

## SCIENTIFIC PUBLICATIONS

## Refereed publications

1. Zhang X.-X. & **Rainey, P. B.** (2007). Construction and validation of a neutrally marked strain of *Pseudomonas fluorescens* SBW25. *Journal of Microbiological Methods* (in press).
2. Zhang X.-X. & **Rainey, P. B.** (2007). Genetic analysis of the histidine utilization (*hut*) genes in *Pseudomonas fluorescens* SBW25. *Genetics* (in press).
3. Tett, A., Spiers, A. J., Crossman, L. C., Aagar, D., Ciric, L., Dow, M., Fry, J., Harris, D., Lilley, A. K., Parkhill, J., Quail, M. A., Seeger, K., Squares, R., Snyder, L., Saunders, N., **Rainey, P. B.**, Thomas, C., Turner, S. L., Zhang, X.-X., Field, D. & Bailey, M. J. (2007). The complete sequence of the pQBR103 plasmid from the sugar beet phytosphere. *ISME Journal* (in press).
4. Bantinaki, E., Kassen, R., Knight, C. G. Robinson, Z. & Spiers, & **Rainey, P. B.** (2007). Adaptive divergence in experimental populations of *Pseudomonas fluorescens*. III. Mutational origins of wrinkly spreader diversity. *Genetics* **176**, 441-453.
5. **Rainey, P. B.** (2007). Unity from conflict. *Nature* **446**, 616.
6. Fukami, T, Beaumont, H. J. E. & Zhang, X.-X. **Rainey, P. B.** Immigration history controls diversification in experimental adaptive radiation. *Nature* **446**, 436-439.
7. Malone, J. G., Williams, R., Christen, M., Jenal, U., Spiers, A. J. & **Rainey, P. B.** (2007). The structure-function relationship of WspR; a *Pseudomonas fluorescens* response regulator with a GGDEF output domain. *Microbiology* **153**, 980-994.
8. Zhang, X.-X. & **Rainey, P. B.** (2007). Biological and ecological significance of a plant-inducible copper-transporting P1-type ATPase from *Pseudomonas fluorescens* SBW25. *Molecular Plant-Microbe Interactions* **20**, 581-588.
9. Kirkelund Hansen, S., **Rainey, P. B.**, Haagenen, J. A. J & Molin, S. (2007). Evolution of species interactions in a biofilm community. *Nature* **445**, 533-536.
10. Buckling, A., Brockhurst, M. A., Travisano, M. & **Rainey, P. B.** (2007). Experimental adaptation to high and low quality environments under different scales of temporal variation. *Journal of Evolutionary Biology*, **20**, 296-300.
11. Brockhurst, M. A., Fenton, A., Roulston, B. & **Rainey, P. B.** (2006). The impact of phages on interspecific competition in experimental populations of bacteria. *BMC Ecology* **6**, 19  
doi:10.1186/1472-6785-6-19.
12. Knight, C. G., Zitzmann, N, Prabhakar, S, Antrobus, R, Dwek, R, Hebestreit, H., & **Rainey, P. B.** (2006). Unravelling adaptive evolution: how a single point mutation affects the protein co-regulation network. *Nature Genetics* **38**, 1015-1022.
13. Goymer, P., Kahn, S. G., Malone, J. G., Gehrig, S. M., Spiers, A. J. & **Rainey, P. B.** (2006). Adaptive divergence in experimental populations of *Pseudomonas fluorescens*. II. Role of the GGDEF regulator, WspR, in evolution and development of the wrinkly spreader phenotype. *Genetics*, **173**, 515-526.
14. Zhang, X.-X., George, A., Bailey, M. J. & **Rainey, P. B.** (2006). The histidine uptake and degradation operon (*hut*) of *Pseudomonas fluorescens* SBW25 is active on plant surfaces, but is not required for colonisation of sugar beet seedlings. *Microbiology*, **152**, 1867-1875.
15. Brockhurst, M. A., Buckling, A. & **Rainey, P. B.** (2006). Spatial heterogeneity and the stability of host-parasite coexistence. *Journal of Evolutionary Biology*, **19**, 374-379.

