



Technische Universität  
München



Wissenschaftszentrum  
Weihenstephan (WZV)

Department für Grundlagen  
der Biowissenschaften

Lehrstuhl für  
Mikrobielle Ökologie

**Prof. Dr. Siegfried Scherer**

Fon: (0)8161-713516  
Fax: (0)8161-714512  
siegfried.scherer@wzw.tum.de  
<http://www.wzw.tum.de/micbio>

Prof. Dr. Siegfried Scherer · WZV · Technische Universität München  
Weihenstephaner Berg 3 · D-85350 Freising · GERMANY

## Molekulare Bakteriengenetik

### Inhaltsübersicht

## I. Vorlesungsteil: Bacterial genomics and genetic engineering

*(PD. Dr. Klaus Neuhaus)*

### 1 Bacterial genomics

- 1.1 Genome structure
- 1.2 Comparative genomics
- 1.3 Genome size and habitat
- 1.4 Metagenomics

### 2 Plasmids

- 2.1 General remarks
- 2.2 Replication
- 2.3 Konjugation
- 2.4 Transformation

### 3 Bacteriophage

- 3.1 Taxonomy
- 3.2 Life cycle
- 3.3 Regulation Lysis/Lysogenie
- 3.4 Applications

### 4 Transposons

- 4.1 Nomenclature
- 4.2 Transposition
- 4.3 Applications

### 5 Hosts

- 5.1 Expression systems
- 5.2  $\alpha$ -complementation
- 5.3 Gene libraries
- 5.4 Recombination

### 6 Mutagenesis strategies

- 6.1 Site-specific mutagenesis
- 6.2 Allele exchange
- 6.3 Deletions
- 6.4 Insertional mutagenesis

## II. Vorlesungsteil: Bacterial gene expression (Prof. Dr. S. Scherer)

### 1 Biological information in the prokaryotic cell

- 1.1 The bacterial cell is an information processing system
- 1.2 Levels of biological information in a bacterial cell
- 1.3 What is a gene?

### 2 Transcription in bacteria: Basics

- 2.1 The bacterial operon structure
- 2.2 RNA polymerase and transcription
- 2.3 Experiments on mRNA (Northern blots, RT-PCR, RNAseq)
- 2.4 Promoter structure and promoter characterization
- 2.5 Transcription of non - coding DNA: ncRNA species

### 3 Gene expression I: Control by transcription factors

- 3.1 Overview: Negative and positive gene regulation
- 3.2 Negative regulation of the *lac* operon
- 3.3 Experimental analysis of the *lac* operon
- 3.4 Repressor – operator interaction
- 3.5 Positive regulation of the *lac* Operon
- 3.6 Regulation of an anabolic operon
- 3.7 Transcription factor binding
- 3.8 Regulation of transcription by DNA topology
- 3.9 Bistability of gene expression

### 4 Gene expression II: Control of by RNA structure

- 4.1 Transcriptional level: Termination and anti-termination
- 4.2 Attenuation of transcription: The *trp* operon
- 4.3 Translational level: SD sequence, codon usage, RNA thermometers  
antisense RNA
- 4.4 Metabolite binding to mRNA: „Riboswitches“
- 4.5 Observing translation: RIBOseq (polysome profiling)
- 4.6 Regulation of gene expression by RNA stability

### 5 Gene expression III: Global gene regulation

- 5.1 Global regulatory hierarchies
- 5.2 Catabolite repression
- 5.3 Global regulation by sigma-factors
- 5.4 The alarmone ppGpp regulates the stringent response of translation

### 6 Communication and gene expression

- 6.1 Two component systems
- 6.2 Quorum sensing and gene regulation
- 6.3 Communication channels between bacteria
- 6.4 Inter-kingdom signalling