tbilisi, Rep. of Georgia
	interests:	DNA organization inside phage, DNA ejection process, early stages of the process of viral infection; thermal properties of receptors for phages and bacterial membrane fragments by means of biophysical methods (calorimetry, viscometry, spectrophotometry). (contents | BEG members | top of page)	
Maite Muniesa	---	mmuniesa @ub.edu	Department of Microbiology, Faculty of Biology, University of Barcelona, Diagonal 645. 08028 Barcelona. (Spain.)
	interests:	Model indicator organisms of faecal contamination in water; environmental (sewage) detection and characterization of bacteria (particularly *E. coli* O157:H7) and bacteriophages carrying the Stx_2 gene; role of phages in spreading virulence factors between bacterial populations and emergence of new pathogenic bacterial strains. (contents | BEG members | top of page)	
B. L. Sarkar	PI	bl_sarkar @hotmail.com	Assistant Director, Vibrio Phage Reference Laboratory, National Institute of Cholera & Enteric Diseases (ICMR), WHO Collaborating Centre for Diarrheal Diseases Research & training, P-33, CIT Road, scheme XM, KOLKATA -700 010, INDIA
	interests:	*Vibrio* phage. (contents | BEG members | top of page)	

The BEG members page can be found at www.phage.org/beg_members.htm. There are two ways of "joining" BEG. One, the "traditional" way, is to have your name listed on the web page and on the list server. The second, the "non-traditional" way, is to have your name only listed on the list server. The latter I refer to as "non-members" on that list. Members, e.g., individuals listed on the BEG members list page, should be limited to individuals who are actively involved in science (research, instruction, outreach, industry) and who can serve as a phage ecology resource to interested individuals. If you have an interest in phage ecology but no real expertise in the area, then you should join as a non-member. To join as a member, please contact BEG using the following link: microdude+@osu.edu . Include:

- your name
- your e-mail address
- your snail-mail address
- the URL of your home page (if you have one)
- a statement of whether or not you are the principal investigator
- a statement of your research interests (or phage ecology interests)
- a list of your phage ecology references, if any

Note that it is preferable that you include the full reference, including the abstract, if the reference is not already present in the BEG bibliography. Responsibility of members includes keeping the information listed on the BEG members page up to date including supplying on a reasonably timely basis the full references of your new phage ecology publications. Reprints can also be sent to *The Bacteriophage Ecology Group*, care of Stephen Abedon, Department of Microbiology, The Ohio State University, 1680 University Dr., Mansfield, Ohio 44906. To join BEG as a non-member, please contact BEG using the following link: http://mansfield.ohio-state.edu/mailman/listinfo/beg.

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Meetings

Please send photos, etc. from meetings, etc. for inclusion in this section.

ASM Conference on the New Phage Biology

For a very personal recounting of this past Summer's Florida meeting, see "Road Trip to Key Biscayne" immediately below.

The BEG Meetings link is now completely defunct. Reminders of certain upcoming meetings will be placed in this section of *BEG News*. If you know of any meetings that might be of interest to BEG members, or would like to recap a meeting that you've attended, then please send this information for posting to microdude+@osu.edu or to "BEG Meetings," *Bacteriophage Ecology Group News*, care of Stephen T. Abedon, Department of Microbiology, The Ohio State University, 1680 University Dr., Mansfield, Ohio 44906.

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Submissions

Road Trip to Key Biscayne

This is my recollection (what little I have) of the August, 2004, Key Biscayne phage meeting.

Day 1 minus 2 (Friday—Mansfield, OH):

The hard part, as always, is to pry myself out of the lab. I'm not even sure what I am doing in the lab. I seem to recall assuming, before summer began, that I would spend *some* time growing up phage stocks and tittering. OK, somehow I neglected to recall the support necessary to keep the lab going: making media, cleaning glassware, autoclaving, autoclaving, autoclaving! Clearly I'm getting a little too old to spend so much time in the lab—and 12 hours a day, day after day, is just ridiculous. So, ignoring my own good advice, and though I really had stopped growing up phage stocks in anticipation of leaving, there I was, still working in the lab.

By 7:00 P.M., the Friday before the meeting's start, I finally pull myself away, shut down shop, mounted what lately is my favorite bicycle, and just then the heavens opened up with a torrential downpour. Half an hour later I'm home, wet, and ready to at least start thinking about packing. At least my poster is dry. Somehow packing is delayed for the next few hours, though the house does get a tad cleaner, and a few piles of possibilities start to rise up in various rooms and on various pieces of furniture. This is the stuff that I at least might be bringing. With great sadness I put away all of the motorcycling gear—I won't be riding to Florida. Then, crazy me, I also pack away the towels I had brought with me the previous weekend, when I spent 1000 miles in the saddle visiting my old home town for my high school reunion. Apparently the need to dry a saddle should it rain is far greater an instinct than the need to dry my body should I swim. Who can think of everything?

Day 1 minus 1 (Saturday—Mansfield, OH):

By 8:30 A.M., Saturday morning, I'm packed, gotten in at least a few hours of sleep, have lovingly placed the pitri dishes that won't be read until at least next Monday into the walk-in cooler, and have even sent off the announcement for a previous (#20) BEG News. And there I am, once again, waiting out a downpour. Forget it! I declare and off I go into the rain during the slightest of breaks. In moments I'm at Paul Hyman's door, about on time, knocking away. No answer. This is the time to go, and this is the right house. Where is he? Back I go to the car to tidy up and otherwise prepare things for the coming drive. I phone Paul, from right outside his house, and lo, he answers. Almost time to go.

Or not. I start to fiddle with the computer while Paul finishes getting ready. Nothing seems to be working for me. He suggests that there is still time to head home and finish things there if that would help. I do, but things don't work very well there, either. This trip is not off to a good start. Eventually, though, by about 10:00 A.M. or so, only about one-hour late, we're on our way. Florida here we come.

Day 1 minus 1 (Saturday—in transit):

As is my custom, I don't bother to look at a map, preferring to simply point the car in what appears to be an appropriate direction, and then let the details work themselves out. But no, Paul has MapQuest directions, so we're obligated to do things logically. East on 30, South on 250, and then South on I-77. We're now on our way.

Everybody in the coming direction has their lights on. Could this be fashion, an indication of lots of construction zones, or, gasp, incredibly intense and long-lived cloud bursts? Naturally it is the latter and we calmly encounter one torrential downpour after another. Meanwhile we pass motorcycle after motorcycle. I'm torn between the certain knowledge that I would be sopping wet and miserable were I riding and, naturally, the certainty that such is but a small price to pay for bliss.

We soldier on, though West Virginia, which is absolutely gorgeous with its steep, verdant "mountains," though the climbs take their toll on mileage. In the Prius, at 70 mph (~112 kph), we're "only" getting about 43 mpg (above 18 kpl). Still, despite how hard the rain keeps on coming, we see motorcycle after motorcycle. Oh well.

We make Florida by 2 A.M., perhaps two hours later than we should have due to a slight directional imprecision as I-77 South and 81 North momentarily coincide and then part ways. The latter somehow took us with it. Paul, fortunately, requested a pit stop at a rest area, which I refused, preferring to fuel up the vehicle so long as a stop was necessary. It was only getting back onto the highway, or at least trying to, that I noticed that I-77 had somehow disappeared. An hour later we were back to the scene of the crime, again making our way south.

As a quick aside, allow me to "wax" on the virtues of Rain-X®. No matter what your speed, no matter how hard it is raining, we just go and go without using our wipers (much). I now keep a spay bottle of it in the car since when I inevitably leave home without first coating the windshield at least I can do so during gas breaks. (and I'm told it works great on motorcycle wind screens and even helmet face shields!)

Day 1 (Sunday—still in transit):

Getting back to Florida, there we are at 2:00 A.M. as Paul declares victory and pulls over into the first rest area we see. Earlier I had fueled up on my obligate vegetarian Subway (no cheese, please, and lots of extra jalapenos). That and a few hours of dozing/sleeping and I'm ready to take back the wheel. I make it another 100 or so miles before calling it quits. Amazing what one can accomplish when speed limits are *not* 55 mph! (and, yes, I do realize that persistent anger over 55 mph speeds limits does date me—yes, I've been driving since something like 1978) We spend from about 3:30 A.M. to 6:30 A.M. in a rest area. At some point Paul suggests that he can start driving again, but I waive off his request. I'm actually getting in some sleep and fear that switching out of the driver's seat will just wake me up. So, at 6:30 A.M., I initiate the next day's driving, Sunday, a.k.a., day 1 of the meeting, and we continue our trek south, down Florida on I-95.

First stop of the morning proper was South Apollo Beach in Canaveral National Seashore (44 East to 1A1 South; take the latter until the latter is no more, park, take your clothes off, and enjoy the sand and surf). Then it is back into the car, a little more rain, and a lot more driving, Miami is getting close. I find it incredible just how not developed Northern Florida actually is. For a guy who got to know Florida in West Palm Beach and other areas relatively South, I was pleasantly surprised by seeing something other than wall-to-wall cars and development, well mixed with an excess of sunshine and humidity. The trip was off to a good start. Let the meeting begin.

Day 1 (Sunday—the meeting):

The biggest impression, and I do mean big, is that there are far more people here than expected. Something like 350 participants. So many that we needed a second and then a third hotel to accommodate everyone. Kudos indeed to the organizers. The meeting began with a poster session, one that was difficult to do properly since all posters were at least supposed to be up on day one, but only some of those posters were supposed to be manned on day 1 (or womanned as the case may be). I was both elated and burnt out as I was pulled back again and again to my own poster to explain what was going on, even though my poster session wasn't scheduled, officially, until day 2. Such, I suppose, were the upsides and downsides of putting together a colorful poster with interesting graphics. I had fun.

After the poster session we all ate buffet style in the hotel. At first we were supposed to be having the buffet outside, but the rain gods intervened, forcing the hotel to fall back on plan B. A number of attendees were very much aware of the problem but had no idea where the dinner had been moved to. Note to the organizers: Great meal, though a little tough on us vegans.

The evening session was an introduction by the two organizers, Ry Young and Sankar Adyha. Due to some sort of transportation delay, Sankar ended up giving his beginning of the session talk at the end of the session, but it worked nonetheless. Now we know more about Ry Young than we had ever hoped to. The first talk was on Seymour Benzer and the fine structure of T4 rII mutants which was followed by an in depth discussion of phage N4. We ended with lots of people ready for bed after a long day of traveling. On to day 2.

Day 2 (Monday—the meeting):

Is it only Monday? Waking up was not easy, though I don't recall getting to bed too late on Sunday. I guess the lesson is to *not* drive to meetings that are 20 hours away (or at least to not show up on the same day that the meeting starts). The morning session was mostly very molecular. I'm struck, though not surprised, by the disconnect between the molecular characterization of phage and the more whole-organismal or ecological phage considerations. Beyond the obvious problem of many talks going overboard in both detail and length, I'm particularly disappointed by the tendency of speakers to target their presentations "traditionally," that is, as though this were a less-general audience. Many in the audience, no doubt, appreciated this targeting. The buzz outside of the lecture hall, however, was that familiar refrain, familiar to me at least, that the talks were just too molecular.