16. Jackson, R. J., Preston G. M. & **Rainey, P. B.** (2005) Genetic characterisation of *Pseudomonas fluorescens* SBW25 *rsp* gene expression in the phytosphere and in vitro. *Journal of Bacteriology* **187**, 8477-8488.
17. Arcus, V. L., **Rainey, P. B.** & Turner, S. J. (2005). The PIN-domain toxin-antitoxin array in mycobacteria. *Trends in Microbiology* **13**, 360-365.
18. Spiers, A. J. & **Rainey, P. B.** (2005). The *Pseudomonas fluorescens* SBW25 wrinkly spreader A-L biofilm requires attachment factor, cellulose fibre and LPS interactions to maintain strength and integrity. *Microbiology* **151** 2829-2839.
19. Cooper, T. F., Beaumont, H. J. E. & **Rainey, P. B.** (2005). Biofilm diversity as a test of the insurance hypothesis. *Microbiology* **151**, 2815-2816.
20. Brockhurst, M. A., Buckling, A. & **Rainey, P. B.** (2005). The effect of a bacteriophage on diversification of the opportunistic bacterial pathogen *Pseudomonas aeruginosa*. *Proceedings of the Royal Society (London) B* **272**, 1385-1391.
21. Rediers, H., **Rainey, P. B.**, Vanderleyden, J. & De Mot, R. (2005). Unravelling the secret lives of bacteria: IVET and DFI promoter traps as tools for exploring niche-specific gene expression. *Microbiology and Molecular Biology Reviews* **69**, 217-261.
22. Zhang, X.-X., Lilley, A. K., Bailey, M. J. & **Rainey, P. B.** (2004). The indigenous *Pseudomonas* plasmid pQBR103 encodes plant-inducible genes including three putative helicases. *FEMS Microbiology Ecology*, **51**, 9-17.
23. Kassen, R., Llewellyn, M. & **Rainey, P. B.** (2004). Ecological constraints in a model adaptive radiation, *Nature* **431**, 984-988.
24. Zhang, X.-X., Lilley, A. K., Bailey, M. J. & **Rainey, P. B.** (2004). Functional and phylogenetic analysis of a plant-inducible oligoribonuclease (*orn*) gene from an indigenous *Pseudomonas* plasmid. *Microbiology* **150**, 2889-2898.
25. Knight, C. G., Kassen, R., Hebestreit, H. & **Rainey, P. B.** (2004) Global analysis of predicted proteomes: functional adaptation and physical properties. *Proceedings of the National Academy of Sciences USA* **101**, 8390-8395.
26. MacLean, C. Bell, G. & **Rainey, P. B.** (2004) The evolution of a pleiotropic fitness tradeoff in *Pseudomonas fluorescens*. *Proceedings of the National Academy of Sciences USA* **101**, 8072-8077.
27. Silby, M. W. **Rainey, P. B.** & Levy, S. B. (2004). IVET experiments in *Pseudomonas fluorescens* reveal cryptic promoters at loci associated with recognizable overlapping genes. *Microbiology* **150**, 518-520.
28. Kassen, R & **Rainey, P. B.** (2004). The ecology and genetics of microbial diversity. *Annual Review of Microbiology* **58**, 207-231
29. **Rainey, P. B.** & Cooper, T. F (2004). Evolution of bacterial diversity and the origins of modularity. *Research in Microbiology* (special issue on genome plasticity dedicated to the memory of Michel Blot) **155**, 370-375.
30. Jessup, C. M., Kassen, R., Forde, S. E., Kerr, B., Buckling, A., **Rainey, P. B.** & Bohannan, B. J. M. (2004) Big questions, small worlds: Microbial model systems in ecology. *Trends in Ecology and Evolution* **19**, 189-197.
31. Brockhurst, M. A., **Rainey, P. B.** & Buckling, A. (2004). The effect of spatial heterogeneity and parasites on the evolution of host diversity. *Proceedings of the Royal Society* **271**, 107-111.

