

## 八、参考文献

1. Aiba, H., et al., *Mutations that alter the allosteric nature of cAMP receptor protein of Escherichia coli*. EMBO J, 1985. **4**(12): p. 3329-32.
2. Altuvia, S., et al., *A small, stable RNA induced by oxidative stress: role as a pleiotropic regulator and antimutator*. Cell, 1997. **90**(1): p. 43-53.
3. Argaman, L., et al., *Novel small RNA-encoding genes in the intergenic regions of Escherichia coli*. Curr Biol, 2001. **11**(12): p. 941-50.
4. Baev, M.V., et al., *Growth of Escherichia coli MG1655 on LB medium: monitoring utilization of amino acids, peptides, and nucleotides with transcriptional microarrays*. Appl Microbiol Biotechnol, 2006. **71**(3): p. 317-22.
5. Berg, O.G. and P.H. von Hippel, *Selection of DNA binding sites by regulatory proteins. II. The binding specificity of cyclic AMP receptor protein to recognition sites*. J Mol Biol, 1988. **200**(4): p. 709-23.
6. Botsford, J.L. and J.G. Harman, *Cyclic AMP in prokaryotes*. Microbiol Rev, 1992. **56**(1): p. 100-22.
7. Busby, S. and R.H. Ebright, *Transcription activation by catabolite activator protein (CAP)*. J Mol Biol, 1999. **293**(2): p. 199-213.
8. Chai, T.J. and J. Foulds, *Purification of protein A, an outer membrane component missing in Escherichia coli K-12 ompA mutants*. Biochim Biophys Acta, 1977. **493**(1): p. 210-5.
9. Datta, D.B., B. Arden, and U. Henning, *Major proteins of the Escherichia coli outer cell envelope membrane as bacteriophage receptors*. J Bacteriol, 1977. **131**(3): p. 821-9.
10. Douchin, V., C. Bohn, and P. Bouloc, *Down-regulation of porins by a small RNA bypasses the essentiality of the regulated intramembrane proteolysis protease RseP in Escherichia coli*. J Biol Chem, 2006. **281**(18): p. 12253-9.
11. Franze de Fernandez, M.T., L. Eoyang, and J.T. August, *Factor fraction required for the synthesis of bacteriophage Qbeta-RNA*. Nature, 1968. **219**(5154): p. 588-90.
12. Geissmann, T.A. and D. Touati, *Hfq, a new chaperoning role: binding to messenger RNA determines access for small RNA regulator*. EMBO J, 2004. **23**(2): p. 396-405.
13. Gibert, I. and J. Barbe, *Cyclic AMP stimulates transcription of the structural gene of the outer-membrane protein OmpA of Escherichia coli*. FEMS