Overall, as a person who just can't stomach too much "all molecular all the time," at least without going quite insane, I will state in no uncertain terms that there is a strong tendency for the molecular to hijack meetings such this. We, as individuals with an interest in more than just the molecular, should fight this emphasis. We should demand that the ecological, evolutionary, and applied aspects of phagology be interspersed with the molecular. By my count, that means that perhaps only one-quarter of the topics covered should primarily emphasize molecular mechanisms. Clearly, on day 2, this ideal was not met.

Dinner consisted of Cuban cuisine, obtained at a restaurant just around the corner. Good food, though sadly not great. Everyone, however, had a grand time. Socializing with colleagues, new and old, over food and drink. This is what meetings are all about.

Day 3 (Tuesday—the meeting):

Why oh why oh why did I stay up until 2:00 A.M. last night? (or was it this morning?) OK, hanging in the hot tub was definitely the thing to do, but somehow sleep depravation doesn't seem all that compatible with deep, or even shallow scientific thinking. Oh well, such are meetings. If only there was more time. In fact, if only there was more centralization at the meeting, such as common breakfasts and dinners, so that we could easily find each other outside of the sessions. But

perhaps I complain too much. Here is quite the opposite: I never knew that Florida, in August, could be so much fun. The sun is hot, but not too hot. The sky is sunny, but not too sunny. And the rainstorms that pass through on a regular basis are awesome. The water of what I assume is the Atlantic Ocean, only a short stroll from the hotel lobby, is warm and smooth and seemingly clean (much more so than the beach on the Jersey shore that I often frequent). Clearly my early impressions of Florida were wrong, forged as they were visiting grandparents in inland West Palm Beach, where naturally sun, surf, and, of course, partying at all hours was little encouraged. What a difference 30 years and just a few miles east (and south) can make!

Meanwhile, I□ve always been biased towards structure talks. I just love 3-D, even when it is faked onto a 2-D medium. Perhaps I just like good pictures (of something other than gels, or DNA or protein sequences), and there is nothing quite like pictures of phage. Anyway, of the morning session Dennis Bamford□s talk on the structure of PRD1□s capsid was simply very, very cool. Those observations lead me to a thought. Some years back I asked a colleague□a very good chemistry instructor□the following question: Why do students think that chemistry is hard? I, personally, had no idea since, frankly, chemistry at the introductory level, of course, isn□t all that hard. Her answer went something like this:

Students can only deal with so much abstraction, and chemistry□dealing with all sorts of stuff that one can□t see or, perhaps, easily visualize□is very abstract. So why do I mention this? I suspect that there is only so many gels and sequences that one can view before one□s mind crosses some abstraction threshold. For those individuals who are used to these things, dealing day in and day out with very abstract concepts that one "visualizes" using gels and sequences, I suppose one more gel or sequence is understandable, expected, even welcome. However, for the rest of us, what we really need are less abstract, ideally pretty pictures that summarize data in forms that are quickly, easily, and enjoyably taken in. And we need lots of those pictures. Think of this as meeting halfway between the big and the small picture. Oh yes, and let□s also try to keep the talks reasonably short.

And speaking of pretty pictures, the talk on the phage T4 tail structure was, in itself, worth the trip to Florida. Yes, the world now has what appears to be a fairly anatomically correct movie of phage T4 colliding with and then adsorbing to a bacterial cell. Wow! And the anatomic models, with the colored proteins on the carousel movies, in fact, were almost even better. But the best of all was the movie of the long tail fibers triggering the extension of the short tail fibers (with just the baseplate shown). Think spidery space alien extending first one set of claws (the long tail fibers) and then a second set (the short tail fibers). Open and closing. Grabbing the surface. Man o□ man, gotta get a hold of that movie!

Day 3 (still Tuesday□the meeting):

Like the day before, by the time the afternoon session rolled around I was no longer a happening guy, and so I retired to my room for some much-needed shut eye. Naturally I received a call from one of my students not long after I had fallen asleep. That got me back down to the sessions, at which I lasted only a while before heading off with a collaborator (Larry Goodridge) to talk science. We were hanging in a (thankfully) well roofed "Tiki" hut that doubled as an enclosure around an outdoor bar and tables. At first the drizzle of rain, sneaking through the absent walls, was very pleasant. Eventually, as the rain grew harder, we moved to the center the structure, some 20 feet from the direction of the wind. Even that ended up being not far enough "inside" to keep us dry. The rain came down not so much in sheets as in one big, continuous blanket. There was no way either of us were willing to attempt the 100-150 feet back to the hotel proper, at least with no roof over our heads for much of the way. Instead we hung out and attempted to keep talking science. This grew more and more difficult as the rain came down harder and harder and then even harder still. The people at the bar held up towels to serve as wind/rain breaks. The thunderclaps were all but deafening.

And about then a new form of liquid entered the scenario, with the bar spontaneously sprouting cups one-third filled with some sort of yellow liquid. It looked like beer, but it sure wasn□t beer. The bartender lured us over to the bar, explaining to us that our job was to sing "Whoa no, wah dah lahara won't do," bang the bar twice, then down whatever it was in the cup. Huh? Then he turned on the music, really, really loud. At first I didn□t recognize the song. Then slowly it dawned on me that were listening to Steely Dan. Then that crystallized into "My Old School." The bartender started singing. I joined in. When we got to refrain, everybody joined in, banged the bar, and quickly swallowed whatever it was in the plastic cup. It sure wasn□t beer, and I drank it way too fast. That was the idea, right? Steely Dan was followed by the Kinks (Lola, of course) which was followed by "It makes me wanna shout" (or however those lyrics go). The bartender was hilarious, acting out

each song in turn. I don't know, but maybe this wasn't the first time he had entertained a small crowd during an unexpected (and extended) cloud burst.

Returning to the session (which, after a long nap, a long conversation, and lots of dancing at the bar, was stilling going strong), I took in wait a minute, I can't even remember what I took in. I finally attempted to take in some posters afterward and, once again, managed to get sucked into my own poster, talking with yet additional interested individuals. That isn't such a bad thing in fact, it's great. But there is no way I'm going to make it through all of these posters. Somehow losing Larry, we then headed off for a Pizza meal, which was quite good, with entertainment consisting of stories of photosynthetic sea slugs (way cool, Liz Summer).

Returning to the hotel around 9:00 P.M., the evening session was still going strong (and how could it not? In phage-meeting hours 9:00 P.M. is equivalent to something like late afternoon). We sat and talked in the lobby until everyone I was with retired up to their rooms. I sat for a while before heading back into the session which, at that point, consisted of a movie overviewing phage λ development. Once again I became totally overwhelmed by the insane number of gene-to-gene-to-protein-to-whatever interactions that form the core of phage λ development and this with a video that was most definitely an oversimplification. Finally the session ended and I hung out in the hallway until a group managed to glom around me. We talked for a while, at least until I was tempted back into the hot tub just outside. That was followed by more talking until, at about 1:00 A.M., I crawled into bed to try to get some sleep. Naturally I was way too wired to actually fall asleep, and it didn't help that, yes, once I had, the phone rang. Only a half a ring, but that was enough to suck me out of dreamland. Oh well.

Day 4 (Wednesday the meeting):

The meeting is starting to become routine. Not a routine I can imagine sustaining for more than a few more days, but at least something that I'm not questioning anymore. Must get out of bed. Must shave(!). Must shower. Must eat something for breakfast. Must show up at the morning's session. Must pay attention. Must stay in the seminar room. Must think about science. Must recall just why it is that I am here.

Right on cue I was disappointed with the first session, but not with the second one. This second session, actually, was the first that I had really enjoyed at the meeting. No surprise there, I suppose, since this was the phage ecology session. At lunch, between sessions, I sat with the organizers as we first talked about strategies for assembling an issue of BEG News to archive the meeting [note: don't hold your collective breaths waiting for that archive], and then how to pull off having the meeting again, including how to improve it. "No more six-dollar beers!" was the resounding cry. We need a central meeting place! and No more separate meals for separate people. Right on schedule, that evening we had a common meal complete with free beer and free wine. And also, let's not forget, decent pickles (I do like my pickles). The pickles prompted me to eat three broiled-chicken sandwiches (with, of course, plenty of pickles on each). Amazing how little I miss being a vegan when I have no real alternative.

Fortunately I had fully fortified myself since, apparently, next on the agenda was dancing the night away. I managed to be coaxed onto the dance floor and then stayed there until the band gave up in exhaustion. Then the bunch of us hung out in the banquet room until all of the tables had been folded up around us. This was followed by walking my good friend Larry home to his hotel, the Ritz Carlton. Man, talk about how the other half live. This place put our resort to total shame. But for twice the price per night per room, well it ought to have. I then managed to stay up, once again, to 2:00 A.M. Actually, to quite a bit past 2:00 A.M., and this time just talking with no hot tub involvement. Meetings, love 'em!

Day 5 (Thursday the meeting):

Considering that I don't have much memory of having slept last night, I actually feel fairly good. I must have eventually fallen asleep since I recall, once again, being pulled out of a dream by the (dang) alarm clock (alarm clocks hate 'em!). I can't believe that we're planning on making it a night out yet again this coming evening. And way bummer indeed that most of the people will be gone by then, since the meeting officially ends sometime this afternoon (I have no idea when). At least there is this smidgen of potential that Friday morning I may do some sleeping-in. Lord knows, I'll need it since we will then be leaving to drive home, back to Ohio!

This morning is the first and only that we will be treated to a breakfast by the meeting. For the sake of being social I definitely needed to show up, but given that I no longer had any lactaid pills to deal with my lactose intolerance, it became a question of whether I was willing to eat anything (and never mind how I ever got through lunches with their ubiquitous cheese this is definitely not a meeting that has coddled to vegans). Oh well, time to get up and start my day

Day 5 (Thursday□post meeting):

And then, suddenly, the meeting officially is over. I don□t recall anything about the last morning□s session. Was I even there? Perhaps for some of it, but mostly I recall socializing outside in the lobby. Maybe I really am an extrovert after all. With the meeting over there no longer were any meals available to us so our thoughts tuned to issues of starvation relief. After seemingly pondering on every possible permutation of people, cars, and restaurants, three of us headed just down the block to a lovely Cuban lunch. Post lunch somehow my plan of taking a nap was nixed in favor of more hot tubbing. Hot tubbing was then truncated by yet additional rain (apparently the hotel is of the opinion that outdoor hot tubs and lightning just don□t mix). Off we went to the outdoor bar, with the hope in my mind of a repeat of the previous improvisation by the same bartender, but the rain never got so bad. We then played another permutations game, this time with our sights set on Miami Beach. What a playground, particularly for the young and well proportioned. We eventually found an Italian place (Tutti□s café) on a parallel street to the main drag. Wonderful meal. Wonderful company. Only spoiled slightly (perhaps not at all) but the resulting parking ticket. Oh well.

Naturally (how could it be otherwise) four of us finished the evening up in our hotel room, drinking beer, and generally listening to Nicola Walker telling one hilarious story after another. The rest of us tried to add to the conversation, but clearly she is the star. By 1:00, my voice hoarse from laughing and my head holding a perfect beer buzz, the party broke up. The meeting, now unofficially as much as officially, finally, unfortunately, was over.

