SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Microbiology (MICR)

has the honor to invite you to the public defense of the PhD thesis of

Indra BERVOETS

to obtain the degree of Doctor of Bioengineering Sciences

Title of the PhD thesis:

A sigma factor toolbox for orthogonal expression in Escherichia coli

Promotors:

Prof. Dr. ir. Eveline Peeters
Prof. Dr. Daniel Charlier

The defense will take place on

Friday April 6 2018 at 17:00h

in Auditorium D.2.01 at the campus Humanities, Sciences and Engineering of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, and will be followed by a reception.

Members of the jury:

Prof. Dr. ir. Remy Loris (chairman)
Prof. Dr. Henri De Greve (secretary)
Prof. Dr. Luc Leyns
Prof. Dr. Oscar Kuipers (Univ. Groningen, Nl.)
Prof. Dr. ir. Marjan De Mey (UGent)

Curriculum vitae

Indra Bervoets obtained her Master in Bioengineering Sciences at the VUB. After two years in industry, she started her PhD in the Research Group of Microbiology of the VUB in collaboration with the Centre for Synthetic Biology of Ghent University. Her research resulted in two first author publications in peer reviewed journals and she presented her work at national and international conferences, both as oral and poster presentations. She has supervised four master theses, participated in several practicals and workshops, and was involved in different research topics.

Abstract of the PhD research

In the context of 'white biotechnology' and the utilization of renewable resources, scientists are developing bio-based methods to produce products that are currently chemically produced. A key component for microbial-based synthesis is the host strain that needs to produce the desired compounds with high yield. In our work we use *Escherichia coli,* which remains an interesting host because of its rapid growth, the extended knowledge of its physiology and the availability of genetic tools. Heterologous gene expression in the host strain must be optimized and synthetic biology aids at engineering living cells for many applications through the design and construction of biological pathways in the cell.

In general the design of genetic circuits can be described analogous to the design of electrical circuits, but despite the analogy biological parts are not as simple as the established parts used in electrical engineering. Biological parts often cause unexpected interferences with the host and/or between different parts of the genetic circuit. Therefore, research is undertaken to create biological parts that behave orthogonal towards the host strain and towards other parts in the same circuit. Similar to electrical circuits, standardized parts can then be exchanged or applied in parallel and used in a modular fashion.

The major goal of this work is to create multiple orthogonal gene expression systems in *E. coli* that can be used in parallel in the cell. As the different parts should be modular and exchangeable, they will constitute a 'new' synthetic biology toolbox that can be used and integrated with other existing genetic systems. In this work, we choose to work with sigma factor proteins and as a result will interfere with transcription initiation, the very first step in the flow of genetic information. This is energetically favorable for the host as the synthesis of mRNA and its translation into unnecessary proteins is avoided.

All the different characterized parts described in this work, sigma factors, anti-sigma factors, promoters and promoter libraries, will constitute the SIGMA FACTOR toolbox.