- Microbiol Lett, 1990. **56**(3): p. 307-11.
14. Gottesman, S., *The small RNA regulators of Escherichia coli: roles and mechanisms\**. Annu Rev Microbiol, 2004. **58**: p. 303-28.
  15. Hong, H., G. Szabo, and L.K. Tamm, *Electrostatic couplings in OmpA ion-channel gating suggest a mechanism for pore opening*. Nat Chem Biol, 2006. **2**(11): p. 627-35.
  16. Ishizuka, H., et al., *Mechanism of the down-regulation of cAMP receptor protein by glucose in Escherichia coli: role of autoregulation of the crp gene*. EMBO J, 1994. **13**(13): p. 3077-82.
  17. Iwamoto, A., S. Lemire, and T. Yonesaki, *Post-transcriptional control of Crp-cAMP by RNase LS in Escherichia coli*. Mol Microbiol, 2008. **70**(6): p. 1570-8.
  18. Johansen, J., et al., *Down-regulation of outer membrane proteins by noncoding RNAs: unraveling the cAMP-CRP- and sigmaE-dependent CyaR-ompX regulatory case*. J Mol Biol, 2008. **383**(1): p. 1-9.
  19. Kallipolitis, B.H., M. Norregaard-Madsen, and P. Valentin-Hansen, *Protein-protein communication: structural model of the repression complex formed by CytR and the global regulator CRP*. Cell, 1997. **89**(7): p. 1101-9.
  20. Koebnik, R., K.P. Locher, and P. Van Gelder, *Structure and function of bacterial outer membrane proteins: barrels in a nutshell*. Mol Microbiol, 2000. **37**(2): p. 239-53.
  21. Lawson, C.L., et al., *Catabolite activator protein: DNA binding and transcription activation*. Curr Opin Struct Biol, 2004. **14**(1): p. 10-20.
  22. Lease, R.A., M.E. Cusick, and M. Belfort, *Riboregulation in Escherichia coli: DsrA RNA acts by RNA:RNA interactions at multiple loci*. Proc Natl Acad Sci U S A, 1998. **95**(21): p. 12456-61.
  23. Lease, R.A., et al., *The small noncoding DsrA RNA is an acid resistance regulator in Escherichia coli*. J Bacteriol, 2004. **186**(18): p. 6179-85.
  24. Lease, R.A. and S.A. Woodson, *Cycling of the Sm-like protein Hfq on the DsrA small regulatory RNA*. J Mol Biol, 2004. **344**(5): p. 1211-23.
  25. Majdalani, N., et al., *DsrA RNA regulates translation of RpoS message by an anti-antisense mechanism, independent of its action as an antisilencer of transcription*. Proc Natl Acad Sci U S A, 1998. **95**(21): p. 12462-7.
  26. Masse, E. and S. Gottesman, *A small RNA regulates the expression of genes involved in iron metabolism in Escherichia coli*. Proc Natl Acad Sci U S A, 2002. **99**(7): p. 4620-5.
  27. Masse, E., N. Majdalani, and S. Gottesman, *Regulatory roles for small RNAs in bacteria*. Curr Opin Microbiol, 2003. **6**(2): p. 120-4.

28. Masse, E., C.K. Vanderpool, and S. Gottesman, *Effect of RyhB small RNA on global iron use in Escherichia coli*. J Bacteriol, 2005. **187**(20): p. 6962-71.
29. Moll, I., et al., *RNA chaperone activity of the Sm-like Hfq protein*. EMBO Rep, 2003. **4**(3): p. 284-9.
30. Moller, T., et al., *Hfq: a bacterial Sm-like protein that mediates RNA-RNA interaction*. Mol Cell, 2002. **9**(1): p. 23-30.
31. Moller, T., et al., *Spot 42 RNA mediates discoordinate expression of the E. coli galactose operon*. Genes Dev, 2002. **16**(13): p. 1696-706.
32. Nilsson, G., et al., *Growth-rate dependent regulation of mRNA stability in Escherichia coli*. Nature, 1984. **312**(5989): p. 75-7.
33. Pulvermacher, S.C., L.T. Stauffer, and G.V. Stauffer, *The role of the small regulatory RNA GcvB in GcvB/mRNA posttranscriptional regulation of oppA and dppA in Escherichia coli*. FEMS Microbiol Lett, 2008. **281**(1): p. 42-50.
34. Pulvermacher, S.C., L.T. Stauffer, and G.V. Stauffer, *Role of the sRNA GcvB in regulation of cycA in Escherichia coli*. Microbiology, 2009. **155**(Pt 1): p. 106-14.
35. Pulvermacher, S.C., L.T. Stauffer, and G.V. Stauffer, *The small RNA GcvB regulates sstT mRNA expression in Escherichia coli*. J Bacteriol, 2009. **191**(1): p. 238-48.
36. Rasmussen, A.A., et al., *Regulation of ompA mRNA stability: the role of a small regulatory RNA in growth phase-dependent control*. Mol Microbiol, 2005. **58**(5): p. 1421-9.
37. Reddy, V.M., P. Galland, and E.D. Lipson, *A new allele with abnormal cyclic-AMP phosphodiesterase activity in Phycomyces*. Mol Gen Genet, 1985. **201**(1): p. 124-5.
38. Sauter, C., J. Basquin, and D. Suck, *Sm-like proteins in Eubacteria: the crystal structure of the Hfq protein from Escherichia coli*. Nucleic Acids Res, 2003. **31**(14): p. 4091-8.
39. Sharma, C.M., et al., *A small RNA regulates multiple ABC transporter mRNAs by targeting C/A-rich elements inside and upstream of ribosome-binding sites*. Genes Dev, 2007. **21**(21): p. 2804-17.
40. Sledjeski, D. and S. Gottesman, *A small RNA acts as an antisilencer of the H-NS-silenced rcsA gene of Escherichia coli*. Proc Natl Acad Sci U S A, 1995. **92**(6): p. 2003-7.
41. Sledjeski, D.D., A. Gupta, and S. Gottesman, *The small RNA, DsrA, is essential for the low temperature expression of RpoS during exponential growth in Escherichia coli*. EMBO J, 1996. **15**(15): p. 3993-4000.
42. Smith, S.G., et al., *A molecular Swiss army knife: OmpA structure, function and*

