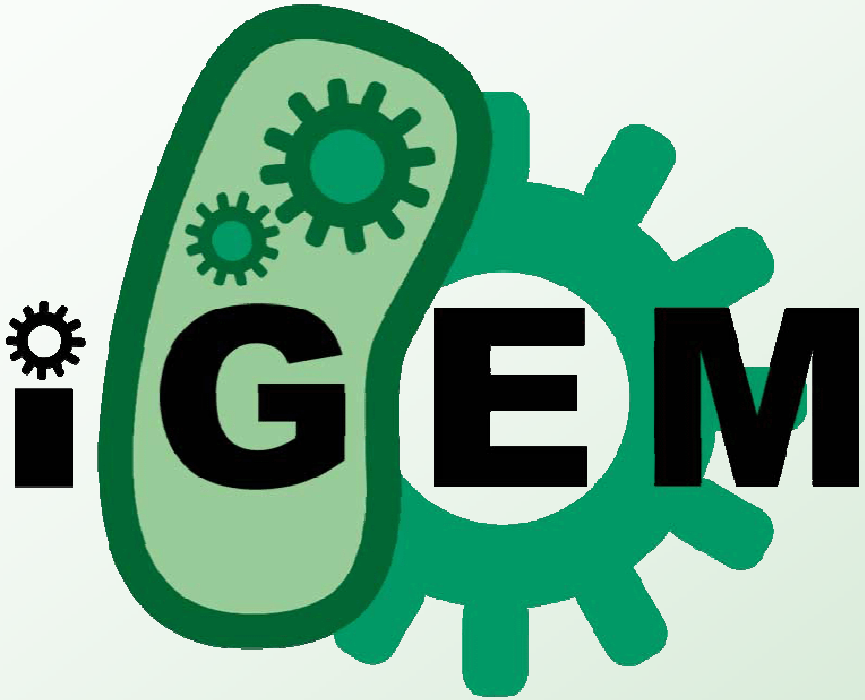


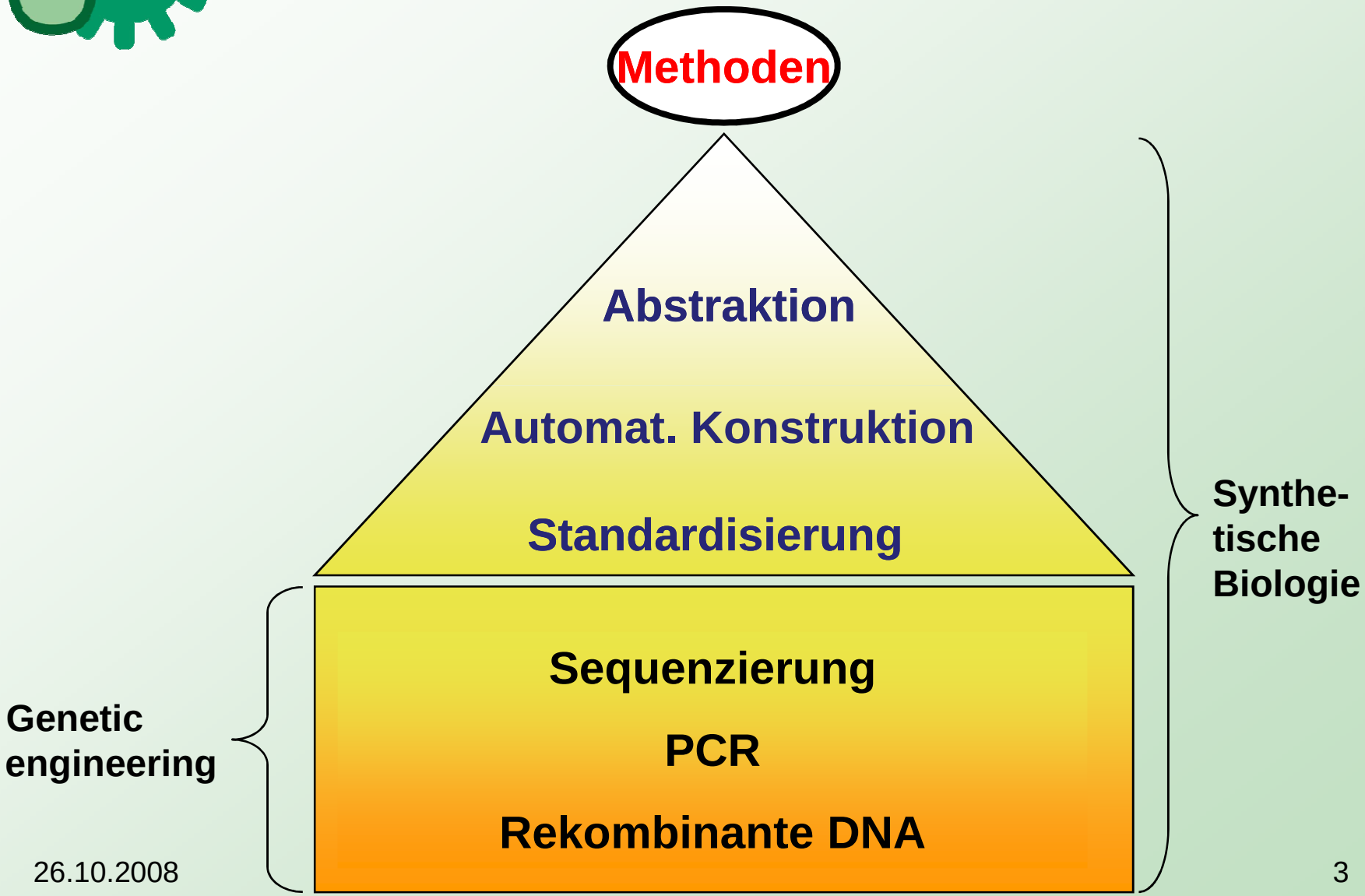
Team Heidelberg 2008

Ecolicence to Kill

Was ist iGEM?

- International Genetically Engineered Machines competition
- Studentischer Wettbewerb auf dem Gebiet der synthetischen Biologie
- Dieses Jahr: 84 Teams, 3 aus Deutschland
- Preisverleihung im November (8/9) am MIT in Boston

Synthetische Biologie



Biobricks

- Ingenieurwissenschaftliche Herangehensweise an Biologie: Module verwenden, die standardisiert und austauschbar sind, sog. **Biobricks**

  → Lego-Baukasten für große Kinder und junggebliebene Erwachsene

