Ökophysiology und Genetik von Mikroorganismen /1

5. März 2010

THEMEN:
Grundlagen der
Genexpression in drei Domänen
Regulation von Enzymaktivitäten
Globale Regulation
Signaltransduktion
Attenuation, Antisense-RNA, Riboswitches

Reaktionen auf Mangel:
Katabolismus/Anabolismus
Global Kontrolle
Stringent response

Reaktionen auf Umweltänderungen:
-Nährstoffe
-Hitze
-Kälte
-UV-Licht, gamma-Strahlung
-Austrocknung

Molekulare Adaptationen von Extremisten:
Thermophile, hyperthermophile
Psychrophile
Barophile
Acidophile
Halophile

-**Zell-Zell-Kommunikation und Biofilme**
-**Multizelluläre Mikroorganismen**
-**Wachstumskontrolle, Antibiotika**
-**Kannibalismus, Fraternizismus**

Transkription und allgemeine Regulationsprinzipien

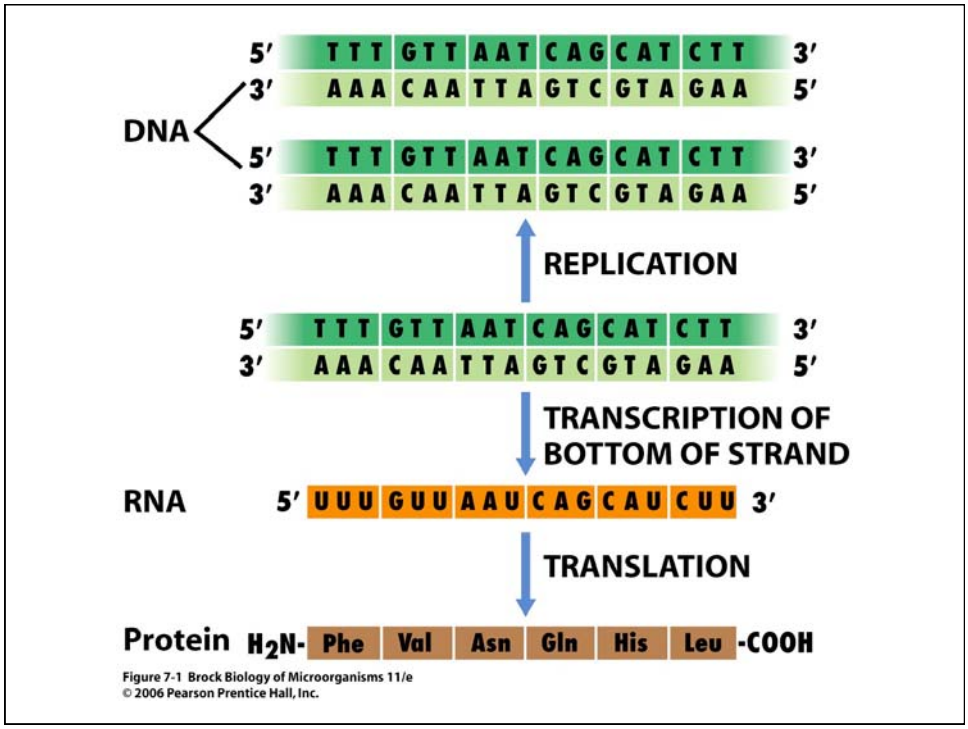
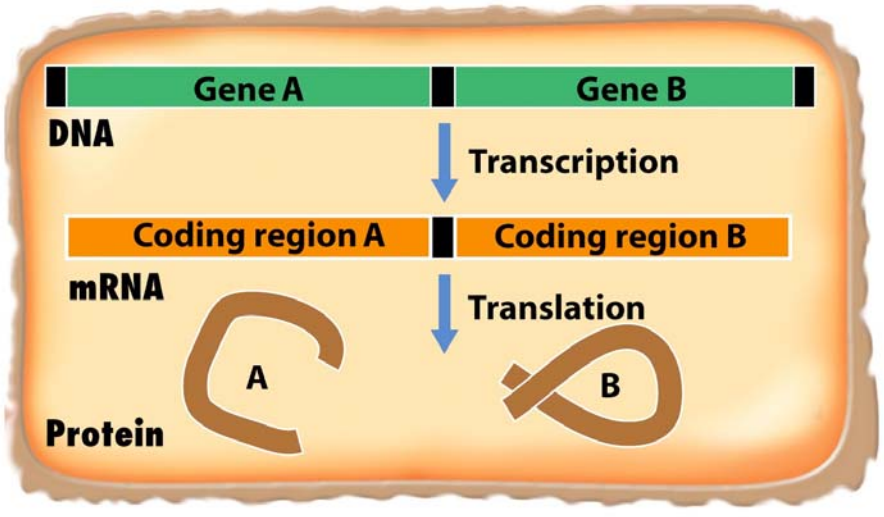