32. Rediers, H., Bonnacarrere, V., **Rainey, P. B.**, Hamonts, K., Vanderleyden, J. & De Mot, R. (2003). Development and application of a *dapB*-based IVET system to study colonization of rice by the endophytic nitrogen-fixing bacterium *Pseudomonas stutzeri* A15. *Applied and Environmental Microbiology* **69**, 6864-6874.
33. Spiers, A. J., Bohannon, J., Gehrig, S. M. & **Rainey, P. B.** (2003). Biofilm formation at the air-liquid interface by the *Pseudomonas fluorescens* SBW25 wrinkly spreader requires an acetylated form of cellulose. *Molecular Microbiology*, **50**, 15-27.
34. Gal, M., Preston, G. M., Massey, R. M., Spiers, A. J. & **Rainey, P. B.** (2003). Genes encoding a cellulosic polymer contribute toward the ecological success of *Pseudomonas fluorescens* SBW25 on plant surfaces. *Molecular Ecology*, **12**, 3109-3121.
35. Brockhurst, M. A., Morgan, A. D., **Rainey, P. B.** & Buckling, A. (2003). Population mixing accelerates coevolution. *Ecology Letters* **6**, 975-979.
36. **Rainey, P. B.** & Rainey, K. (2003). Evolution of co-operation and conflict in experimental bacterial populations. *Nature* **425**, 72-74.
37. Aldrige, P., Paul, R., Goymer, P. J., **Rainey, P. B.** & Jenal, U. (2003). Role of the GGDEF regulator PleD in polar development of *Caulobacter crescentus*. *Molecular Microbiology* **47**, 1695-1708.
38. Buckling, A. & **Rainey, P. B.** (2002). The role of parasites on sympatric and allopatric diversification of hosts. *Nature* **420**, 496-499.
39. Hodgson, D., **Rainey, P. B.** & Buckling A (2002). Mechanisms linking, productivity and invasibility in experimental bacterial communities. *Proceedings of the Royal Society (London) B* **269**, 2277-2283.
40. D'Argenio, D. A., Calfee, M. W., **Rainey, P. B.** & Pesci, E. C. (2002) Autolysis and autoaggregation in *Pseudomonas aeruginosa* colony morphology mutants. *Journal of Bacteriology* **184**, 6481-6489.
41. Buckling, A & **Rainey, P. B.** (2002). Antagonistic coevolution between a bacterium and a bacteriophage. *Proceedings of the Royal Society (London) B* **269**, 931-936.
42. Spiers, A. J., Kahn, S. G., Bohannon, J., Travisano, M. & **Rainey, P. B.** (2002). Adaptive divergence in experimental populations of *Pseudomonas fluorescens*. 1. Genetic and phenotypic bases of wrinkly spreader fitness. *Genetics* **161**, 33-46.
43. Preston, G. M. Bertrand, N. & **Rainey, P. B.** (2001). Type III (Hrp) secretion in plant growth-promoting *Pseudomonas fluorescens* SBW25. *Molecular Microbiology* **41**, 999-1014.
44. Spiers, A. J., Field, D., Bailey, M. J. & **Rainey, P. B.** (2001). Notes on designing a partial genomic database: The PfSBW25 Encyclopaedia, a sequence database for *Pseudomonas fluorescens* SBW25. *Microbiology* **147**, 247-249.
45. Buckling, A. Kassen, R. Bell, G. & **Rainey, P. B.** (2000). Diversity and disturbance in experimental microcosms. *Nature*, **408**, 961-964.
46. Spiers, A. J., Buckling, A. & **Rainey, P. B.** (2000). The causes of *Pseudomonas* diversity. *Microbiology*, **146**, 2345-2350.
47. **Rainey, P. B.** & Preston, G. M. (2000). IVET strategies: valuable tools for biotechnology. *Current Opinion in Biotechnology* **11**, 440-444.
48. Travisano, M. & **Rainey, P. B.** (2000). Studies of adaptive radiation using model microbial systems. *American Naturalist*, **156**, S35-S44.

