Concept contents chapters thesis Martijn Wehrens

Title thesis: How single bacterial cells handle genome-wide fluctuations, and how single filamentous bacteria handle division.

1. Very brief introduction outlining the research and its relevance. (1 page)
2. Review: The relevance of gene noise in single cell growth rate and metabolism

*Chapter will be submitted to* ***Current opinion in systems biology****.*

* 1. Consequences of noisy gene expression for growth.
  2. Different methods for single cell time lapse.
  3. Using cross-correlations and modeling to understand noise transmission between gene expression and growth.
  4. Single cell regulation to deal with cell-wide effects of noisiness.
  5. Outlook.

1. Short methods chapter applying to chapter 4 and 5.

[Method(s) chapter(s) were also already written by Daan Kiviet, Noreen Walker, Sebastian Gude, Sarah Boulineau – a bigger version of this chapter would be nice, but here I'll just outline techniques that were not previously described.]

* 1. Mother machine.
  2. Updates to schnitzcells code: skeleton length, straightening of bacteria, GUI.
  3. Brief reflection on fluorophore measurements.
  4. Controls of the cross-correlations.

1. The interaction between metabolism-wide regulation by CRP-cAMP and gene expression noise.

*[Story not clear yet.]*

* 1. Introduction: Global regulatory systems can enforce optimality; not yet known how this translates to dynamical behavior.
  2. Method: We can remove the feedback regulation from CRP-cAMP to probe its dynamic role.
  3. Understanding dynamic gene expression in steady state versus gene expression responding to environmental changes.

*[Note: the current results are not understood sufficiently yet to make this case.]*

* 1. Transmission of noise through metabolic enzyme expression increases w/o feedback.

*[Note: the current results are not understood sufficiently yet to make this case.]*

* 1. Conclusion: Regulatory interactions shape the distribution of cellular growth phenotypes in steady state.

1. Some ribosomal parts are more equal than others; differential effects of noisy ribosomal RNA and protein expression on global gene expression and growth.

*[Large datasets need to be analyzed still; conclusions not yet clear.]*

* 1. Introduction: the 58 different parts of the ribosome, ribosomes suggested role in extrinsic noise, different environmental conditions, [interpreting cross-correlations relating to ribosomes?].
  2. (Absence of) direct correlations between ribosomal and gene expression; and the effect of ribosomes on growth.
  3. A more insightful picture using cross-correlations between ribosomal and gene expression and growth.
  4. Transmission of ribosomal gene expression fluctuations to gene expression and growth.

1. Size and division laws in filamentous Escherichia coli cells.

*Currently in revision process at* ***Current Biology****.*

1. Summary EN
2. Summary NL (samenvatting)
3. Acknowledgements