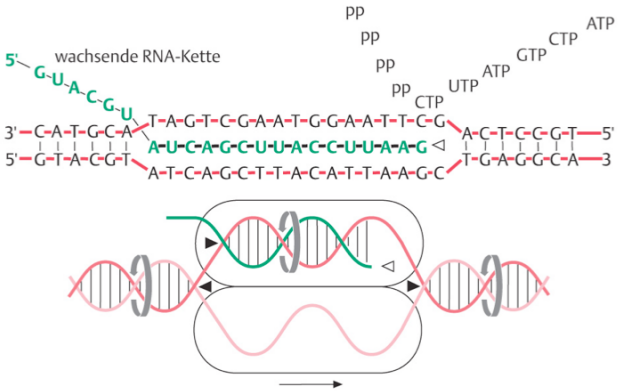
Figure 7-1 Brock Biology of Microorganisms 11/e

Genexpression in „Prokaryoten“

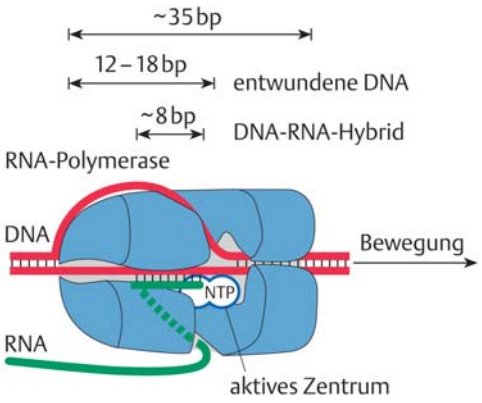


Prokaryote
Figure 7-2a Brock Biology of Microorganisms 11/e

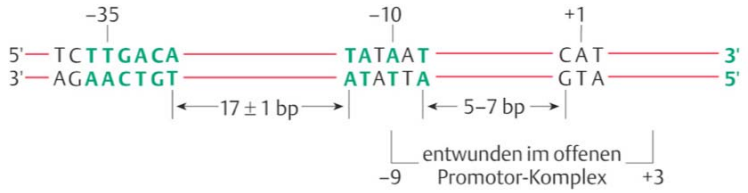
RNA Synthese im Schema

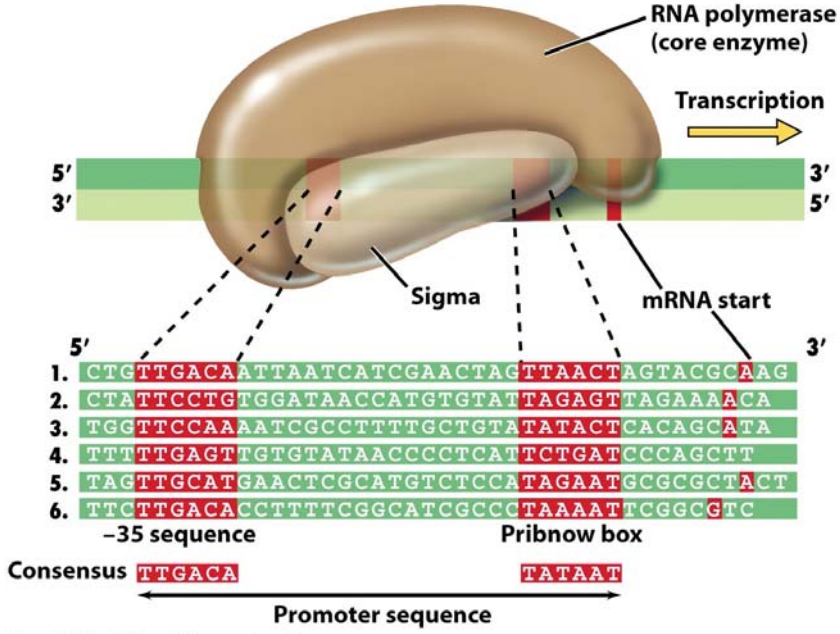


Stabile Bindung des Dreierkomplexes (DNA, RNA, Protein)
Bei gleichzeitiger Fortbewegung der RNA-Polymerase



Musterpromoter des E.coli Genoms





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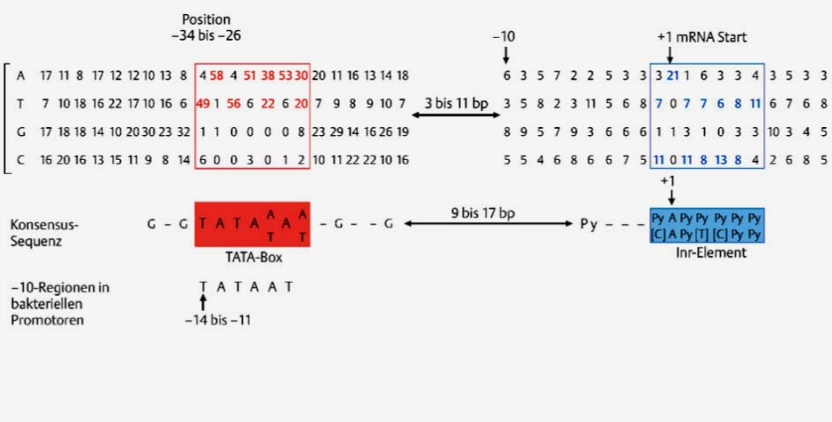
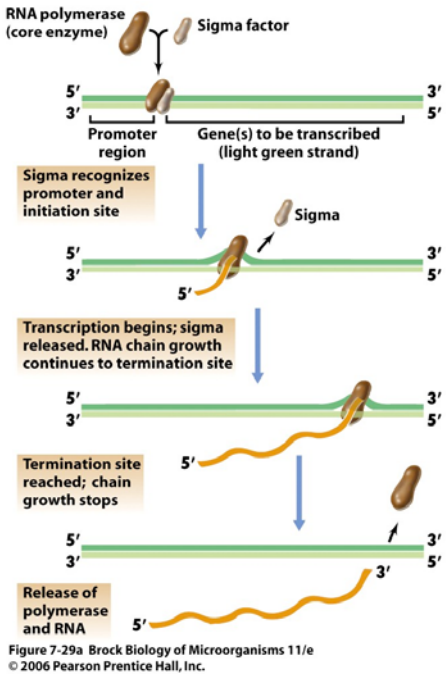
Frequency of nucleotides in mapped promoters



