ABSTRACT

Upon growth arrest of the bacterium *Escherichia coli*, RNA polymerase ($E\sigma^{70}$) is redirected from transcribing genes encoding the protein synthesizing system (PSS) to those involved in maintenance and stress resistance. The small nucleotide ppGpp, which is directly targeting $E\sigma^{70}$, is a key regulatory molecule required for this response. In addition, the protein DksA has been hypothesized to be required for the regulatory function of ppGpp. Cells defective in the synthesis of either ppGpp or DksA do not undergo a shift in gene expression upon growth arrest and are deficient in maintenance-related activities. The underlying mechanism of how regulation of gene expression is exerted by ppGpp and DksA is the main focus of this thesis.

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On top of a direct role of ppGpp in regulating gene expression, ppGpp can potentially affect gene regulation passively by modulating the levels of free $E\sigma^{70}$ in the cell. Using a mini-cell approach, I demonstrate an inverse correlation between the levels of ppGpp and free $E\sigma^{70}$. Thus, I hypothesize that ppGpp contribute to the redistribution of $E\sigma^{70}$ at promoters during growth arrest also by decreasing free $E\sigma^{70}$ levels, which would negatively affect promoters requiring high levels of $E\sigma^{70}$ for efficient transcription, such as those of the PSS.

ISBN 978-91-628-8280-8 http://hdl.handle.net/2077/24934

The Importance of a Fifth Element in Transcription
Transcriptional Discrimination in *Escherichia coli*

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AKADEMISK AVHANDLING

För filosofie doktorsexamen i mikrobiologi (examinator Thomas Nyström), som enligt fakultetsstyrelsens beslut kommer att offentligt försvaras fredagen den 29 april 2011, kl. 10.00 i föreläsningssalen Arvid Carlsson, Medicinaregatan 3, Göteborg

Fakultetsopponent: Associate Professor Carlos Balsalobre, University of Barcelona, Spain

Papers included in this thesis;

I. **Identical, Independent, and Opposing Roles of ppGpp and DksA in *Escherichia coli*.**
Magnusson, L. U. [1)], B. Gummesson [1)], P. Joksimović, A. Farewell and T. Nyström
J. Bacteriol. (2007) **189**(14): 5193-5202.
[1)] contributed equally

II. **Increased RNA polymerase availability directs resources towards growth at the expense of maintenance.**
Gummesson, B. [1)], L. U. Magnusson [1)], M. Lovmar, K. Kvint, Ö. Persson, M. Ballesteros, A. Farewell and T. Nyström
EMBO J (2009) **28**(15): 2209-2219.
[1)] contributed equally

III. **-Text removed from public version-**
Gummesson, B., M. Lovmar and T. Nyström
Manuscript (2011)

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