Day 5 plus 1 (Friday□post meeting):

I□m elated. I□m totally burnt out. I□m running on empty. I□m completely full. I□m exhausted. My mind is buzzing. There is nothing quite like a phage meeting, seeped as it is in the Cold Spring Harbor tradition of social informality and scientific intensity. I want the meeting to have gone on for another week. Maybe another month. Perhaps the rest of my life. At the same time, productively at least, I don□t think I could have managed another day. The next one, next year, is in the paradise of Evergreen. I will see you all there. We can think profound scientific thoughts, and prance in the rain forest (drinking beer). Ah to be a phage biologist. It doesn□t get any better than this.

Epilog

by Paul Hyman

The Return □ Day 5 plus 2:

I startle awake and look out the window. The world has disappeared into a soft gray cotton candy of dense fog. "Wow" is all my sleep-fuddled mind can think of. I hear Steve chuckling.

Suddenly we break out of the cloud into clear air. Dimly I can see hills or mountains ahead and I try to remember where I put my glasses. I squint at the clock but can□t make it out. Finally I recall the correct little bin and restore my vision. It is nearly four A.M. and I have apparently been asleep for almost six hours.

"Are we in West Virginia yet?" I am mistakenly assuming that I have slept through another night in the car in a rest area. It turns out we are in Ohio and Steve has driven non-stop, "carefully titrating" his caffeine to stay awake the entire night.

The Return □ Day 5 plus 1:

We finally had gotten ourselves packed up and on the road at 10:00 A.M. Steve driving and me riding. After about an hour-and-a-half we need to fuel up and switch seats. This is the beginning of the pattern we will follow. Major stops only when the car needs fuel. All else is secondary to the trip north.

The time passes remarkably quickly between conversation in the car, music and cell phone conversations with my fiancé. Thank goodness for cell phones and traveling on interstates with plenty of towers. Rehashing and recounting the meeting and the miles roll by□ Six and a half hours and nearly four hundred miles to the next stop in Georgia. Such is the joy of a car with a hybrid engine and an unreal range.

Gas, sandwiches and we are on the road again. Soon it begins to get dark and I begin to doze in the passenger□s seat. I stay awake long enough to navigate Steve past potential detours off the road we want, and then I fall completely asleep.

The Return □ Day 5 plus 2:

After another hour we reach the exit off the interstate onto the slower but more interesting state road. Another stop for fuel and fortified with beef jerky (an excellent road meal, plenty of protein and enough fat and sugar to be satisfying) and we are cruising through rural Ohio. On the trip out we were passing more Amish buggies than I have seen in my entire six months in Ohio. This time there are none, of course (it is too early), but Steve still needs to be alert as our speed rises and falls as

we pass through little towns and up and down the hills, in and out of the fog. Finally we reach Wooster, 40 minutes to go!

Halfway, Steve finally reaches his limit and I take over for the last little stretch. The sky is lightening in the rearview mirror as we cruise into Mansfield. 19 hours 45 minutes and we are done. Throw the bags out of the car and Steve slips silently away into the morning (that hybrid technology again). I enter the apartment, memories of the meeting, and the drive, already beginning to merge into the past as the new day begins.

Submissions Archive

- On an Invisible Microbe Antagonistic to the Dysentery Bacillus by Felix d'Hérelle
- Obituary: Hansjürgen Raettig - Collector of Bacteriophage References (October 12, 1911 - December 1, 1997) by Hans-W. Ackermann
- Some Quotations by Stephen T. Abedon
- Bacteriophages: A Model System for Human Viruses by J. -Y. Maillard
- How Big is 10^{30}? by Stephen T. Abedon
- Selling Phage Candy by Stephen T. Abedon
- A List of Phage Names by Hans-W. Ackermann and Stephen T. Abedon
- An Expanded Overview of Phage Ecology by Stephen T. Abedon
- Rendering Phage Heads by Steven McQuinn
- The Contractile-Tail Sheath, In Three Dimensions by Steven McQuinn
- Eye On The Needle: Phage T4 Puncturing Point May Answer Penetrating Questions by Steven McQuinn
- Pioneering genetic researcher Gisela Mosig dies
- Updated Eiserling T4 Virion
- Some Recent Phage and Phage-Related U.S. Patents (1976-present) by Stephen T. Abedon
- Some Images of BEG Members by Stephen T. Abedon
- Early Phage References, pre-1950 by Stephen T. Abedon
- Zooming Through the Tail Tube A Steve McQuinn Perspective on Phage T4 by Steven McQuinn
- The T4 Prolate Head by Steven McQuinn
- The Cyanophage Literome by Stephen T. Abedon
- Road Trip to Key Biscayne Florida by Stephen T. Abedon

Submissions are non-editorial items describing or highlighting some aspect of bacteriophage ecology including news pieces, historical pieces, reviews, and write-ups of research. Peer review of submissions is possible and a desire for peer review should be indicated. Send all submissions to microdude+@osu.edu or to "Submissions", Bacteriophage Ecology Group News, care of Stephen T. Abedon, Department of Microbiology, The Ohio State University, 1680 University Dr., Mansfield, Ohio 44906. Please send all submissions as Microsoft Word documents, if possible (I'll let you know if I have trouble converting any other document formats), and in English.

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Phage Images

Phage Image Archive

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- T4 phage v1
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- Homologous Recombination - 2000 by Jake McKinlay
- X-Ray Structure of Bacteriophage HK97 by William R. Wikoff
- Balloon Phage T4 by Celeste O'Neil and Larry Goodridge
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- Siphovirus pin by Jutta Loeffler
- Vaudeville phage by Gary E. Kaiser
- Origami phage by Masamune Washington
- The λ twins from the Summer, 2004, phage meeting

Please send any phage images that you would like to present in this section to "Phage Images," *The Bacteriophage Ecology Group*, care of Stephen T. Abedon, Department of Microbiology, The Ohio State University, 1680 University Dr., Mansfield, Ohio 44906. Alternatively, you may scan the images yourself and send them as an attachment to microdude+@osu.edu . Please save all scans in gif or jpg formats and preferably with an image size (in terms of width, height, and kbytes) that will readily fit on a standard web page. No copyrighted material without permission, please!

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New Publications

New bacteriophage publications are listed below. Each quarter not-yet-listed publications from the previous two years will be presented along with their abstracts. The indicator "???" denotes, of course, that specific information is not yet in the BEG Bibliography. Please help in the compilation of the BEG Bibliography by supplying any updated information, correcting any mistakes, and, of course, e-mailing with the references to your bacteriophage ecology publications, as well as the references to any bacteriophage ecology publications that you know of but which are not yet in the bibliography or to point out references that are not appropriate for the bibliography (send to microdude+@osu.edu or to "BEG Bibliography," *Bacteriophage Ecology Group News*, care of Stephen T. Abedon, Department of Microbiology, The Ohio State University, 1680 University Dr., Mansfield, Ohio 44906). This list is also present with available abstracts at the end of *BEG News*.

1. Effect of temperature and sanitizers on the survival of feline calicivirus, *Escherichia coli*, and F-specific coliphage MS2 on leafy salad vegetables. Allwood, P. B., Malik, Y. S., Hedberg, C. W., Goyal, S. M. (2004). *Journal of Food Protection* 67:1451-1456. [PRESS FOR ABSTRACT]

2. A is for adaptation. Boeke, J. D. (2004). *Nature* 431:408-409. [PRESS FOR ABSTRACT]

3. Bioaerosols from the land application of biosolids in the desert southwest USA. Brooks, J. P., Tanner, B. D., Josephson, K. L., Gerba, C. P., Pepper, I. L. (2004). *Water Science and Technology* 50:7-12. [PRESS FOR ABSTRACT]

4. The discovery of a novel algal virus type infection of the phytoplankter μ*monas pusilla* by a double stranded RNA reovirus. Brussard, C. P. D., Sandaa, R.-A., Bratbak, G. (2004). *Virology* 319:280-291. [PRESS FOR ABSTRACT]

5. Phages and the evolution of bacterial pathogens: from genomic rearrangements to lysogenic conversion. Brüssow, H., Canchaya, C., Hardt, W. D. (2004). *Microbiology and Molecular Biology Reviews* 68:560-602. [PRESS FOR ABSTRACT]

6. Rapid diagnosis of pulmonary tuberculosis by mycobacteriophage assay. Butt, T., Ahmad, R. N., Kazmi, S. Y., Mahmood, A. (2004). *International Journal of Tuberculosis and Lung Disease* 8:899-902. [PRESS FOR ABSTRACT]

7. Recent pre-harvest supplementation strategies to reduce carriage and shedding of zoonotic enteric bacterial pathogens in food animals. Callaway, T. R., Anderson, R. C., Edrington, T. S., Genovese, K. J., Harvey, R. B., Poole, T. L., Nisbet, D. J. (2004). *Animal health research reviews / Conference of Research Workers in Animal Diseases* 5:35-47. [PRESS FOR ABSTRACT]

8. Role of irrigation and wastewater reuse: comparison of subsurface irrigation and furrow irrigation. Choi, C., Song, I., Stine, S., Pimentel, J., Gerba, C. (2004). *Water Science and Technology* 50:61-68. [PRESS FOR ABSTRACT]

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18. Isolation of bacteriophages from the oral cavity. Hitch, G., Pratten, J., Taylor, P. W. (2004). *Letters in Applied Microbiology* 39:215-219. [PRESS FOR ABSTRACT]

19. Evaluation of the purification capacity of nine portable, small-scale water purification devices. Horman, A., Rimhanen-Finne, R., Maunula, L., von Bonsdorff, C. H., Rapala, J., Lahti, K., Hanninen, M. L. (2004). *Water Science and Technology* 50:179-183. [PRESS FOR ABSTRACT]

20. PCR detection of pathogenic viruses in southern California urban rivers. Jiang, S. C., Chu, W. (2004). *Journal of Applied Microbiology* 97:17-28. [PRESS FOR ABSTRACT]

21. Optimizing concentration and timing of a phage spray application to reduce *Listeria monocytogenes* on honeydew melon tissue. Leverentz, B., Conway, W. S., Janisiewicz, W., Camp, M. J. (2004). *Journal of Food Protection* 67:1682-1686. [PRESS FOR ABSTRACT]

22. Transfer of photosynthesis genes to and from *Prochlorococcus* viruses. Lindell, D., Sullivan, M. B., Johnson, Z. I., Tolonen, A. C., Rohwer, F., Chisholm, S. W. (2004). *Proceedings of the National Academy of Sciences, USA* 101:11013-11018. [PRESS FOR ABSTRACT]

23. A comparison of the survival of F+RNA and F+DNA coliphages in lake water microcosms. Long, S. C., Sobsey, M. D. (2004). *Water Health* 2:15-22. [PRESS FOR ABSTRACT]

24. The impact of bacteriophage genomics. McGrath, S., Fitzgerald, G. F., van Sinderen, D. (2004). *Current Opinion in Biotechnology* 15:94-99. [PRESS FOR ABSTRACT]

25. Genetic organization of the *psbAD* region in phages infecting marine *Synechococcus* strains. Millard, A., Clokie, M., Shub, D. A., Mann, N. H. (2004). *Proceedings of the National Academy of Sciences, USA* 101:11007-11012. [PRESS FOR ABSTRACT]