Initiation der Transkription bei Bakterien



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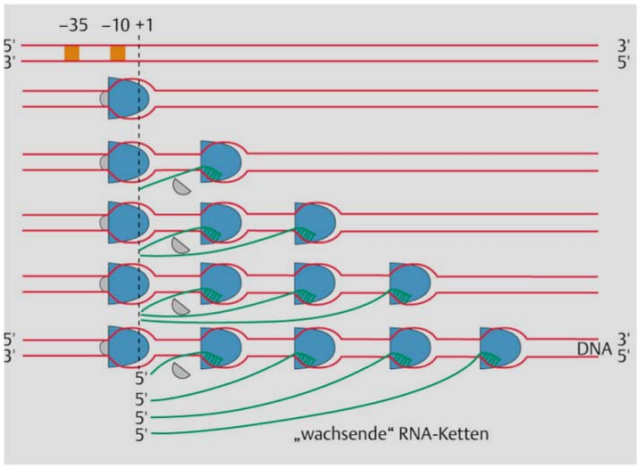
Fortschreiten der Transkription



Transkripte im Elektronenmikroskop sichtbar gemacht:

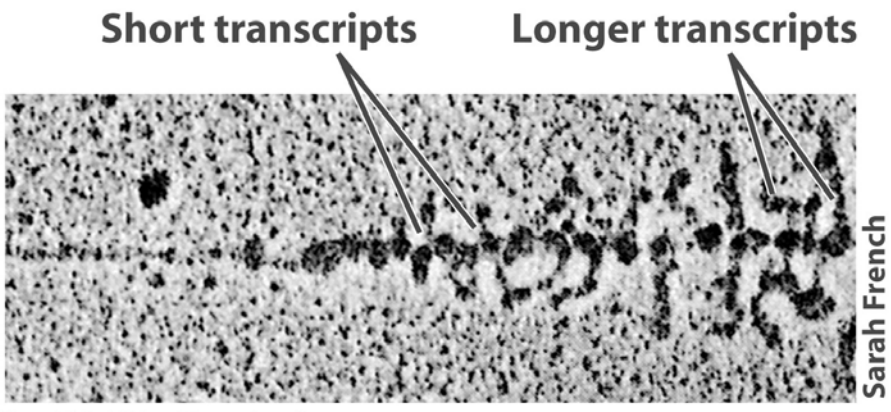


Figure 7-29b Brock Biology of Microorganisms 11/e
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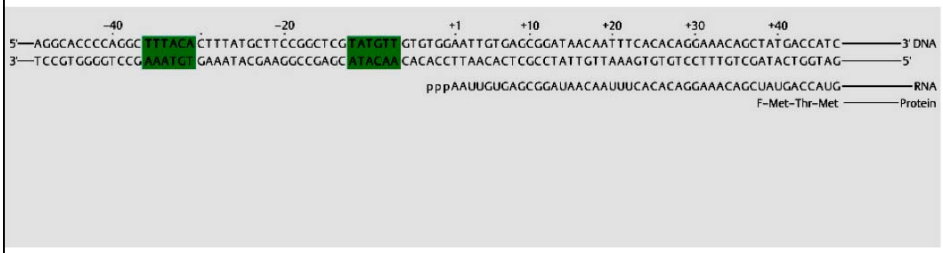
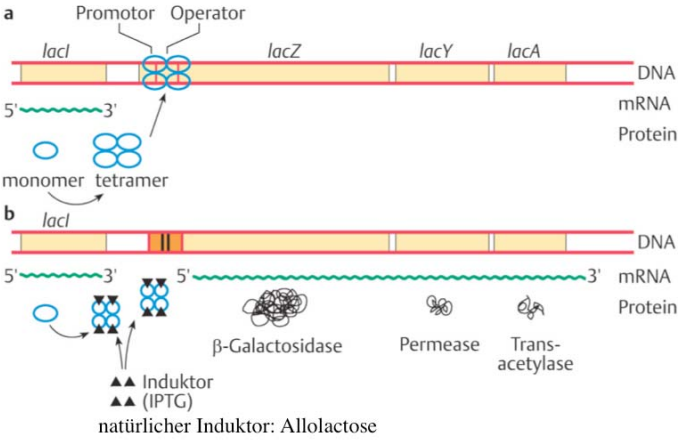
Der lac Promoter