- Es gibt 3 Klassen von Biobricks:
  - parts, devices und systems

- DNA ist gepeichert in einer Datenbank: **Registry**

Regulatory Regions (Promoters)

Available repressible regulators (normally ON) -?- *Show 0 more parts* *Edit*

-?-	Name	Description	Direction	Control -?-	Output Low	Output High	Length
A W	BBa_I14032	promoter P(Lac) IQ	Forward	lacI			37
A W	BBa_R0040	TetR repressible promoter	Forward	aTc, tetracyline			54
A W	BBa_R0051	promoter (lambda cI regulated)	Forward	lambda cI			49

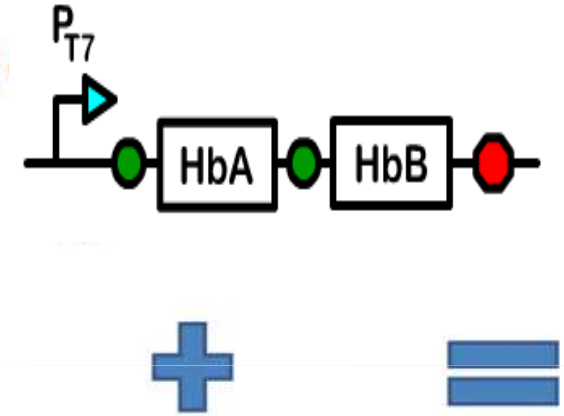
Available inducible regulators (normally OFF) -?- *Show 0 more parts* *Edit*