26. Free Shiga toxin bacteriophages isolated from sewage showed diversity although the *stx* genes appeared conserved. Muniesa, M., Serra-Moreno, R., Jofre, J. (2004). *Environmental Microbiology* 6:716-725. [PRESS FOR ABSTRACT]

27. Diversity of stx_2 converting bacteriophages induced from Shiga-toxin-producing *Escherichia coli* strains isolated from cattle. Muniesa, M., Blanco, J. E., de Simón, M., Serra-Moreno, R., Blanch, A. R., Jofre, J. (2004). *Microbiology* 150:2959-2971. [PRESS FOR ABSTRACT]

28. Presence of bacterial phage-like DNA sequences in commercial Taq DNA polymerase reagents. Newsome, T., Li, B. J., Zou, N., Lo, S. C. (2004). *Journal of Clinical Microbiology* 42:2264-2267. [PRESS FOR ABSTRACT]

29. Removal of F-specific RNA bacteriophages in artificial recharge of groundwater□a field study. Niemi, R. M., Kytovaara, A., Paakkonen, J., Lahti, K. (2004). *Water Science and Technology* 50:155-158. [PRESS FOR ABSTRACT]

30. Site-specific recombination links the evolution of P2-like coliphages and pathogenic enterobacteria. Nilsson, A. S., Karlsson, J. L., Haggard-Ljungquist, E. (2004). *Molecular Biology and Evolution* 21:1-13. [PRESS FOR ABSTRACT]

31. Bacteria and viruses in the water column of tropical freshwater reservoirs. Peduzzi, P., Schiemer, F. (2004). *Environmental Microbiology* 6:707-715. [PRESS FOR ABSTRACT]

32. Sewage impact on shellfish microbial contamination. Pommepuy, M., Dumas, F., Caprais, M. P., Camus, P., Le Mennec, C., Parnaudeau, S., Haugarreau, L., Sarrette, B., Vilagines, P., Pothier, P., Kholi, E., Le Guyader, F. (2004). *Water Science and Technology* 50:117-124. [PRESS FOR ABSTRACT]

33. Drift increases the advantage of sex in RNA bacteriophage F6. Poon, A., Chao, L. (2004). *Genetics* 166:19-24. [PRESS FOR ABSTRACT]

34. Development and evaluation of methods to detect coliphages in large volumes of water. Sobsey, M. D., Yates, M. V., Hsu, F. C., Lovelace, G., Battigelli, D., Margolin, A., Pillai, S. D., Nwachuku, N. (2004). *Water Science and Technology* 50:211-217. [PRESS FOR ABSTRACT]

35. Microbicidal efficacy of an advanced oxidation process using ozone/hydrogen peroxide in water treatment. Sommer, R., Pribil, W., Pfleger, S., Haider, T., Werderitsch, M., Gehringer, P. (2004). *Water Science and Technology* 50:159-164. [PRESS FOR ABSTRACT]

36. Therapeutic use of bacteriophages. Soothill, J., Hawkins, C., Anggard, E., Harper, D. (2004). *The Lancet infectious diseases* 4:544-545. [PRESS FOR ABSTRACT]

37. Automatic identification of bacterial types using statistical imaging methods. Trattner, S., Greenspan, H., Tepper, G., Abboud, S. (2004). *IEEE Transactions on Medical Imaging* 23:807-820. [PRESS FOR ABSTRACT]

38. Inactivation of enteric microbes in water by electro-chemical oxidant from brine (NaCl) and free chlorine. Venczel, L. V., Likirdopulos, C. A., Robinson, C. E., Sobsey, M. D. (2004). *Water Science and Technology* 50:141-146. [PRESS FOR ABSTRACT]

39. Evaluation of microbial source tracking methods using mixed fecal sources in aqueous test samples. Griffith, J. F., Weisberg, S. B., McGee, C. D. (2003). *Water Health* 1:141-151. [PRESS FOR ABSTRACT]

40. Use of viral pathogens and indicators to differentiate between human and non-human fecal contamination in a microbial source tracking comparison study. Noble, R. T., Allen, S. M., Blackwood, A. D., Chu, W., Jiang, S. C., Lovelace, G. L., Sobsey, M. D., Stewart, J. R., Wait, D. A. (2003). *Water Health* 1:195-207. [PRESS FOR ABSTRACT]

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New Publications with Abstracts

For your convenience, a list of new publications without associated abstracts (but with links to abstracts) is found above. The list presented below is identical to the above list except that abstracts are included.

1. **Effect of temperature and sanitizers on the survival of feline calicivirus, *Escherichia coli*, and F-specific coliphage MS2 on leafy salad vegetables. Allwood, P. B., Malik, Y. S., Hedberg, C. W., Goyal, S. M. (2004). *Journal of Food Protection* 67:1451-1456.** We conducted a series of experiments to compare the survival of *Escherichia coli,* feline calicivirus, and F-specific coliphage MS2 on lettuce and cabbage with and without disinfection. Inoculated produce was held at 4, 25, or 37ºC for 21 days or was treated with different concentrations of sodium bicarbonate, chlorine bleach, peroxyacetic acid, or hydrogen peroxide. Survival was measured by the decimal reduction value (time to 90% reduction in titer) and the change in log titers of the test organisms. A stronger correlation of survival measures was observed between feline calicivirus and MS2 than between *E. coli* and either of the viral agents at 25 and 37ºC. The maximum time to detection limit for MS2 at all temperatures was 9 days, whereas feline calicivirus was detected for a maximum of 14 days at 4ºC. In contrast, *E. coli* was detectable for 21 days at 4 and 25ºC and for 14 days at 37ºC. Significant increases in *E. coli* titer occurred within the first 5 days, but virus titers decreased steadily throughout the experiments. *E. coli* was also highly susceptible to all disinfectants except 1% sodium bicarbonate and 50 ppm chlorine bleach, whereas the viruses were resistant to all four disinfectants.

2. **A is for adaptation. Boeke, J. D. (2004). *Nature* 431:408-409.** Studies of a bacterial virus have revealed an unexpected weapon that helps it to overcome its host's rapidly changing defences. A look at other organisms hints that the mechanism might be widespread.

3. **Bioaerosols from the land application of biosolids in the desert southwest USA. Brooks, J. P., Tanner, B. D., Josephson, K. L., Gerba, C. P., Pepper, I. L. (2004). *Water Science and Technology* 50:7-12.** This study evaluated bioaerosol emissions during land application of Class B biosolids in and around Tucson, Arizona, to aid in developing models of the fate and transport of bioaerosols generated from the land application of biosolids. Samples were collected for 20 min at distances between 2 m and 20 m downwind of point sources, using an SKC BioSampler impinger. A total of six samples were collected per sampling event, which consisted of a biosolid spray applicator applying liquid biosolids to a cotton field. Each application represented one exposure. Samples were collected in deionised water amended with peptone and antifoam agent. Ambient weather conditions were also monitored every 10 min following initiation of sampling. Concurrently with downwind samples, background (ambient) air samples were collected to compensate for any ambient airborne microorganisms. In addition, biosolids samples were collected for analysis of target indicator and pathogenic organisms. Soil samples were also collected and analysed. Significant numbers of heterotrophic plate count (HPC) bacteria were found in air samples collected during the biosolid application process. These could have arisen from soil particles being aerosolised during the land application process. Aerosolised soil may contribute significantly to the amount of aerosolised microorganisms. Soil particles may be able to more readily aerosolise, due to their low density, small particle size and low mass. Aerosolised HPC bacteria found during biosolids land application were similar to those found during normal tractor operation on non-biosolids applied fields. Coliforms and coliphages were not routinely detected even though they were found to be present in the biosolids at relatively high concentrations, 10^6 and 10^4/g (dry weight) of biosolids respectively. This could be due to the die-off rate of aerosolised Gram-negative bacteria or sorption to the solid portion of the biosolids. Low numbers of aerosolised coliphages may likewise be due to sorption phenomena. We theorise that only organisms in the aqueous phase of the biosolids were available to desorb and be aerosolised. Animal viruses, which were not detected in the biosolids, were likewise not detected in the aerosol samples. *Clostridium perfringens* was detected in only a small percent of aerosol samples although it was detected during all weather conditions; other microorganisms were detected during more favourable environmental conditions (relative humidity >10%). Despite the fact that many of these organisms were present in the biosolids at significant concentrations, their presence in bioaerosols generated during the land application of biosolids was limited to only a small percentage of samples. Bacteria as well as viruses may sorb to biosolids, which contain a high percentage of organic matter, and desorption during land application of biosolids may not readily take place; therefore, these microorganisms may not be readily aerosolized.

4. **The discovery of a novel algal virus type infection of the phytoplankter μ*monas pusilla* by a double stranded RNA reovirus. Brussard, C. P. D., Sandaa, R.-A., Bratbak, G. (2004). *Virology* 319:280-291.** We report the isolation of the first double-stranded (ds) RNA virus in the family Reoviridae that infects a protist (microalga μ*monas pusilla*, Prasinophyceae). The dsRNA genome was composed of 11 segments ranging between 0.8 and 5.8 kb, with a total size of approximately 25.5 kb. The virus (MpRNAV-01B) could not be assigned to the genus level because host type, genome size, and number of segments smaller than 2 kb did not correspond to either of the two existing 11-segmented dsRNA genera Rotavirus and Aquareovirus. MpRNAV-01B has a particle size of 65-80 nm, a narrow host range, a latent period of 36 h, and contains five major proteins (120, 95, 67, 53, and 32 kDa). MpRNAV-01B was stable to freeze-thawing, resistant to chloroform, ether, nonionic detergents, chelating and reducing agents. The virus was inactivated at temperatures above 35ºC and by ionic detergent, ethanol, acetone, and acidic conditions (pH 2-5).

5. **Phages and the evolution of bacterial pathogens: from genomic rearrangements to lysogenic conversion. Brüssow, H., Canchaya, C., Hardt, W. D. (2004). *Microbiology and Molecular Biology Reviews* 68:560-602.** Comparative genomics demonstrated that the chromosomes from bacteria and their viruses (bacteriophages) are coevolving. This process is most evident for bacterial pathogens where the majority contain prophages or phage remnants integrated into the bacterial DNA. Many prophages from bacterial pathogens encode virulence factors. Two situations can be distinguished: *Vibrio cholerae*, Shiga toxin-producing *Escherichia coli*, *Corynebacterium diphtheriae*, and *Clostridium botulinum* depend on a specific prophage-encoded toxin for causing a specific disease, whereas *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Salmonella enterica* serovar *Typhimurium* harbor a multitude of prophages and each phage-encoded virulence or fitness factor makes an incremental contribution to the fitness of the lysogen. These prophages behave like "swarms" of related prophages. Prophage diversification seems to be fueled by the frequent transfer of phage material by recombination with superinfecting phages, resident prophages, or occasional acquisition of other mobile DNA elements or bacterial chromosomal genes. Prophages also contribute to the diversification of the bacterial genome architecture. In many cases, they actually represent a large fraction of the strain-specific DNA sequences. In addition, they can serve as anchoring points for genome inversions. The current review presents the available genomics and biological data on prophages from bacterial pathogens in an evolutionary framework.