Regulation:
Das lac Operon

Der lac - Repressor

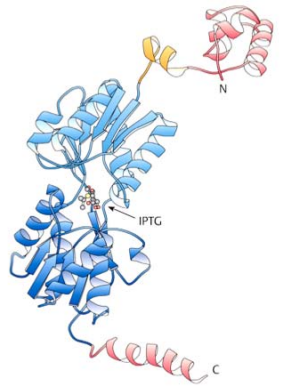
Repression



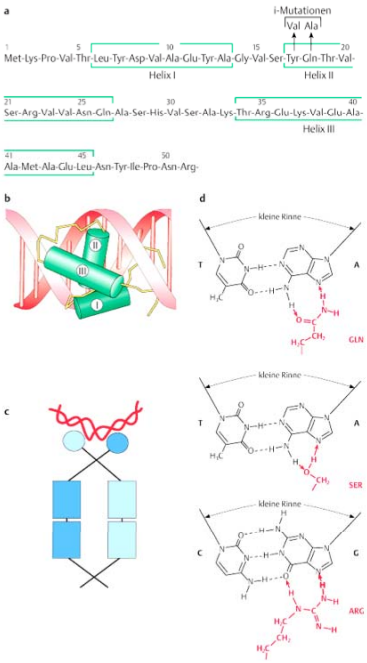
natürlicher Induktor: Allolactose

Expression

Der lac Repressor

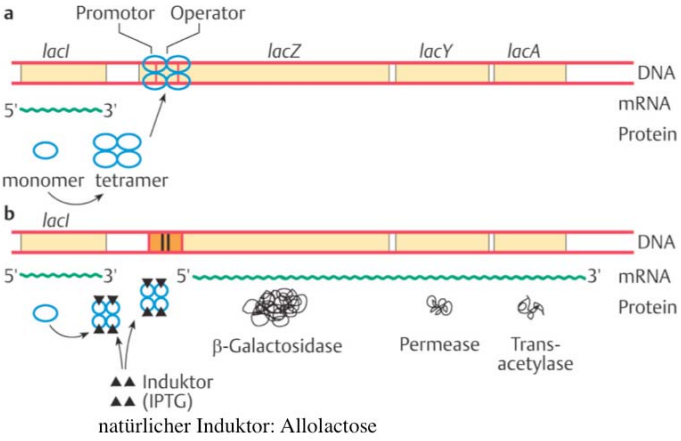


Helix-Turn-Helix Motiv



Der lac - Repressor

Repression

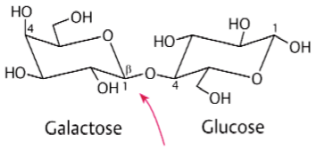


natürlicher Induktor: Allolactose

Expression

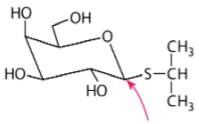
Lactose und das Analogon IPTG

Lactose



β-galactosidische Bindung; wird durch das Enzym β-Galactosidase gespalten

Isopropyl-thiogalactosid



Diese Bindung kann nicht durch *E. coli*-Enzyme gespalten werden

Positive Control of Transcription

Maltose Catabolism in *Escherichia coli*

Kein kanonischer Promoter!

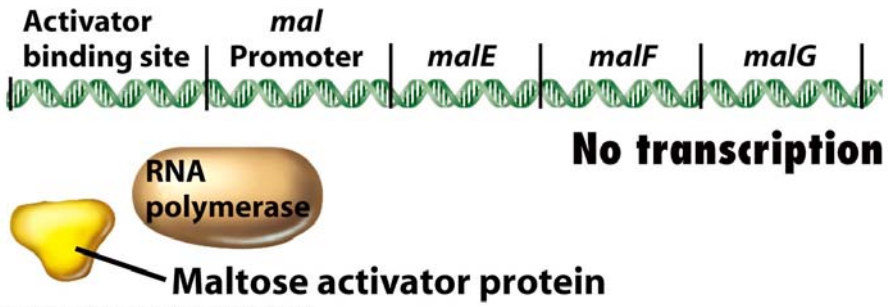


Figure 8-15a Brock Biology of Microorganisms 11/e
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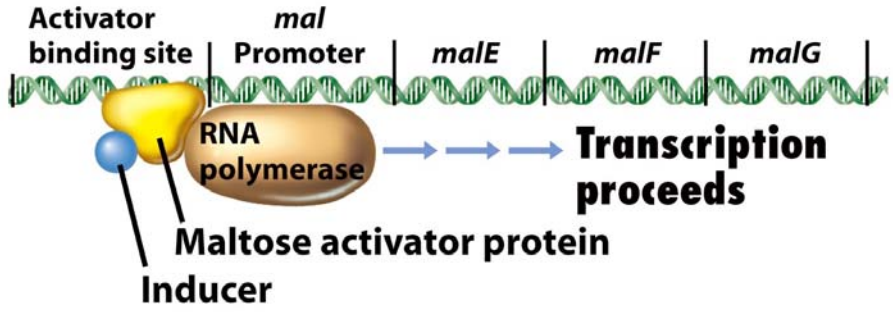
Promoter wird nur mit Hilfe eines Aktivators erkannt