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51. **Rainey, P. B.**, Buckling, A., Kassen, R. & Travisano, M. (2000). The emergence and maintenance of diversity: Insights from experimental microbial populations. *Trends in Ecology and Evolution*, **15**, 243-247.
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54. **Rainey, P. B.** (1999). Adaptation of *Pseudomonas fluorescens* to the plant rhizosphere. *Environmental Microbiology* **1**, 243-258.
55. Haubold, B., Travisano, M., **Rainey, P. B.** & Hudson, R. R. (1998). Testing linkage equilibrium in bacterial populations. *Genetics* **150**, 1342-1348.
56. Preston, G. M., Haubold, B. & **Rainey, P. B.** (1998) Bacterial genomics and adaptation to life on plants: Implications for the evolution of pathogenicity and symbiosis. *Current Opinion in Microbiology* **1**, 589-597.
57. **Rainey, P. B.** & Travisano, M. (1998) Adaptive radiation in a heterogeneous environment. *Nature* **394**, 69-72.
58. **Rainey, P. B.**, Heithoff, D. & Mahan, M. (1997). Single-step conjugative cloning of gene fusions involved in microbial-host interactions. *Molecular and General Genetics* **256**, 84-87.
59. Appleby, B. M., Petty, S. J., Blakey, J. K., **Rainey, P. B.** & MacDonald, D. W. Does variation of sex ratio enhance reproductive success of offspring in tawny owls (*Strix aluco*)? *Proceedings of the Royal Society, London Series B* **264**, 1111-1116.
60. Ebert, D., **Rainey, P. B.**, Embley, M. & Scholz, D. (1996). Development, life cycle, ultrastructure and phylogenetic position of *Pasteuria ramosa* Metchnikoff 1888:rediscovery of an obligate endoparasite of *Daphnia magna* Straus. *Philosophical Transactions of the Royal Society, London B* **351**, 1689-1701.
61. Haubold, B. & **Rainey, P. B.** (1996). Genetic and ecotypic structure of a fluorescent *Pseudomonas* population. *Molecular Ecology* **5**, 747-761.
62. **Rainey, P. B.** & Bailey, M. J. (1996). Physical and genetic map of the *Pseudomonas fluorescens* SBW25 chromosome. *Molecular Microbiology* **19**, 521-533.
63. Bailey, M. J., Lilley, A. K., Thompson, I. P., **Rainey, P. B.** & Ellis, R. J. (1995). Site-directed chromosomal marking of a fluorescent pseudomonad isolated from the phytosphere of sugar beet: stability and potential for marker gene transfer. *Molecular Ecology* **4**, 755-763.
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65. Livesley, M. A., Thompson, I. P., **Rainey, P. B.** & Nuttall, P. A. (1995). Comparison of *Borrelia* isolated from UK foci of Lyme disease. *FEMS Microbiology Letters* **130**, 151-158.
66. **Rainey, P. B.**, Bailey, M. J. & Thompson, I. P. (1994). Phenotypic and genotypic diversity of fluorescent pseudomonads isolated from the phyllosphere of sugar beet. *Microbiology* **140**, 2315-2331.