6. **Rapid diagnosis of pulmonary tuberculosis by mycobacteriophage assay. Butt, T., Ahmad, R. N., Kazmi, S. Y., Mahmood, A. (2004). *International Journal of Tuberculosis and Lung Disease* 8:899-902.** We evaluated FASTPlaqueTB, a recently introduced bacteriophage assay for rapid detection of *Mycobacterium tuberculosis* complex in sputum specimens, using 169 non-duplicate sputum specimens from patients suspected of pulmonary tuberculosis. The results of 160 specimens were analysed. FASTPlaqueTB assay detected tuberculosis in 77% (46/60) of culture-positive cases. Among the AFB smear-positive cases (n = 47) it had a sensitivity of 76% and specificity of 60% while among AFB smear-negative cases (n = 113) its sensitivity and specificity were 78% and 98%, respectively. The overall sensitivity and specificity of the technique were 77% and 96%, respectively, and the positive and negative predictive values were respectively 92% and 87%. The overall efficiency of the test was 89%. Test results were available in 48 h.

7. **Recent pre-harvest supplementation strategies to reduce carriage and shedding of zoonotic enteric bacterial pathogens in food animals. Callaway, T. R., Anderson, R. C., Edrington, T. S., Genovese, K. J., Harvey, R. B., Poole, T. L., Nisbet, D. J. (2004). *Animal health research reviews / Conference of Research Workers in Animal Diseases* 5:35-47.** Food-borne bacterial illnesses strike more than 76 million North Americans each year. Many of these illnesses are caused by animal-derived foodstuffs. Slaughter and processing plants do an outstanding job in reducing bacterial contamination after slaughter and during further processing, yet food-borne illnesses still occur at an unacceptable frequency. Thus, it is imperative to widen the window of action against pathogenic bacteria. Attacking pathogens on the farm or in the feedlot will improve food safety all the way to the consumer's fork. Because of the potential improvement in overall food safety that pre-harvest intervention strategies can provide, a broad range of preslaughter intervention strategies are currently under investigation. Potential interventions include direct anti-pathogen strategies, competitive enhancement strategies and animal management strategies. Included in these strategies are competitive exclusion, probiotics, prebiotics, antibiotics, antibacterial proteins, vaccination, bacteriophage, diet, and water trough interventions. The parallel and simultaneous application of one or more preslaughter strategies has the potential to synergistically reduce the incidence of human food-borne illnesses by erecting multiple hurdles, thus preventing entry of pathogens into the food chain. This review emphasizes work with *Escherichia coli* O157:H7 to illustrate the various strategies.

8. **Role of irrigation and wastewater reuse: comparison of subsurface irrigation and furrow irrigation. Choi, C., Song, I., Stine, S., Pimentel, J., Gerba, C. (2004). *Water Science and Technology* 50:61-68.** Two different irrigation systems, subsurface drip irrigation and furrow irrigation, are tested to investigate the level of viral contamination and survival when tertiary effluent is used in arid and semi-arid regions. The effluent was injected with bacteriophages of PRD1 and MS2. A greater number of PRD1 and MS2 were recovered from the lettuce in the subsurface drip-irrigated plots as compared to those in the furrow-irrigated plots. Shallow drip tape installation and preferential water paths through cracks on the soil surface appeared to be the main causes of high viral contamination in subsurface drip irrigation plots, which led to the direct contact of the lettuce stems with the irrigation water which penetrated the soil surface. The water use efficiency of the subsurface drip irrigation system was higher than that of the furrow irrigation system. Thus, subsurface drip irrigation is an efficient irrigation method for vegetable crops in arid and semi-arid regions if viral contamination can be reduced. Deeper installation of drip tapes, frequent irrigations, and timely harvests based on cumulative heat units may further reduce health risks by ensuring viral die-off under various field conditions.

9. **The *vir* gene of bacteriophage MAV1 confers resistance to phage infection on *Mycoplasma arthritidis*. Clapper, B., Tu, A. H., Elgavish, A., Dybvig, K. (2004). *Journal of Bacteriology* 186:5715-5720.** Lysogenization of *Mycoplasma arthritidis* with the MAV1 bacteriophage increases the virulence of the mycoplasma in rats. The MAV1 vir gene is one of only two constitutively transcribed phage genes in the lysogen. We show here that Vir is a lipoprotein and is located on the outer surface of the cell membrane. To investigate whether Vir is a virulence factor, the vir gene was cloned into the transposon vector Tn4001T and inserted in the genome of the nonlysogen strain 158. The virulence of the resulting transformants was no different from that of the parent strain. Interestingly, all vir-

containing transformants were resistant to infection by MAV1. Vir had no effect on MAV1 adsorption. We conclude that Vir is not a virulence factor but functions to exclude superinfecting phage, possibly by blocking the injection of phage DNA into the bacterial cytoplasm

10. **Bacterial viruses as human vaccines? Clark, J. R., March, J. B. (2004). *Expert Rev. Vaccines* 3:463-476.** Bacteriophages (or phages) are viruses of bacteria, consisting of nucleic acid packaged within a protein coat. In eukaryotic hosts, phages are unable to replicate and in the absence of a suitable prokaryotic host, behave as inert particulate antigens. In recent years, work has shown that whole phage particles can be used to deliver vaccines in the form of immunogenic peptides attached to modified phage coat proteins or as delivery vehicles for DNA vaccines, by incorporating a eukaryotic promoter-driven vaccine gene within their genome. While both approaches are promising by themselves, in future there is also the exciting possibility of creating a hybrid phage combining both components to create phage that are cheap, easy and rapid to produce and that deliver both protein and DNA vaccines via the oral route in the same construct.

11. **Contribution of the colmation layer to the elimination of coliphages by slow sand filtration. Dizer, H., Grutzmacher, G., Bartel, H., Wiese, H. B., Szewzyk, R., Lopez-Pila, J. M. (2004). *Water Science and Technology* 50:211-214.** River bank or slow sand filtration is a major procedure for processing surface water to drinking water in central europe. In order to model the performance of river bank and slow sand filtration plants, we are studying the different mechanisms by which the elimination of pathogens is realized. An important question concerning the mode of action of slow sand filters and river bank filtration units is the role of the colmation layer or "schmutzdecke" on the elimination of human pathogens. The schmutzdecke is an organic layer which develops at the surface of the sand filter short after the onset of operation. We have inoculated a pilot plant for slow sand filtration with coliphages and determined their rate of breakthrough and their final elimination. In the first experiment, with a colmation layer still missing, the breakthrough of the coliphages in the 80 cm mighty sandy bed amounted to ca. 40 %. In contrast, less than 1 % of coliphages escaped from the filter as the same experiment was repeated two months later, when a substantial colmation layer had developed. Our preliminary conclusions are that the colmation layer is extremely efficient in eliminating of viruses.

12. **Tropism switching in *Bordetella* bacteriophage defines a family of diversity-generating retroelements. Doulatov, S., Hodes, A., Dai, L., Mandhana, N., Liu, M., Deora, R., Simons, R. W., Zimmerly, S., Miller, J. F. (2004). *Nature* 431:476-481.** *Bordetella* bacteriophages generate diversity in a gene that specifies host tropism. This microevolutionary adaptation is produced by a genetic element that combines the basic retroelement life cycle of transcription, reverse transcription and integration with site-directed, adenine-specific mutagenesis. Central to this process is a reverse transcriptase-mediated exchange between two repeats; one serving as a donor template (TR) and the other as a recipient of variable sequence information (VR). Here we describe the genetic basis for diversity generation. The directionality of information transfer is determined by a 21-base-pair sequence present at the 3' end of VR. On the basis of patterns of marker transfer in response to variant selective pressures, we propose that a TR reverse transcript is mutagenized, integrated into VR as a single non-coding strand, and then partially converted to the parental VR sequence. This allows the diversity-generating system to minimize variability to the subset of bases under selection. Using the *Bordetella* phage cassette as a signature, we have identified numerous related elements in diverse bacteria. These elements constitute a new family of retroelements with the potential to confer selective advantages to their host genomes.

13. **Polylysogeny and prophage induction by secondary infection in *Vibrio cholerae*. Espeland, E. M., Lipp, E. K., Huq, A., Colwell, R. R. (2004). *Environmental Microbiology* 6:760-763.** Strains of *Vibrio cholerae* O1, biotypes El Tor and classical, were infected with a known temperate phage (ΦP15) and monitored over a 15-day period for prophage induction. Over the course of the experiment two morphologically and three genomically distinct virus-like particles were observed from the phage-infected El Tor strain by transmission electron microscopy and field inversion gel electrophoresis, respectively, whereas only one phage, ΦP15, was observed from the infected classical strain. In the uninfected El Tor culture one prophage was spontaneously induced after 6 days. No induction in either strain was observed after treatment with mitomycin C. Data indicate that El Tor biotypes of *V. cholerae* may be polylysogenic and that secondary infection can promote multiple prophage induction. These traits may be important in the transfer of genetic material among *V. cholerae* by providing an environmentally relevant route for multiple prophage propagation and transmission.

14. **Detection of bacteriophage infection and prophage induction in bacterial cultures by means of electric DNA chips. Gabig-Ciminska, M., Los, M., Holmgren, A., Albers, J., Czyz, A., Hintsche, R., Wegrzyn, G., Enfors, S. O. (2004). *Analytical biochemistry* 324:84-91.** Infections of bacterial cultures by bacteriophages are common and serious problems in many biotechnological laboratories and factories. A method for specific, quantitative, and quick detection of phage contamination, based on the use of electric DNA chip is described here. Different phages of *Escherichia coli* and *Bacillus subtilis* were analyzed. Phage DNA was isolated from bacterial culture samples and detected by combination of bead-based sandwich hybridization with enzyme-labeled probes and detection of the enzymatic product using silicon chips. The assay resulted in specific signals from all four tested phages without significant background. Although high sensitivity was achieved in 4h assay time, a useful level of sensitivity (10^7-10^8 phages) is achievable within 25 min. A multiplex DNA chip technique involving a mixture of probes allows for detection of various types of phages in one sample. These analyses confirmed the specificity of the assay.

15. **Rapid response of marginal zone B cells to viral particles. Gatto, D., Ruedl, C., Odermatt, B., Bachmann, M. F. (2004). *Journal of Immunology* 173:4308-4316.** Marginal zone (MZ) B cells are thought to be responsible for the first wave of Abs against bacterial Ags. In this study, we assessed the in vivo response of MZ B cells in mice immunized with viral particles derived from the RNA phage Qβ. We found that both follicular (FO) and MZ B cells responded to immunization with viral particles. MZ B cells responded with slightly faster kinetics, but numerically, FO B cells dominated the response. B1 B cells responded similarly to MZ B cells. Both MZ and FO B cells underwent isotype switching, with MZ B cells again exhibiting faster kinetics. In fact, almost all Qβ-specific MZ B cells expressed surface IgG by day 5. Histological analysis demonstrated that a population of activated B cells remain associated with the MZ, probably due to the elevated integrin levels expressed by these cells. Thus, both MZ and FO B cells respond with rapid proliferation to viral infection and both populations undergo isotype switching, but MZ B cells

remain in the MZ and may be responsible for local Ab production, opsonizing pathogens entering the spleen.

