



Impact and Regulatory Control of the CGP3 Prophage in *Corynebacterium glutamicum*

Eugen Pfeifer

Schlüsseltechnologien / Key Technologies

Band / Volume 164

ISBN 978-3-95806-301-3

Forschungszentrum Jülich GmbH
Institut für Bio- und Geowissenschaften
Biotechnologie (IBG-1)

Impact and Regulatory Control of the CGP3 Prophage in *Corynebacterium glutamicum*

Eugen Pfeifer

Schriften des Forschungszentrums Jülich
Reihe Schlüsseltechnologien / Key Technologies

Band / Volume 164

ISSN 1866-1807

ISBN 978-3-95806-301-3

Contents

| | |
|--|-----|
| 1. Summary | 1 |
| 1.1 English summary..... | 1 |
| 1.2 German summary | 2 |
| 2. Introduction..... | 3 |
| 2.1 Impact of foreign DNA on bacteria..... | 3 |
| 2.2 Defective virus-like elements may harbor beneficial traits | 3 |
| 2.3 Activation of prophages, the lysogenic-lytic switch | 4 |
| 2.4 SOS-independent prophage induction..... | 6 |
| 2.5 Spontaneous prophage induction (SPI)..... | 8 |
| 2.6 Defense systems against exogenous DNA..... | 9 |
| 2.7 An outstanding group within nucleoid-associated proteins: xenogeneic silencer | 10 |
| 2.8 Xenogeneic silencing facilitates mutual adaptation..... | 11 |
| 2.9 State of the art: CGP3 prophage in <i>Corynebacterium glutamicum</i> | 12 |
| 2.10 Aims of this work | 13 |
| 3. Results | 15 |
| 3.1 Live cell imaging of SOS and prophage dynamics in isogenic bacterial populations... .. | 17 |
| 3.2 Silencing of cryptic prophages in <i>Corynebacterium glutamicum</i> | 35 |
| 3.3 Adaptive laboratory evolution of <i>Corynebacterium glutamicum</i> towards higher growth rates on glucose minimal medium..... | 55 |
| 4. Discussion..... | 71 |
| 4.1 Prophages in bacterial genomes | 71 |
| 4.2 SOS-dependent and independent SPI | 72 |
| 4.3 Virus-like elements are silenced by small NAPs | 75 |
| 4.4 How does the molecular mechanism of CGP3 induction work? | 77 |
| 4.5 Maintenance and impact of CGP3 on <i>C. glutamicum</i> populations | 80 |
| 4.6 XS-derived interactions in regulatory circuits of bacteria and virus-like elements | 83 |
| 4.7 A step into the unknown – CgpS orthologues on phage genomes..... | 85 |
| 5. References..... | 91 |
| 6. Appendix | 101 |
| 6.1 A prophage-encoded actin-like protein required for efficient viral DNA replication in bacteria..... | 101 |
| 6.2 Results of phenotypic micro array experiment..... | 119 |

| | |
|--|-----|
| 6.3 Supplemental material to: Live cell imaging of SOS and prophage dynamics in isogenic bacterial populations | 133 |
| 6.4 Supplemental material to: Silencing of cryptic prophages in <i>Corynebacterium glutamicum</i> | 147 |
| 6.5 Supplemental material to: Adaptive laboratory evolution of <i>Corynebacterium glutamicum</i> towards higher growth rates on glucose minimal medium. | 167 |
| 6.6 Supplemental material to: A prophage-encoded actin-like protein required for efficient viral DNA replication in bacteria | 185 |

Schlüsseltechnologien / Key Technologies
Band / Volume 164
ISBN 978-3-95806-301-3