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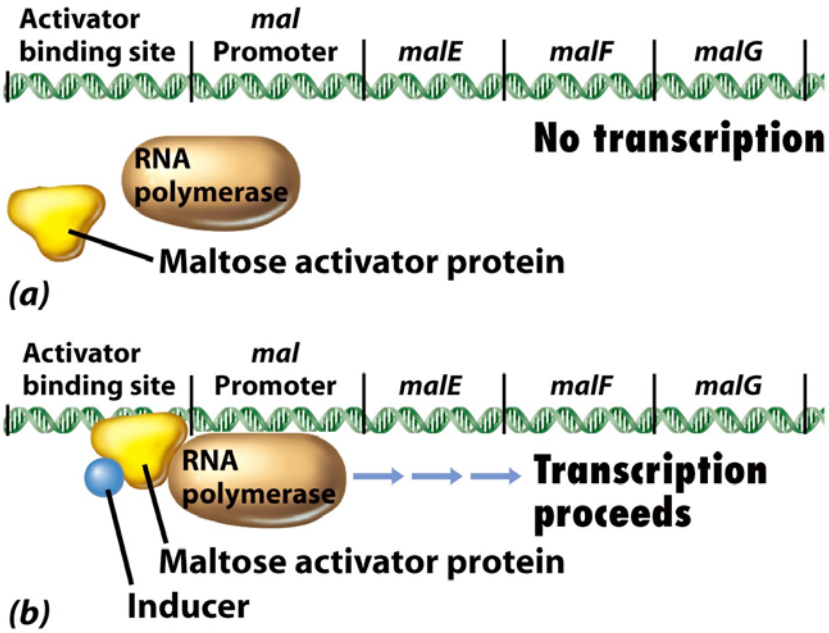

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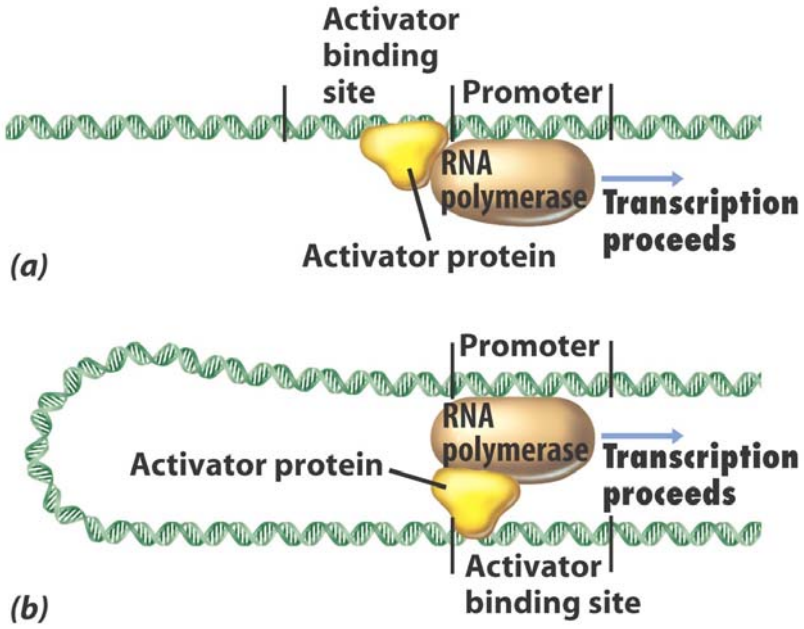
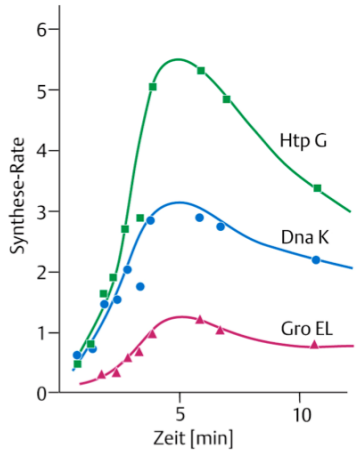


Figure 8-17 Brock Biology of Microorganisms 11/e

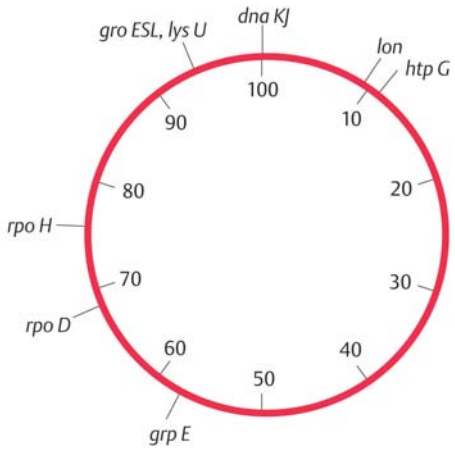
Bakterielle Genregulation:

Das Hitzeschock - **Regulon**

Synthese von Hitzeschockproteinen in E. coli
Shift von 30°C auf 42°C



Lage der Hitzeschockgene auf der E. coli Genkarte (verstreut)