- expression. FEMS Microbiol Lett, 2007. **273**(1): p. 1-11.
43. Storz, G., J.A. Opdyke, and A. Zhang, *Controlling mRNA stability and translation with small, noncoding RNAs*. Curr Opin Microbiol, 2004. **7**(2): p. 140-4.
  44. Sugawara, E. and H. Nikaido, *OmpA protein of Escherichia coli outer membrane occurs in open and closed channel forms*. J Biol Chem, 1994. **269**(27): p. 17981-7.
  45. Udekwu, K.I., et al., *Hfq-dependent regulation of OmpA synthesis is mediated by an antisense RNA*. Genes Dev, 2005. **19**(19): p. 2355-66.
  46. Ueno, H. and T. Yonesaki, *Phage-induced change in the stability of mRNAs*. Virology, 2004. **329**(1): p. 134-41.
  47. Urban, J.H. and J. Vogel, *Translational control and target recognition by Escherichia coli small RNAs in vivo*. Nucleic Acids Res, 2007. **35**(3): p. 1018-37.
  48. Vogel, J., et al., *RNomics in Escherichia coli detects new sRNA species and indicates parallel transcriptional output in bacteria*. Nucleic Acids Res, 2003. **31**(22): p. 6435-43.
  49. Vytvytska, O., et al., *Host factor I, Hfq, binds to Escherichia coli ompA mRNA in a growth rate-dependent fashion and regulates its stability*. Proc Natl Acad Sci U S A, 1998. **95**(24): p. 14118-23.
  50. Vytvytska, O., et al., *Hfq (HF1) stimulates ompA mRNA decay by interfering with ribosome binding*. Genes Dev, 2000. **14**(9): p. 1109-18.
  51. Wang, Y., *The function of OmpA in Escherichia coli*. Biochem Biophys Res Commun, 2002. **292**(2): p. 396-401.
  52. Wassarman, K.M., et al., *Identification of novel small RNAs using comparative genomics and microarrays*. Genes Dev, 2001. **15**(13): p. 1637-51.
  53. Williams, A.E., *Functional aspects of animal microRNAs*. Cell Mol Life Sci, 2008. **65**(4): p. 545-62.
  54. Yohannes, E., D.M. Barnhart, and J.L. Slonczewski, *pH-dependent catabolic protein expression during anaerobic growth of Escherichia coli K-12*. J Bacteriol, 2004. **186**(1): p. 192-9.
  55. Zakharian, E. and R.N. Reusch, *Kinetics of folding of Escherichia coli OmpA from narrow to large pore conformation in a planar bilayer*. Biochemistry, 2005. **44**(17): p. 6701-7.
  56. Zhang, A., et al., *Global analysis of small RNA and mRNA targets of Hfq*. Mol Microbiol, 2003. **50**(4): p. 1111-24.
  57. Zheng, D., et al., *Identification of the CRP regulon using in vitro and in vivo transcriptional profiling*. Nucleic Acids Res, 2004. **32**(19): p. 5874-93.
  58. Baba, T., et al., *Construction of Escherichia coli K-12 in-frame, single-gene*