16. **Childhood tuberculosis and its early diagnosis. Gray, J. W. (2004). *Clinical Biochemistryy* 37:450-455.** Traditional methods for laboratory diagnosis of tuberculosis are unsatisfactory, especially for children, in whose specimens mycobacteria are usually sparse. Recent changes in tuberculosis epidemiology in developed countries, including a large increase in incidence in children from certain ethnic minorities, have prompted interest in newer diagnostic methods. Liquid-based culture detection systems offer improved sensitivity and speed of diagnosis, although the time taken for detection of growth is still upwards of 1 week. Nucleic acid amplification techniques offer more rapid results, but perform best on smear-positive samples; sensitivities may be as low as 50% in smear-negative specimens. Although these newer techniques are widely used in some developed countries, in others, they are not perceived as offering sufficient benefit to justify their routine use. The diagnostic accuracy of mycobacteriophage and serologic methods is insufficient to justify their wide use even in developing countries. Despite recent developments, there is still no panacea for diagnosis of childhood tuberculosis.

17. **Elimination of viruses, bacteria and protozoan oocysts by slow sand filtration. Hijnen, W. A. M., Schijven, J. F., Bonne, P., Visser, A., Medema, G. J. (2004). *Water Science and Technology* 50:147-154.** The decimal elimination capacity (DEC) of slow sand filters (SSF) for viruses, bacteria and oocysts of *Cryptosporidium* has been assessed from full-scale data and pilot plant and laboratory experiments. DEC for viruses calculated from experimental data with MS2-bacteriophages in the pilot plant filters was 1.5-2 $\log_{10}$. *E. coli* and thermotolerant coliforms (Coli44) were removed at full-scale and in the pilot plant with 2-3 $\log_{10}$. At full-scale, *Campylobacter* bacteria removal was 1 $\log_{10}$ more than removal of Coli44, which indicated that Coli44 was a conservative surrogate for these pathogenic bacteria. Laboratory experiments with sand columns showed 2-3 and >5-6 $\log_{10}$ removal of spiked spores of sulphite-reducing clostridia (SSRC; *C. perfringens*) and oocysts of *Cryptosporidium* respectively. Consequently, SSRC was not a good surrogate to quantify oocyst removal by SSF. Removal of indigenous SSRC by full-scale filters was less efficient than observed in the laboratory columns, probably due to continuous loading of these filter beds with spores, accumulation and retarded transport. It remains to be investigated if this also applies to oocyst removal by SSF. The results additionally showed that the schmutzdecke and accumulation of (in)organic charged compounds in the sand increased the elimination of microorganisms. Removal of the schmutzdecke reduced DEC for bacteria by +/-2 $\log_{10}$, but did not affect removal of phages. This clearly indicated that, besides biological activity, both straining and adsorption were important removal mechanisms in the filter bed for microorganisms larger than viruses.

18. **Isolation of bacteriophages from the oral cavity. Hitch, G., Pratten, J., Taylor, P. W. (2004). *Letters in Applied Microbiology* 39:215-219.** AIMS: To isolate bacteriophages lytic for oral pathogens from human saliva, dental plaque and mature biofilms constituted from saliva-derived bacteria. METHODS AND RESULTS: Saliva and dental plaque samples from healthy volunteers and from patients with gingivitis and periodontitis were examined for the presence of lytic bacteriophage using a panel of oral pathogens and bacteria isolated from the samples. Samples were also enriched for bacteriophage using static culture techniques and mature biofilms. A limited number of samples contained bacteriophage particles that were visualized using electron microscopy. Cultures yielded phage infecting non-oral bacteria (*Proteus mirabilis*) but no bacteriophage specific for recognized oral pathogens were found. Some micro-organisms from the oral microflora elaborated antibacterial substances that inhibited growth of other residents of the oral cavity. CONCLUSIONS: Unlike other ecosystems, the composition of the oral cavity does not appear to be heavily influenced by interactions between bacteriophages and their hosts. SIGNIFICANCE AND IMPACT OF THE STUDY: Bacteriophage for control of oral infections may need to be obtained from other sources. Antibacterial substances derived from some members of the oral microflora warrant investigation as potential antibiotics.

19. **Evaluation of the purification capacity of nine portable, small-scale water purification devices. Horman, A., Rimhanen-Finne, R., Maunula, L., von Bonsdorff, C. H., Rapala, J., Lahti, K., Hanninen, M. L. (2004). *Water Science and Technology* 50:179-183.** A test was performed to evaluate the microbial and chemical purification capacity of nine portable, small-scale water purification filter devices with production capacity less than 100 L/h. The devices were tested for simultaneous removal capacity of bacteria (cultured *Escherichia coli*, *Clostridium perfringens*, *Klebsiella pneumoniae* and *Enterobacter cloacae*), enteric protozoans (formalin-stored *Cryptosporidium parvum* oocysts), viral markers (F-RNA bacteriophages) and microcystins produced by toxic cyanobacterial cultures. In general, the devices tested were able to remove bacterial contaminants by 3.6-6.9 $\log_{10}$ units from raw water. Those devices based only on filtration through pores 0.2-0.4 μm or larger failed in viral and chemical purification. Only one device, based on reverse osmosis, was capable of removing F-RNA phages at concentrations under the detection limit and microcystins by 2.5 $\log_{10}$. The present study emphasised the need for evaluation tests of water purification devices from the public safety and HACCP (Hazard Analysis and Critical Control Point) points of view. Simultaneous testing for various pathogenic/indicator microbes and microcystins was shown to be a useful and practical way to obtain essential data on actual purification capacity of commercial small-scale drinking-water filters.

20. **PCR detection of pathogenic viruses in southern California urban rivers. Jiang, S. C., Chu, W. (2004). *Journal of Applied Microbiology* 97:17-28.** AIMS: To investigate human viral contamination in urban rivers and its impact on coastal waters of southern California, USA. METHODS AND RESULTS: Three types of human viruses (adeno, entero and hepatitis A) were detected using nested- and RT-PCR from 11 rivers and creeks. Faecal indicator bacteria as well as somatic and F-specific coliphage were also tested. Approximately 50% of the sites were positive for human adenoviruses. However, there was no clear relationship between detection of human viruses and the concentration of indicator bacteria and coliphage. Both faecal indicator bacteria and human viral input at beaches near river mouths were associated with storm events. The first storm of the wet season seemed to have the greatest impact on the quality of coastal water than following storm events. CONCLUSIONS: This study provides the first direct evidence that human viruses are prevalent in southern California urban rivers. Urban run-off impacts coastal water quality most significantly during the storm season. SIGNIFICANCE AND IMPACT OF THE STUDY: To protect human health during water recreational activities, it is necessary to develop effective strategies to manage urban run-off during storm events.

21. **Optimizing concentration and timing of a phage spray application to reduce *Listeria monocytogenes* on honeydew melon tissue. Leverentz, B., Conway, W. S., Janisiewicz, W., Camp, M. J. (2004). *Journal of Food Protection* 67:1682-1686.** A phage cocktail was applied to honeydew melon pieces 1, 0.5, and 0 h before contamination with *Listeria monocytogenes* strain LCDC 81-861 and 0.5, 1, 2, and 4 h after contamination. The phage application was most effective when applied 1, 0.5, or 0 h before contamination with *L. monocytogenes*, reducing pathogen populations by up to 6.8 log units after 7 days of storage. This indicates that under commercial conditions, if contamination occurs at the time of cutting, phage would have to be applied as soon as possible after cutting the produce. However, all phage applications from 1 h before to 4 h after contamination and all phage concentrations ranging from 10^4 to 10^8 PFU/ml reduced bacterial populations on honeydew melon pieces. Higher phage concentrations were more effective in reducing pathogen populations. A phage concentration of approximately 10^8 PFU/ml was necessary to reduce the pathogen populations to nondetectable levels immediately after treatment, and pathogen growth was suppressed by phage concentrations of 10^6 through 10^8 throughout the storage period of 7 days at 10ºC. In an attempt to enhance the effectiveness of the phage cocktail on low pH fruit, such as apples, the phage was applied in combination with $MnCl_2$. This combination, however, did not enhance the effectiveness of the phage on apple tissue. The results from this study indicate that the effectiveness of the phage application on honeydew melon pieces can be optimized by using a phage concentration of at least 10^8 PFU/ml applied up to 1 h after processing of the honeydew melons.

22. **Transfer of photosynthesis genes to and from *Prochlorococcus* viruses. Lindell, D., Sullivan, M. B., Johnson, Z. I., Tolonen, A. C., Rohwer, F., Chisholm, S. W. (2004). *Proceedings of the National Academy of Sciences, USA* 101:11013-11018.** Comparative genomics gives us a new window into phage-host interactions and their evolutionary implications. Here we report the presence of genes central to oxygenic photosynthesis in the genomes of three phages from two viral families (Myoviridae and Podoviridae) that infect the marine cyanobacterium *Prochlorococcus*. The genes that encode the photosystem II core reaction center protein D1 (*psbA*), and a high-light-inducible protein (HLIP) (*hli*) are present in all three genomes. Both myoviruses contain additional *hli* gene types, and one of them encodes the second photosystem II core reaction center protein D2 (*psbD*), whereas the other encodes the photosynthetic electron transport proteins plastocyanin (*petE*) and ferredoxin (*petF*). These uninterrupted, full-length genes are conserved in their amino acid sequence, suggesting that they encode functional proteins that may help maintain photosynthetic activity during infection. Phylogenetic analyses show that phage D1, D2, and HLIP proteins cluster with those from *Prochlorococcus*, indicating that they are of cyanobacterial origin. Their distribution among several *Prochlorococcus* clades further suggests that the genes encoding these proteins were transferred from host to phage multiple times. Phage HLIPs cluster with multicopy types found exclusively in *Prochlorococcus*, suggesting that phage may be mediating the expansion of the *hli* gene family by transferring these genes back to their hosts after a period of evolution in the phage. These gene transfers are likely to play a role in the fitness landscape of hosts and phages in the surface oceans.

23. **A comparison of the survival of F+RNA and F+DNA coliphages in lake water microcosms. Long, S. C., Sobsey, M. D. (2004). *Water Health* 2:15-22.** The survival of seven F+RNA phages (MS2 Group I ATCC type strain, two Group I environmental isolates, a Group II environmental isolate, a Group III environmental isolate, and two Group IV environmental isolates) and six F+DNA phages (M13, fd, f1, and ZJ/2 ATCC type strains, and two environmental isolates) were examined in microcosms using a surface drinking water source. Phages were spiked into replicate aliquots of a source water at about 20,000 pfu/ml. Replicate spikes were incubated at 4 and 20ºC and monitored for 110 days. At 4 degrees C, Groups I and II F+ RNA phages were detectable through 110 days, with reductions of about 1 and 3 $\log_{10}$, respectively. The Group III F+RNA phage demonstrated 5 $\log_{10}$ reduction after 3 weeks, and the Group IV F+RNA phages were reduced to detection limits (5 $\log_{10}$ reduction) within 10 days. Of the F+DNA phages, all four type strains were detectable with about 2.5 $\log_{10}$ reduction after 110 days at 4 degrees C. The F+DNA environmental isolates were detectable with about a 4 $\log_{10}$ reduction after 110 days at 4ºC. All phages demonstrated faster decay at 20ºC. These results suggest that differences in F+ phage survival may influence their prevalence in environmental waters and the ability to attribute their prevalence to specific human and animal sources of faecal contamination.