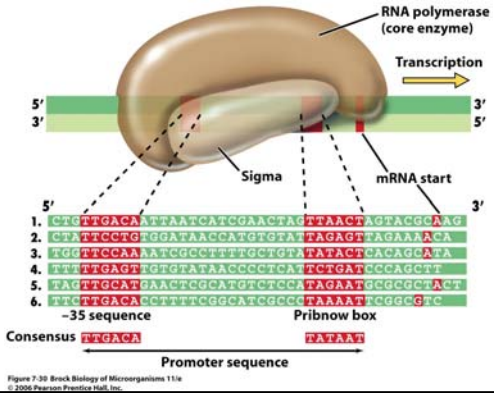


Regulation durch unterschiedliche Sigma-Faktoren

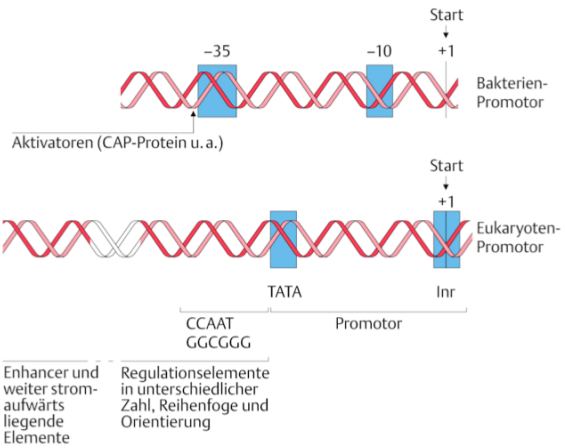
Konsensus-Sequenzen

	−35-Region	−10-Region
Standard-Promotor:	TCTTGAC	−16–18 bp −TATAAT
Hitzeschock-Promotor:	CCTTGAA	−13–15 bp −CCCCAT

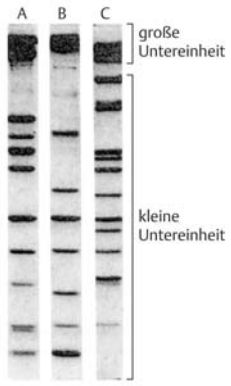
Sigma 70
Sigma 32

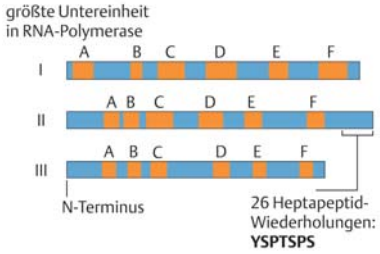


Vergleich von Bakteriellen und Eukaryotischen Promotoren



3 RNA Polymerases in Eukaryotes

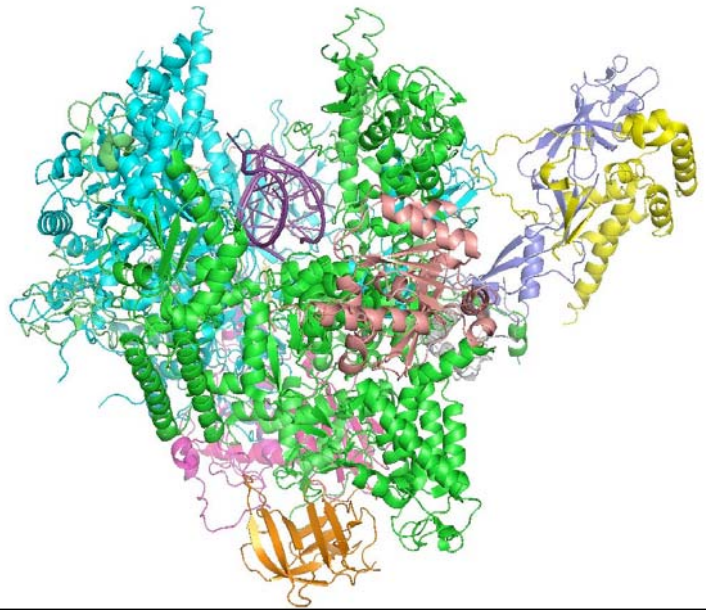




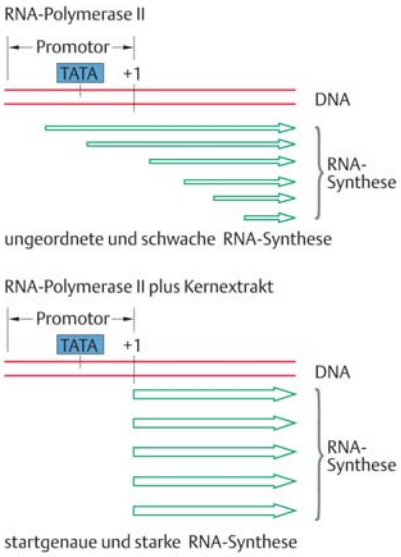
	Zahl der Aminosäuren	M_r
I	1664	186 270
II	1733	191 600
III	1460	162 320

RNA Polymerase I: ribosomale RNA Gene
RNA Polymerase II: Protein-codierende Gene
RNA Polymerase III: kleine RNA Gene (5S rRNA, tRNA etc)