67. **Rainey, P. B.**, Thompson, I. P. & Palleroni, N. J. (1994). Genome and fatty acid analysis of *Pseudomonas stutzeri*. *International Journal of Systematic Bacteriology* **44**, 54-61.
68. Moxon, E. R., **Rainey, P. B.**, Nowak, M. & Lenski, R. E. (1994). Adaptive evolution of highly mutable loci in pathogenic bacteria. *Current Biology* **4**, 24-33.
69. **Rainey, P. B.**, Brodey, C. L. & Johnstone, K. (1993). Identification of a gene cluster encoding three high molecular weight proteins which is required for synthesis of tolaasin by the mushroom pathogen *Pseudomonas tolaasii*. *Molecular Microbiology* **8**, 643-652.
70. **Rainey, P. B.** & Moxon, E. R. (1993). Unusual mutational mechanisms and evolution. *Science* **260**, 1958.
71. Thompson, I. P., Bailey, M. J., Fenlon, J. S., Fermor, T. R., Lilley, A., Lynch, J. M., McCormack, P., McQuilken, M. P., Purdy, K. P., **Rainey, P. B.** and Whipps, J. (1993). Quantitative and qualitative seasonal changes in the microbial community from the phyllosphere of sugar beet (*Beta vulgaris*). *Plant and Soil* **150**, 177-191.
72. Han, F.S., Mortishire-Smith, R. J., **Rainey, P. B.** & Williams, D. H. (1992). Structure of the white line inducing principle from *Pseudomonas reactans*. *Acta Crystallographia* **48C**, 1965-1969.
73. **Rainey, P. B.** (1991). Phenotypic variation of *Pseudomonas putida* and *P. tolaasii* affects attachment to *Agaricus bisporus* mycelium. *Journal of General Microbiology*. **137**, 2769-2779.
74. **Rainey, P. B.**, Brodey, C. L. & Johnstone, K. (1991). Biological properties and spectrum of activity of tolaasin, a lipodepsipeptide toxin produced by the mushroom pathogen, *Pseudomonas tolaasii*. *Physiological and Molecular Plant Pathology*. **39**, 57-70.
75. **Rainey, P. B.** (1991). Effect of *Pseudomonas putida* on hyphal growth of *Agaricus bisporus*. *Mycological Research*. **95**, 699-704.
76. Brodey, C. L., **Rainey, P. B.**, Tester, M. & Johnstone, K. (1991). Bacterial blotch disease of the cultivated mushroom is caused by an ion-channel forming lipodepsipeptide toxin. *Molecular Plant-Microbe Interactions*. **4**, 407-411.
77. Grewal, S. I. S. & **Rainey, P. B.** (1991). Phenotypic variation of *Pseudomonas putida* and *P. tolaasii* affects the chemotactic response toward *Agaricus bisporus* mycelial exudate. *Journal of General Microbiology*. **137**, 2761-2768.
78. Mortishire-Smith, R. J., Nutkins, J., Packman, L., Brodey, C. L., **Rainey, P. B.**, Johnstone, K. & Williams, D. H. (1991). Determination of the structure of an extracellular peptide produced by the mushroom saprotroph, *Pseudomonas reactans*. *Tetrahedron* **47**, 3645-3654.
79. Nutkins, J., Mortishire-Smith, R. J., Packman, L., Brodey, C. L., **Rainey, P. B.**, Johnstone, K. & Williams, D. H. (1991). Structure determination of tolaasin, an extracellular toxin produced by the mushroom pathogen *Pseudomonas tolaasii*. *Journal of the American Chemical Society* **113**, 2621-2627.
80. **Rainey, P. B.**, Cole, A. L. J., Fermor, T. R. & Wood, D. A. (1990). A model system for determining the effect of bacteria on basidiome initiation of *Agaricus bisporus*. *Mycological Research* **94**, 191-195.
81. **Rainey, P. B.** (1989). A new laboratory medium for the cultivation of *Agaricus bisporus*. *New Zealand Natural Sciences* **16**, 109-112.
82. **Rainey, P. B.** & Cole, A. L. J. (1988). A new bacterial disease of the cultivated mushroom, *Agaricus bisporus*. *Transactions of the British Mycological Society* **90**, 122-125.