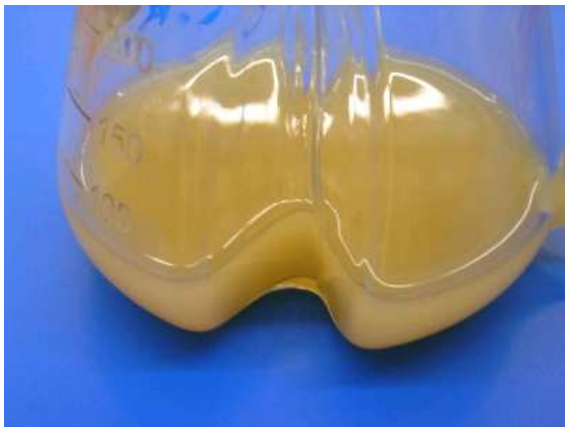
-?-	Name	Description	Direction	Control -?-	Output Low	Output High	Length
A	BBa_I12007	Modified lambda Prm promoter (OR-3 obliterated)	Forward	cI			82
A	BBa_R0062	Promoter (luxR & HSL regulated -- lux pR)	Forward	luxR, HSL			55
A	BBa_R0079	Promoter (LasR & PAI regulated)	Forward	PAI			157
A	BBa_R0080	Promoter (AraC regulated)	Forward	araC			149

Available other regulators *Show 374 more parts* *Edit*

-?-	Name	Description	Direction	Control -?-	Output Low	Output High	Length
A W	BBa_I0500	Inducible pBad/araC	Forward	araC, arabinose			1210
A W	BBa_I13453	Pbad promoter					130
A W	BBa_I712004	CMV promoter					654
A W	BBa_I712074	T7 promoter (strong promoter from T7 bacteriophage)					46
A W	BBa_I714889	OR21 of PR and PRM					101
A W	BBa_I714924	RecA_DlexO_DLacO1					862
A W	BBa_I714927	RecA_S_WTlexO_DLacO					862
A W	BBa_I714929	RecA_S_WTlexO_DLacO3					862
A W	BBa_I714930	RecA_D_consenLexO_lacO1					862
A W	BBa_I714933	WT_sulA_Single_LexO_double_LacO1					884
A W	BBa_I714935	WT_sulA_Single_LexO_double_LacO2					884
A W	BBa_I714936	WT_sulA_Single_LexO_double_LacO3					884
A W	BBa_I714937	sluA_double_lexO_LacO1					884
A W	BBa_I714938	sluA_double_lexO_LacO2					884
A W	BBa_I714939	sluA_double_lexO_LacO3					884
A W	BBa_I715038	pLac-RBS-T7 RNA Polymerase					2878
A W	BBa_I716102	pir (Induces the R6K Origin)					918
A W	BBa_I719005	T7 Promoter					23
A W	BBa_I732205	NOT Gate Promoter Family Member (D001055)					124

UC Burckley (´07): Baktoblood



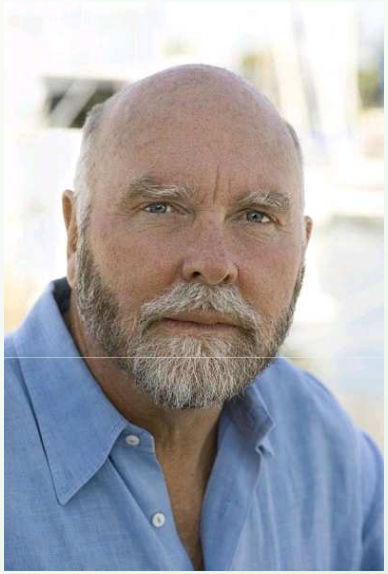


MIT: Biogurt

- *Streptococcus mutans* ist häufigster Kariesauslöser
- Yogurt-Bakterien mit p1025-Protein verhindert das anwachsen der Streptococcen

→ 1 Yogurt schützt 90 Tage lang vor Karies

Craig Venter: künstliches Genom



- Erstes künstliches Bakteriumgenom des Bakteriums *Mycoplasma genitalium* (JCVI 1.0)
- 582,970 bp
- Synthese eines Virusgenoms innerhalb von 2 Wochen
- Sequenzierung des Humanen Genoms