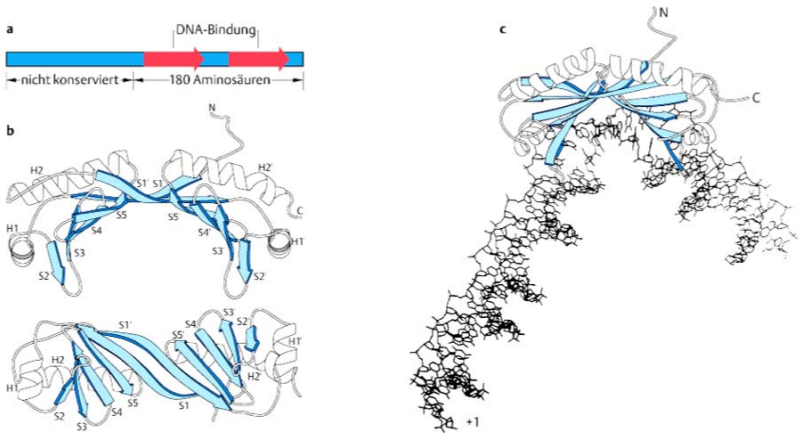
Die eukaryotische RNA-Polymerase



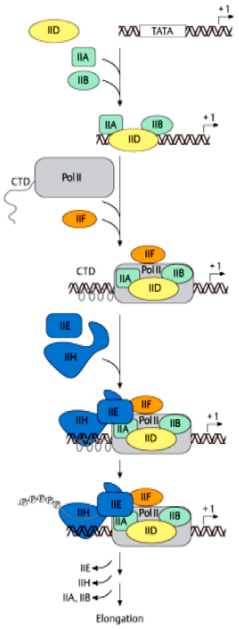
RNA Polymerase II started alleine keine spezifische Transkription



Das TATA-Box Bindeprotein TBP



Der Prä-Initiationskomplex in Eukaryoten



TFIID:
TBP: Erkennen der TATA-Box
TAF (14x) regulatorische Faktoren

TFIIA: Stabilisierung der TFIID-Bindung

TFIIB: Bindung der RNA-Polymerase II

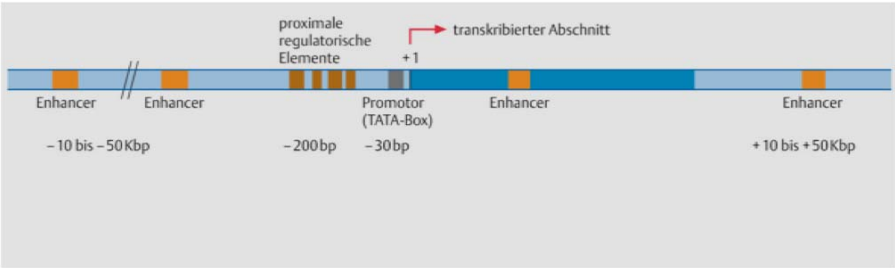
TFIIF: Heranführen der RNAPII an Promoter

TFIIE: Heranführen von TFIIH

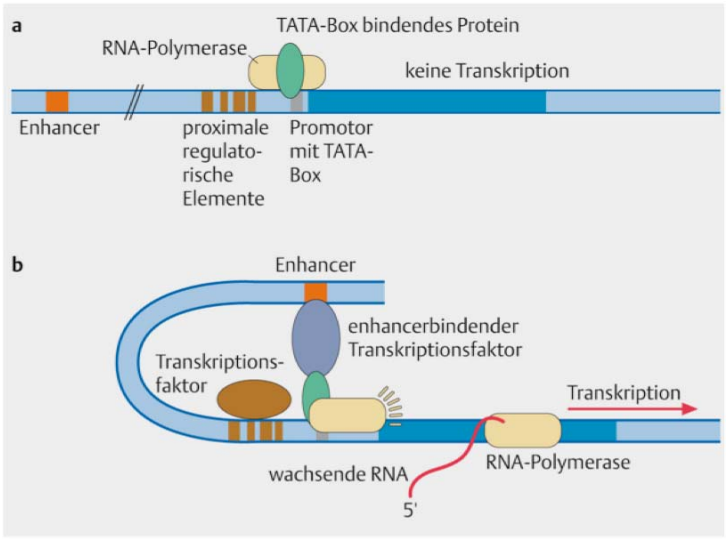
TFIIH: Helikase: Entwindung der Promoter-sequenz

Transkription:

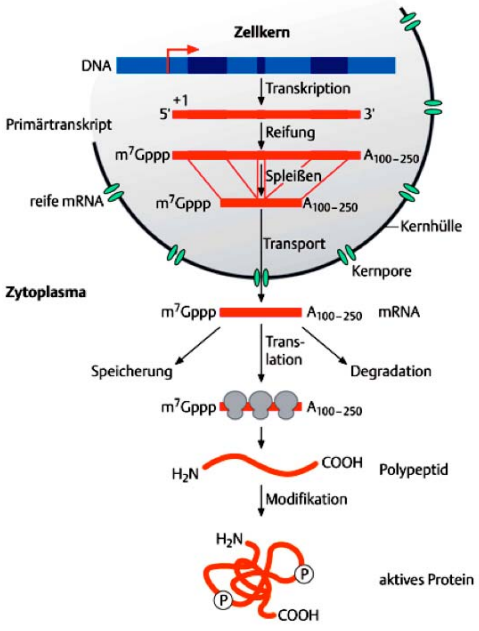
Schematische Darstellung von regulatorischen Elementen in Eukaryoten