**Invited papers, chapters, articles**

1. Beaumont, H. J. E., Gehrig, S. M., Kassen, R., Knight, C., Malone, J., Spiers, A. J. & **Rainey, P. B.** (2006). *The genetics of phenotypic innovation*. In *Prokaryotic Diversity: Mechanisms and Significance* (ed Logan, N.), Cambridge University Press, pp. 91-104.
2. **Rainey, P. B.**, Brockhurst, M., Buckling, A., Hodgson, D. & Kassen, R. (2005). The causes and consequences of microbial diversity. In *Biological Diversity and Function in Soils*. (eds Bardgett, R., Hopkins, D & Usher, M.). Cambridge University Press, pp. 83-99.
3. **Rainey, P. B.** (2005). Bacteria evolve and function within communities: observations from experimental *Pseudomonas* populations. In *The Influence of Cooperative Bacteria on Animal Host Biology*. (ed. McFail-Ngai, M., Henderson, B., Ruby, N). Cambridge University Press, pp. 83-102.
4. **Rainey, P. B.** (2004). Bacteria adapt – genetically, by natural selection – even in the lab! *Microbiology Today* 31, 160-162.
5. **Rainey, P. B.** (2003). Big questions in evolution. *New Scientist*. 14<sup>th</sup> june 2003 issue (article featured on front cover).
6. Preston G, Spiers A, Zhang X-X, Jackson R, Gal M, Knight C, Gehrig S, Malone J, Moon C, Godfrey S, Robinson Z, Bertrand N, Field D and **Rainey P. B.** (2003). The secret life of *Pseudomonas fluorescens* SBW25. In *Pseudomonas syringae and related pathogens*. (eds Iacobellis N.S., Collmer A., Hutcheson S.W., Mansfield J.W., Morris C.E., Murillo J., Schaad N.W., Stead D.E., Surico G., and Ullrich M.S.) Kluwer Academic Publishers. Dordrecht, The Netherlands. pp 347-353.
7. **Rainey, P. B.** (2003). Mutation rate evolution and implications for *Pseudomonas aeruginosa* in cystic fibrosis. In *Antibiotic Resistance in Cystic Fibrosis – an Emerging Crisis?* (ed. Pitt, T.) Royal Society of Medicine Press. pp 23-28.
8. Bailey, M. J., **Rainey, P. B.**, Zhang, X.-X., & Lilley, A. K. (2002). Population dynamics, gene transfer and gene expression in plasmids, the role of the horizontal gene pool in local adaptation at the plant surface. In *Phyllosphere Microbiology* (eds Lindow, S. E., Hecht-Poinar, E. I. & Elliot, V. J.) American Phytopathological Society Press. pp 173-192.
9. **Rainey, P. B.** (1999). A sense of science. *Time Higher Education Supplement*, February 99; and several more sets of book reviews since for *THES*.
10. Moxon, E. R, Lenski, R. E. & **Rainey, P. B.** (1998). *Perspectives in Biology and Medicine* 42, 154-155.
11. **Rainey, P. B.** (1997) Contributor of definitions and short articles for *Encyclopedia of Ecology and Environmental Management*. Blackwell Science.
12. Haubold, B. & **Rainey, P. B.** (1997). Toward an understanding of the population genetics of plant-colonizing bacteria. *Advances in Botanical Research Incorporating Advances in Plant Pathology*. Academic Press 24, 335-351.
13. Moxon, E. R. & **Rainey, P. B.** (1995). Pathogenic bacteria; the wisdom of their genes. In *Ecology of Pathogenic Bacteria: Molecular and Evolutionary Aspects*. Proceedings of the 1995 Royal Netherlands Academy of Arts and Sciences Symposium. pp 255-268.
14. **Rainey, P. B.** & Beckman, K. (1994). Plant Pathology. In *Encyclopedia of Molecular Biology*. (ed. J. Kendrew) Blackwell Scientific Publications. pp 838-843.
15. **Rainey, P. B.** (1994) Contributor of definitions on bacterial genetics for *Encyclopedia of Molecular Biology*. (ed. J. Kendrew). Blackwell Scientific Publications.
16. **Rainey, P. B.**, Moxon, E. R. & Thompson, I. P. (1993) Intraclonal polymorphism in bacteria. *Advances in Microbial Ecology* Vol 13, pp. 263-300. Plenum Press.

17. **Rainey, P. B.**, Brodey, C. L. & Johnstone, K. (1992). Biology of *Pseudomonas tolaasii*, cause of brown blotch disease of mushrooms. *Advances in Plant Pathology*. **8**, 95-117. Academic Press.

**Patents**

1. **Rainey, P. B.**, Spiers A. J. & Bantinaki, E. (2001). Bacterial polysaccharides and biofilm development. US Patent 20040054165