- knockout mutants: the Keio collection*. Mol Syst Biol, 2006. **2**: p. 2006 0008.
59. Repoila, F. and S. Gottesman, *Signal transduction cascade for regulation of RpoS: temperature regulation of DsrA*. J Bacteriol, 2001. **183**(13): p. 4012-23.
  60. Brennan, R.G. and T.M. Link, *Hfq structure, function and ligand binding*. Curr Opin Microbiol, 2007. **10**(2): p. 125-33.
  61. Aiba, H., *Mechanism of RNA silencing by Hfq-binding small RNAs*. Curr Opin Microbiol, 2007. **10**(2): p. 134-9.
  62. Tsui, H.C., G. Feng, and M.E. Winkler, *Transcription of the mutL repair, miaA tRNA modification, hfq pleiotropic regulator, and hflA region protease genes of Escherichia coli K-12 from clustered Esigma32-specific promoters during heat shock*. J Bacteriol, 1996. **178**(19): p. 5719-31.
  63. Hajnsdorf, E. and P. Regnier, *Host factor Hfq of Escherichia coli stimulates elongation of poly(A) tails by poly(A) polymerase I*. Proc Natl Acad Sci U S A, 2000. **97**(4): p. 1501-5.
  64. Mohanty, B.K., V.F. Maples, and S.R. Kushner, *The Sm-like protein Hfq regulates polyadenylation dependent mRNA decay in Escherichia coli*. Mol Microbiol, 2004. **54**(4): p. 905-20.
  65. Vecerek, B., I. Moll, and U. Blasi, *Translational autocontrol of the Escherichia coli hfq RNA chaperone gene*. RNA, 2005. **11**(6): p. 976-84.
  66. Gorke, B. and J. Vogel, *Noncoding RNA control of the making and breaking of sugars*. Genes Dev, 2008. **22**(21): p. 2914-25.
  67. Takahashi, Y., *Effect of glucose and cyclic adenosine 3',5'-monophosphate on the synthesis of succinate dehydrogenase and isocitrate lyase in Escherichia coli*. J Biochem, 1975. **78**(5): p. 1097-100.

## 九、附錄

附表一、本實驗所使用到的 primer 與 probe 序列

ompA DIG-probe	T <sub>m</sub> (°C)
F- TTGGATTTAGTGTCTGCACG	59
R- ATGAAAAAGACAGCTATCGC	59
Kanamycin	
KT(F)- CGGCCACAGTCGATGAATCC	59
K2(R)- GGACAGGTCGGTCTTGACAA	59
pKD13 P1 and P2	
P1(F)- ATTCCGGGGATCCGTCGACC	59
P2(R)- TGTAGGCTGGAGCTGCTTCG	59
sRNA knockout H1 and H2	
rseX(F)- GCTTTATTAATTCATTTAATCAATATATTAGCACTGATTACAATTATACC	
rseX(R)- ATTGTTGCGCCAAACGGCTGGTGTGATCAGGCGCACATTAATGAAGGCAT	
dsrA(R)- TATTCATGACTTCAGCGTCTCTGAAGTGAATCGTTGAATGCACAATAAAA	
dsrA(F)- ATATGGCGAATATTTTCTTGTCAGCGAAAAAATTGCGGATAAGGTGATG	
gcvB(F)- ATTATAAATTGTCCGTTGAGCTTCTACCAGCAAATACCTATAGTGGCGGC	
gcvB(R)- TGACGTGAAAGAGATGGTCGAACTGGATCAGTAATTCGCGATCGCAAGGT	
sRNA knockout check	
rseX(F)- ATATCAATATGTTATGAGTTGAGCG	59
dsrA(R)- CCTTCGAACTGGATATTCATGAC	59
gcvB(R)- ATTATAAATTGTCCGTTGAGCTTCT	59

Northern blot dsrA DIG-probe

---

DIG- TCCCAGCCCTGAGGGGGTCGGGATGAAACTTGC

---

hfq DIG-probe

---

F- GGAACGTGTTCCAGTTTCTATTTAT 59

R- ACCATGATGGTAGTTACTGCTGG 59

---

Q-PCR primer

---

dsrA(F)- ACATCAGATTTCTGGTGTAACG 60

dsrA(R)- AAATCCCGACCCTGAGGG 60

gcvB(F)- GCCGGAACGAAAAGTTTTATCGGAA 60

gcvB(R)- CACAACCGTAAGCCAAAAGTTCACCAG 60

ryhA(F)- GTGCGGCCTGAAAAACAGT 60

ryhA(R)- GCCAACACCAGGGAAATCTT 60

hfq(F)- CAAGCACGCGATTTCTACTGTT 60

hfq(R)- CACCGCGTTGTTACTGTGA 60

16S(F)- CGTGTGTGAAATGTTGGGTAA 60

16S(R)- ACCGCTGGCAACAAAAGATAA 60

---