Schematische Darstellung zur Wirkungsweise von Transkriptionsfaktoren

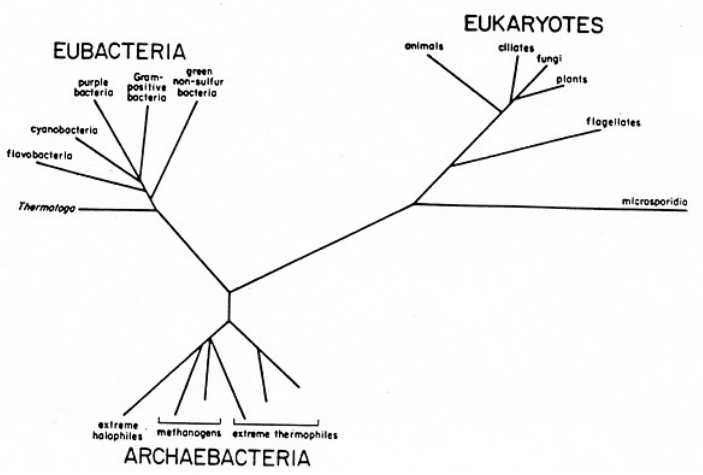


Übersicht Genexpression in Eukaryoten



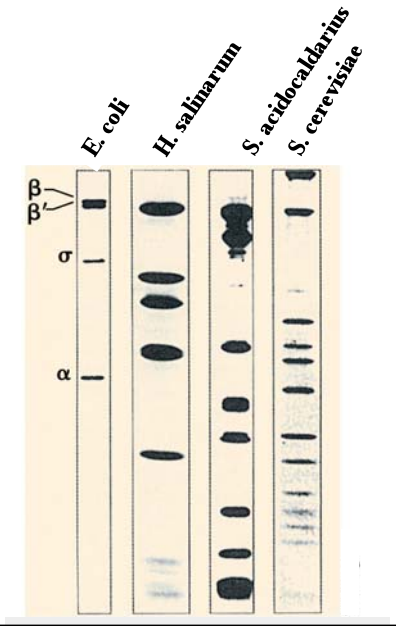
1. Transkription
2. Capping und Polyadenylierung
3. Spleißen
4. Transport ins Cytoplasma
5. Translation
6. Modifikation
7. Faltung

1977: Discovery of a New Domain

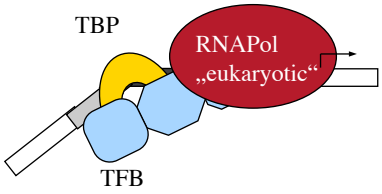


Carl Woese
Crafoord Price
In Biosciences
2003

RNA Polymerases of Archaea are Homologous to the Eukaryotic Counterparts

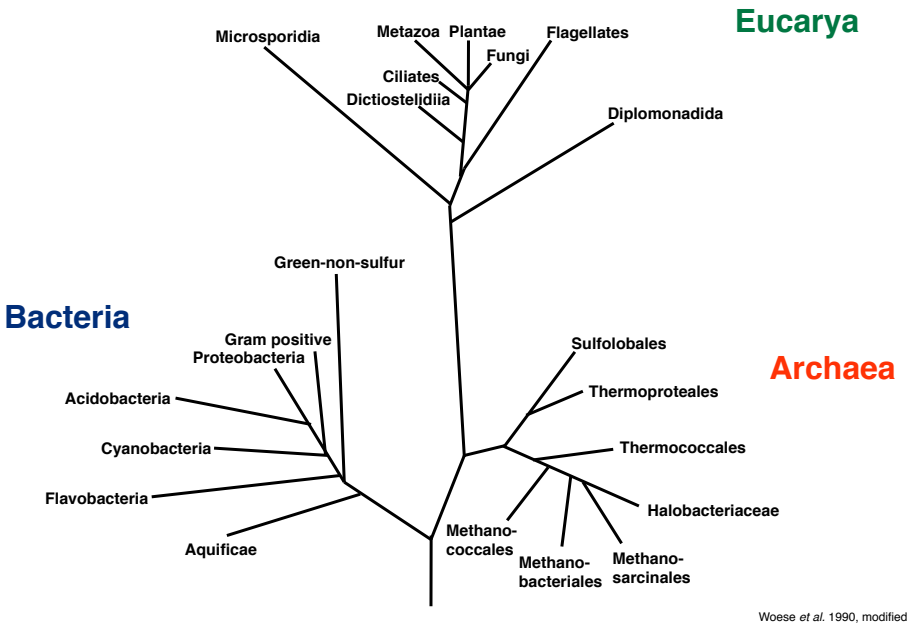


Basic Transcription in Archaea: Similar to Eukaryotes



Archaea Consensus	$\frac{T}{C}TTA\frac{T}{A}A$	$\frac{T}{A}TG\overset{*}{}\frac{C}{A}$
In vitro transcription	$\frac{T}{C}TTA\frac{T}{A}A$	py/pu*
Eucaryal RNAP II promoter	TATA	pyA*py

The three domains



Woese *et al.* 1990, modified