24. **The impact of bacteriophage genomics. McGrath, S., Fitzgerald, G. F., van Sinderen, D. (2004). *Current Opinion in Biotechnology* 15:94-99.** The discovery of (bacterio)phages revolutionised microbiology and genetics, while phage research has been integral to answering some of the most fundamental biological questions of the twentieth century. The susceptibility of bacteria to bacteriophage attack can be undesirable in some cases, especially in the dairy industry, but can be desirable in others, for example, the use of bacteriophage therapy to eliminate pathogenic bacteria. The relative ease with which entire bacteriophage genome sequences can now be elucidated has had a profound impact on the study of these bacterial parasites.

25. **Genetic organization of the *psbAD* region in phages infecting marine *Synechococcus* strains. Millard, A., Clokie, M., Shub, D. A., Mann, N. H. (2004). *Proceedings of the National Academy of Sciences, USA* 101:11007-11012.** The discovery of the genes *psbA* and *psbD*, encoding the D1 and D2 core components of the photosynthetic reaction center PSII (photosystem II), in the genome of the bacteriophage S-PM2 (a cyanomyovirus) that infects marine cyanobacteria begs the question as to how these genes were acquired. In an attempt to answer this question, it was established that the occurrence of the genes is widespread among marine cyanomyovirus isolates and may even extend to podoviruses. The phage *psbA* genes fall into a clade that includes the *psbA* genes from their potential *Synechococcus* and *Prochlorococcus* hosts, and thus, this phylogenetic analysis provides evidence to support the idea of the acquisition of these genes by horizontal gene transfer from their cyanobacterial hosts. However, the phage *psbA* genes form distinct subclades within this lineage, which suggests that their acquisition was not very recent. The *psbA* genes of two phages contain identical 212-bp insertions that exhibit all of the canonical structural features of a group I self-splicing intron. The different patterns of genetic organization of the *psbAD* region are consistent with the idea that the *psbA* and *psbD* genes were acquired more than once by cyanomyoviruses and that their horizontal transfer between phages via a common phage gene pool, as part of mobile genetic modules, may be a continuing process. In addition, genes were discovered encoding a high-light inducible protein and a putative key enzyme of dark metabolism, transaldolase, extending the areas of host-cell

metabolism that may be affected by phage infection.

26. **Free Shiga toxin bacteriophages isolated from sewage showed diversity although the *stx* genes appeared conserved. Muniesa, M., Serra-Moreno, R., Jofre, J. (2004). *Environmental Microbiology* 6:716-725.** Phages carrying the stx_2 gene were detected in a range of sewage samples using a plaque hybridization-based method.

    After detection, phages were isolated and propagated with a laboratory strain of *Escherichia coli* as host for characterization purposes. Although it was not possible to conduct propagation or transduction experiments on most of the phages, 11 reached a sufficiently high titre for studies of host infectivity, electron microscopy and sequencing of the stx_2 flanking regions to be performed. These phages showed a wide range of host infectivity and morphology.

    The genetic structure of the 5' *stx* flanking region appeared conserved whereas the 3' region differed from that of previously described phages. This is the first description of infectious *stx*-phages isolated as free particles in the environment, and as such constitutes a new contribution to the study of the ecology of these phages.

27. **Diversity of stx_2 converting bacteriophages induced from Shiga-toxin-producing *Escherichia coli* strains isolated from cattle. Muniesa, M., Blanco, J. E., de Simón, M., Serra-Moreno, R., Blanch, A. R., Jofre, J. (2004). *Microbiology* 150:2959-2971.** The presence of bacteriophages encoding Shiga toxin 2 (stx_2 phages) was analysed in 168 strains of Shiga-toxin-producing *Escherichia coli* (STEC) isolated from cattle. Following mitomycin C induction, strains carrying stx_2 phages were screened by plaque blot and hybridization with an stx_2A-probe. In the stx_2-phage-carrying strains, the amounts of phage production, phage DNA extracted and Stx_2 produced after induction were assessed. The induced stx_2 phages were characterized morphologically and genetically. Assays to obtain lysogens from different strains were also carried out and phages induced from the lysogens were compared with those induced from the STEC isolates. Results indicated that 18% of the strains carried an inducible stx_2 phage. Most of them showed a direct relationship between phage induction and toxin production. Each strain carried only one inducible stx_2 phage, although a few strains had two copies of the stx_2 in the chromosome. The stx_2 phages showed diverse morphology and a wide variability in their genome. Assays to obtain lysogens showed that not all the phages were transduced with the same frequency and only six lysogens were obtained. Phages in the lysogens were the same as those induced from their respective initial STEC host strains, although the induction and relative toxin production of the lysogens varied. Most phages carried the stx_2 gene, while a few carried stx_2 variants. Infectivity of the phages depended on the different hosts, although O157 :H7 was preferentially infected by phages induced from O157 strains. The results show that inducible stx_2 phages are common among STEC of animal origin and that they may enhance the spread of stx_2.

28. **Presence of bacterial phage-like DNA sequences in commercial Taq DNA polymerase reagents. Newsome, T., Li, B. J., Zou, N., Lo, S. C. (2004). *Journal of Clinical Microbiology* 42:2264-2267.** Many studies have reported the presence of bacterial DNA contamination in commercial Taq DNA polymerase reagents. This is the first report of the presence of phage-like DNA sequences in certain commercial Taq DNA polymerase reagents. Precautions are needed when using amplification reagents with exogenous DNAs.

29. **Removal of F-specific RNA bacteriophages in artificial recharge of groundwater□a field study. Niemi, R. M., Kytovaara, A., Paakkonen, J., Lahti, K. (2004). *Water Science and Technology* 50:155-158.** Artificial recharge of groundwater offers a semi-natural means to produce raw water for drinking-water plants. Surface water works are increasingly being replaced by artificial groundwater works in Finland. Two municipalities, one serving 30,000 and the other 170,000 inhabitants, have considered filtering river water through eskers for the production of potable water. In this study the removal of bacteriophages during infiltration of river water was estimated, for the evaluation of treatment adequacy in a field study. A 5-m-deep column of sand was constructed and used to mimic the percolating phase in infiltration. An artificial esker was constructed on the riverbank by isolating a 2-m-wide, 2-m-deep and 18-m-long bed of coarse sand with plastic. The sand bed represented the saturated zone. River water was pumped at a rate of 40 L/h to the sand column. The river water was spiked with F+ specific RNA phage MS2 by adding phage suspension during one week at an average concentration of 4.3×10^9 PFU/mL. Samples for phage assays were taken during one month, from four sampling sites, on the basis of detention time as estimated by a tracer experiment with sodium chloride. The median count of MS2 for percolated water was 2.4×10^5 PFU/mL, representing a 96.7% reduction. During the passage of 6 m in the saturated zone, a further reduction of 98.5% occurred. During the passage from 6 m to 12 m the additional reduction was 99.97%. The overall reduction was between 6 and 7 $\log_{10}$ units. The removal of MS2 phages was rather efficient, although the esker material was coarse, mainly sandy, gravel.

30. **Site-specific recombination links the evolution of P2-like coliphages and pathogenic enterobacteria. Nilsson, A. S., Karlsson, J. L., Haggard-Ljungquist, E. (2004). *Molecular Biology and Evolution* 21:1-13.** The genome of the tailed temperate coliphage P2 (Myoviridae) contains some genes that probably are horizontally transferred additions to the genome. One of these genes, the *Z/fun* gene, was recently found intact in the genome of *Neisseria meningitidis*. We have investigated the presence of P2-like phages, and the genetic variation at the position corresponding to the phage P2 Z/fun locus, in the *Escherichia coli* reference collection (ECOR). P2-like phages are common in *E. coli* since they are present in about 30% of the ECOR strains. Hybridizations and PCR amplifications indicate that the overall variation among these phages is small. Amplification of the region corresponding to the phage P2 *Z/fun* locus in 11 prophages revealed that this is a multivariable locus. Sequencing of the region resulted in 10 completely different sequences but with a similar high AT-content as the *Z/fun* gene. All sequences contained at least one open reading frame with good transcription and translation signals. All sequences were also surrounded by a highly similar, previously undiscovered, inverted repeat (IR). We also found this IR in genetically unstable regions in pathogenic enterobacteria. This demonstrates that P2-like phages are important factors in the evolution of bacteria, not only because they carry a diversity of lysogenic conversion genes but also because they can act as vectors for single genes. The genes found between the IRs have unknown functions, and only a few clearly similar genes have been found in other bacteria.

31. **Bacteria and viruses in the water column of tropical freshwater reservoirs. Peduzzi, P., Schiemer, F. (2004). *Environmental Microbiology* 6:707-715.** In tropical freshwater reservoirs of Sri Lanka, which are linked in an aquatic network, bacterial abundance and production as well as virus abundance, frequency of viral infection and virus production were investigated together with a set of nutrient species (Kjeldahl-N, NO_3-N, total P, soluble P, PO_4-P). At two characteristic seasons (wet season, dry season), samples were taken from two types of reservoirs (new upland impoundment and ancient, shallow lowland reservoir), each during 4 days at various depths of the entire water columns. Kjeldahl-N and total P were greatly elevated in the wind-mixed water body of the shallow impoundment during the dry season, whereas the deeper reservoir type exhibited no obvious seasonality. In SYBR green trade mark -stained samples, bacterial abundance showed no seasonal pattern in either reservoir type. Bacterial secondary production, however, was significantly elevated in the entire water column of the shallow impoundment under wind-mixed conditions in the dry season. Highest abundance of virus particles and elevated frequency of bacteria containing mature phages were also observed in the shallow reservoir during the dry season indicating favourable conditions for virus propagation. Data from this aquatic network show that most virus parameters, such as abundance or frequency of visibly infected cells, were positively linked to bacterial abundance and production, but also to organic nitrogen or some phosphorus species. We calculated that between 13.2% and 46.1% of the bacterial standing stocks would be subjected to virus-mediated mortality. Estimates of bacteriophage production revealed that from 10×10^9 up to 98×10^9 phages were produced per litre and day. Bacteria and viruses in the studied tropical freshwater system appear to be linked to various environmental conditions and may affect processes at the ecosystem scale.

32. **Sewage impact on shellfish microbial contamination. Pommepuy, M., Dumas, F., Caprais, M. P., Camus, P., Le Mennec, C., Parnaudeau, S., Haugarreau, L., Sarrette, B., Vilagines, P., Pothier, P., Kholi, E., Le Guyader, F. (2004). *Water Science and Technology* 50:117-124.** Coastal areas are frequently contaminated by microorganisms of human origin, due to high population density and low seawater renewal. To evaluate the impact of wastewater input on shellfish quality, a study was conducted in Brittany (France) over a period of 20 months. A hydrodynamic model was used to simulate wastewater impact on microbial water quality. To validate the model, wastewater from the three main sewage treatment plants and shellfish from three sites were sampled monthly. Bacterial indicators (*E. coli*), F-RNA phages were searched for by culture and noroviruses by RT-PCR and hybridisation. These microorganisms were detected in the three effluents and clams, with no marked seasonal variation. The microbial concentrations in the two oyster beds, distant from the effluent outfall, were low, and only three of the samples were positive for norovirus. For simulation, the winter wastewater inputs of *E. coli* and phages were calculated and an estimation for norovirus flux was made from the epidemic situation in the population. The microbial behaviour was included in the model by a decay-rate factor. Results from the model calculations were found to be very similar to *E. coli* and phage concentrations observed in shellfish. For noroviruses, the model indicated that shellfish distant from the wastewater input were under the detection limit of the RT-PCR method. This study demonstrated the use of modelisation to interpret norovirus contamination in various areas.

33. **Drift increases the advantage of sex in RNA bacteriophage F6. Poon, A., Chao, L. (2004). *Genetics* 166:19-24.** The pervasiveness of sex and recombination remains one of the most enigmatic problems in evolutionary biology. According to many theoretical models, recombination can increase the rate of adaptation by restoring genetic variation. However, the potential for genetic drift to generate conditions that produce this outcome has yet to be studied experimentally. We have designed and performed an experiment that reveals the effects of drift on existing genetic variation by minimizing the influence of variation on beneficial mutation rate. Our experiment was conducted in populations of RNA bacteriophage F6 initiated from a common source population at varying bottleneck sizes. The segmented genome of this virus results in genetic exchange between viruses that co-infect the same host cell. In response to selection for growth in a high-temperature environment, sexual lines outperformed their asexual counterparts on average. The advantage of sex attenuated with increasing effective population size, implying that the rate of adaptation was limited by clonal interference among segments caused by drift. This is the first empirical evidence that the advantage of sex during adaptation increases with the intensity of drift.

34. **Development and evaluation of methods to detect coliphages in large volumes of water. Sobsey, M. D., Yates, M. V., Hsu, F. C., Lovelace, G., Battigelli, D., Margolin, A., Pillai, S. D., Nwachuku, N. (2004). *Water Science and Technology* 50:211-217.** New and improved methods have been developed to detect somatic and male-specific coliphages in large volumes of water by single agar layer (SAL), enrichment and membrane filter methods. Somatic coliphages were detected efficiently on *E. coli* hosts C and CN13, male-specific coliphages were detected more efficiently on *E. coli* Famp than on *Salmonella typhimurium* WG49 and both types of coliphages were detected simultaneously on *E. coli* C3000. For water volumes of up to 100 ml, the SAL method was efficient and reliable. For water volumes of <1 L and as many as 10 multiple 1 L volumes, the enrichment method was efficient in detecting very low numbers of coliphages. Membrane filter methods, in which coliphages were adsorbed to and eluted from filters, also were relatively efficient, but they were less efficient than SAL and enrichment methods and were considered to be more cumbersome. For filter adsorption-elution methods, coliphage recoveries were most efficient for cellulose ester filters, less efficient for electropositive 1 MDS filters and least efficient for a direct membrane filter method. Overall, the enrichment method was preferred because of its ability to easily and rapidly detect low levels of coliphages in large sample volumes by either presence-absence or most probable number quantification.

35. **Microbicidal efficacy of an advanced oxidation process using ozone/hydrogen peroxide in water treatment. Sommer, R., Pribil, W., Pfleger, S., Haider, T., Werderitsch, M., Gehringer, P. (2004). *Water Science and Technology* 50:159-164.** The combined application of ozone and hydrogen peroxide represents a kind of advanced oxidation for water treatment. The radicals that are generated during the process are used for the degradation of organic pollutants from groundwater and industrial effluents. The aim of our study was to evaluate the possible microbicidal, and particularly virucidal, efficacy of such a process, since no substantial data were available. The investigations were performed at a pilot plant installed for the elimination of perchloroethylene from polluted groundwater (reduction efficacy for perchloroethylene from 26 μg/L to 5 μg/L). To enable a reliable evaluation of the microbicidal effect, a set of alternate test organisms was used. As model viruses we chose bacteriophages MS2 (F+ specific, single-stranded RNA), ϕX174 (single-stranded DNA) and PRD-1 (coated, double-stranded DNA). Furthermore, spores of *Bacillus subtilis* were included as possible surrogates for protozoa and *Escherichia coli* as representative for traditional indicator bacteria used in water analysis. The microbicidal efficiency was compared to

the inactivation by means of ozone under two standard conditions (20ºC): (a) 0.4 mg/L residual after 4 min and (b) 0.1 mg/L residual after 10 min. Surprisingly, a good microbicidal effect of the ozone/hydrogen peroxide process was found. This was somewhat unexpected, because we had assumed that the disinfection potential of ozone would have been interfered with by the presence of hydrogen peroxide. *Escherichia coli* and the three test viruses revealed a reduction of about 6-log. In contrast, spores of *Bacillus subtilis* showed after the total process a reduction of 0.4-log. These results matched the effect of the ozone treatment (a) with a residual of 0.4 mg/L after 4 min contact time (20ºC). The test condition (b) with a residual of 0.1 mg/L ozone after a contact time of 10 min at 20ºC gave a higher reduction of the *B. subtilis* spores (1.5-log). The presented study revealed a satisfying microbicidal efficacy of the ozone/hydrogen peroxide process with respect to vegetative bacteria and viruses (bacteriophages). However, it has to be emphasised that intense mixing and sufficient contact time have to be optimised and tested for each individual installation.

36. **Therapeutic use of bacteriophages. Soothill, J., Hawkins, C., Anggard, E., Harper, D. (2004). *The Lancet infectious diseases* 4:544-545.** [first two paragraphs] We respond to two articles, published in *The Lancet* and *The Lancet Infectious Diseases* on the use of bacteriophages as therapeutic agents. Jane Bradbury gave much attention to uncontrolled work from eastern Europe, but did not include the extensive, carefully controlled, and positive work of Smith and colleagues. The findings of our recent research challenge Bernard Dixon's discussion of the effects of bacteriophage-induced lysis and the usefulness of inhibiting bacteriophage replication. ¶ We have done the first regulatory approved clinical study of the efficacy of bacteriophage therapy, addressing chronic, antibiotic resistant *Pseudomonas aeruginosa* ear infections in pet dogs that have not responded to conventional therapy. Dixon proposed that endotoxins released as a result of bacterial lysis lead to side effects, particularly circulatory shock, and that this is a problem with bacteriophage medicine for human beings. We do not know of any published evidence that bacteriophage multiplication or lysis of bacteria resulting from the use of bacteriophages has been associated with circulatory shock in patients. In carefully conducted animal experiments, including those of Smith and colleagues such effects have not been noted. In our research we minimised any such theoretical issue by focusing on local rather than systemic infections.

37. **Automatic identification of bacterial types using statistical imaging methods. Trattner, S., Greenspan, H., Tepper, G., Abboud, S. (2004). *IEEE Transactions on Medical Imaging* 23:807-820.** The objective of the current study is to develop an automatic tool to identify microbiological data types using computer-vision and statistical modeling techniques. Bacteriophage (phage) typing methods are used to identify and extract representative profiles of bacterial types out of species such as the *Staphylococcus aureus*. Current systems rely on the subjective reading of profiles by a human expert. This process is time-consuming and prone to errors, especially as technology is enabling the increase in the number of phages used for typing. The statistical methodology presented in this work, provides for an automated, objective and robust analysis of visual data, along with the ability to cope with increasing data volumes.

38. **Inactivation of enteric microbes in water by electro-chemical oxidant from brine (NaCl) and free chlorine. Venczel, L. V., Likirdopulos, C. A., Robinson, C. E., Sobsey, M. D. (2004). *Water Science and Technology* 50:141-146.** Oxidant solutions of mostly free chlorine can be electrochemically produced on-site from brine (NaCl) solution and used to disinfect water at the household or community level. In this study electrochemical oxidant (ECO) from brine and free chlorine were evaluated under laboratory conditions for inactivation of test microbes. Purified suspensions of *Escherichia coli*, the rugose strain of *Vibrio cholerae*, *Clostridium perfringens* spores, MS2 coliphage and *Cryptosporidium parvum* oocysts were treated with 2 mg/L or 5 mg/L solutions of ECO or free chlorine at 5ºC and 25ºC and pH 6, 8, and 10 (pH 7 and 25ºC only for *C. parvum* oocysts) for contact times <60 min. Under nearly all conditions, inactivation kinetics were more rapid for *E. coli*, *V. cholerae*, *C. perfringens* spores and MS2 coliphage with ECO than with free chlorine. ECO reduced *E. coli*, *V. cholerae* and MS2 by >4 $\log_{10}$ within 30 min and *C. perfringens* spores by >2 $\log_{10}$ within 10 min at pH 8 and 25ºC. Contrary to previous results, however, *C. parvum* oocysts were not inactivated by ECO, and the reasons for this difference are uncertain. The on-site electrolytic generation of oxidants from brine provided a convenient and inexpensive disinfectant containing free chlorine that was effective against many enteric microbes, for the treatment of household and community drinking-water supplies worldwide. However, the effectiveness of such oxidants for inactivating *C. parvum* oocysts was variable and sometimes ineffective.

39. **Evaluation of microbial source tracking methods using mixed fecal sources in aqueous test samples. Griffith, J. F., Weisberg, S. B., McGee, C. D. (2003). *Water Health* 1:141-151.** Microbiological source tracking (MST) methods are increasingly being used to identify fecal contamination sources in surface waters, but these methods have been subjected to limited comparative testing. In this study, 22 researchers employing 12 different methods were provided sets of identically prepared blind water samples. Each sample contained one to three of five possible fecal sources (human, dog, cattle, seagull or sewage). Researchers were also provided with portions of the fecal material used to inoculate the blind water samples for use as library material. No MST method that was tested predicted the source material in the blind samples perfectly. Host-specific PCR performed best at differentiating between human and non-human sources, but primers are not yet available for differentiating between all of the non-human sources. Virus and F+ coliphage methods reliably identified sewage, but were unable to identify fecal contamination from individual humans. Library-based isolate methods correctly identified the dominant source in most samples, but also had frequent false positives in which fecal sources not in the samples were incorrectly identified as being present. Among the library-based methods, genotypic methods generally performed better than phenotypic methods.

40. **Use of viral pathogens and indicators to differentiate between human and non-human fecal contamination in a microbial source tracking comparison study. Noble, R. T., Allen, S. M., Blackwood, A. D., Chu, W., Jiang, S. C., Lovelace, G. L., Sobsey, M. D., Stewart, J. R., Wait, D. A. (2003). *Water Health* 1:195-207.** Assays for the detection and typing of adenoviruses, enteroviruses and F+ specific coliphages were performed on samples created as part of a national microbial source tracking methods comparison study. The samples were created blind to the researchers, and were inoculated with a variety of types of fecal contamination source (human, sewage, dog, seagull and cow) and mixtures of sources. Viral tracer and pathogen assays demonstrated a general ability to discriminate human from non-human fecal contamination. For example, samples inoculated with sewage were correctly identified as containing human fecal contamination because they contained human adenovirus or human

enterovirus. In samples containing fecal material from individual humans, human pathogen analysis yielded negative results probably because the stool samples were taken from healthy individuals. False positive rates for the virus-based methods (0-8%) were among the lowest observed during the methods comparison study. It is suggested that virus-based source tracking methods are useful for identification of sewage contamination, and that these methods may also be useful as an indication of the public health risk associated with viral pathogens. Overall, virus-based source tracking methods are an important approach to include in the microbial source tracking 'toolbox'.

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Contact Steve Abedon (microdude+@osu.edu) with suggestions, criticisms, comments, or anything else that might help make this a better site.