Team Heidelberg

16 Undergrade Students

12 Mentoren

Ecolicence to Kill

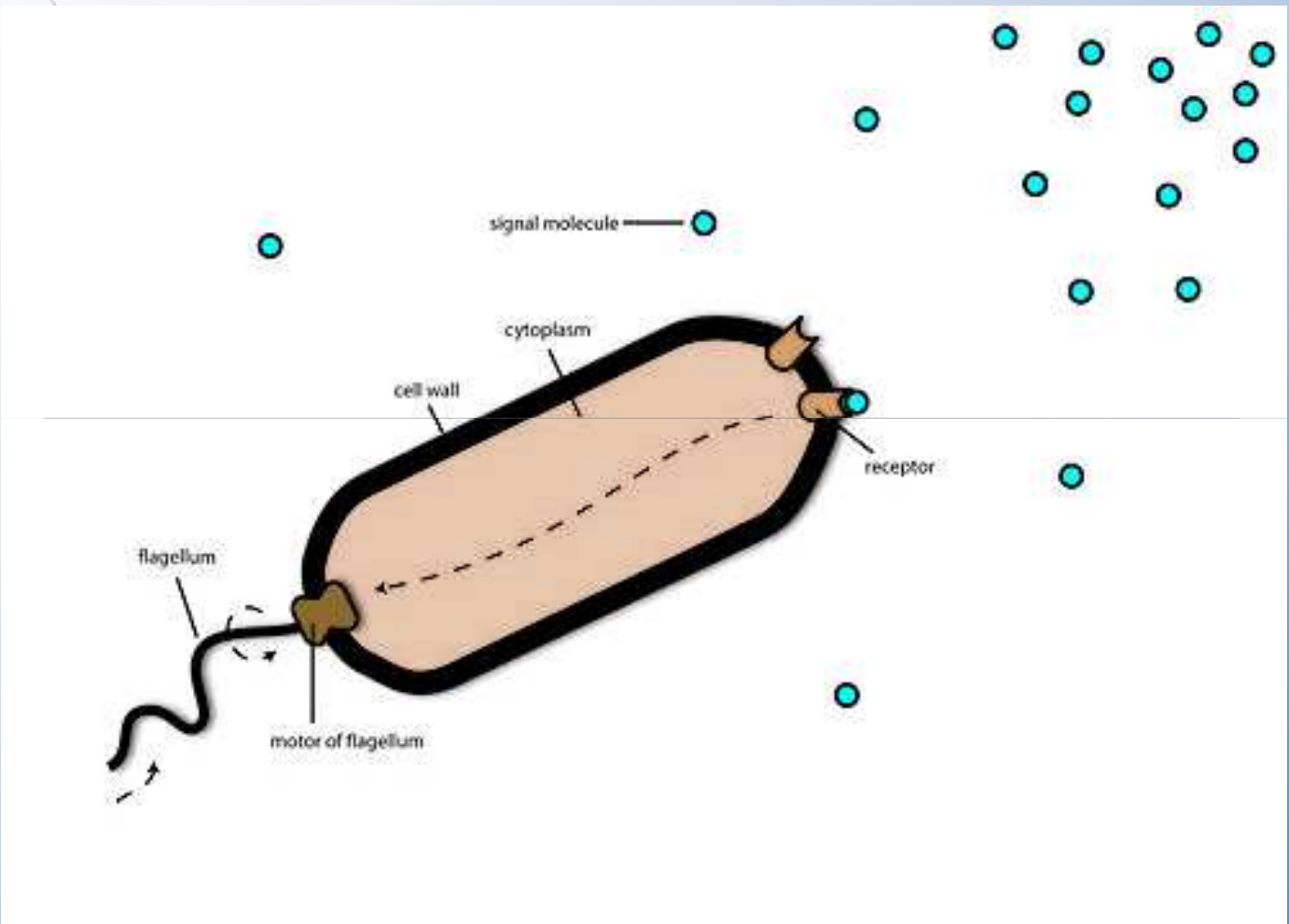
Ziel: Bakterielle „Killermaschine“ bauen, die Pathogene (Krankheitserreger) abtöten kann

1) **Sensing**: Aufspüren der Krankheitserreger

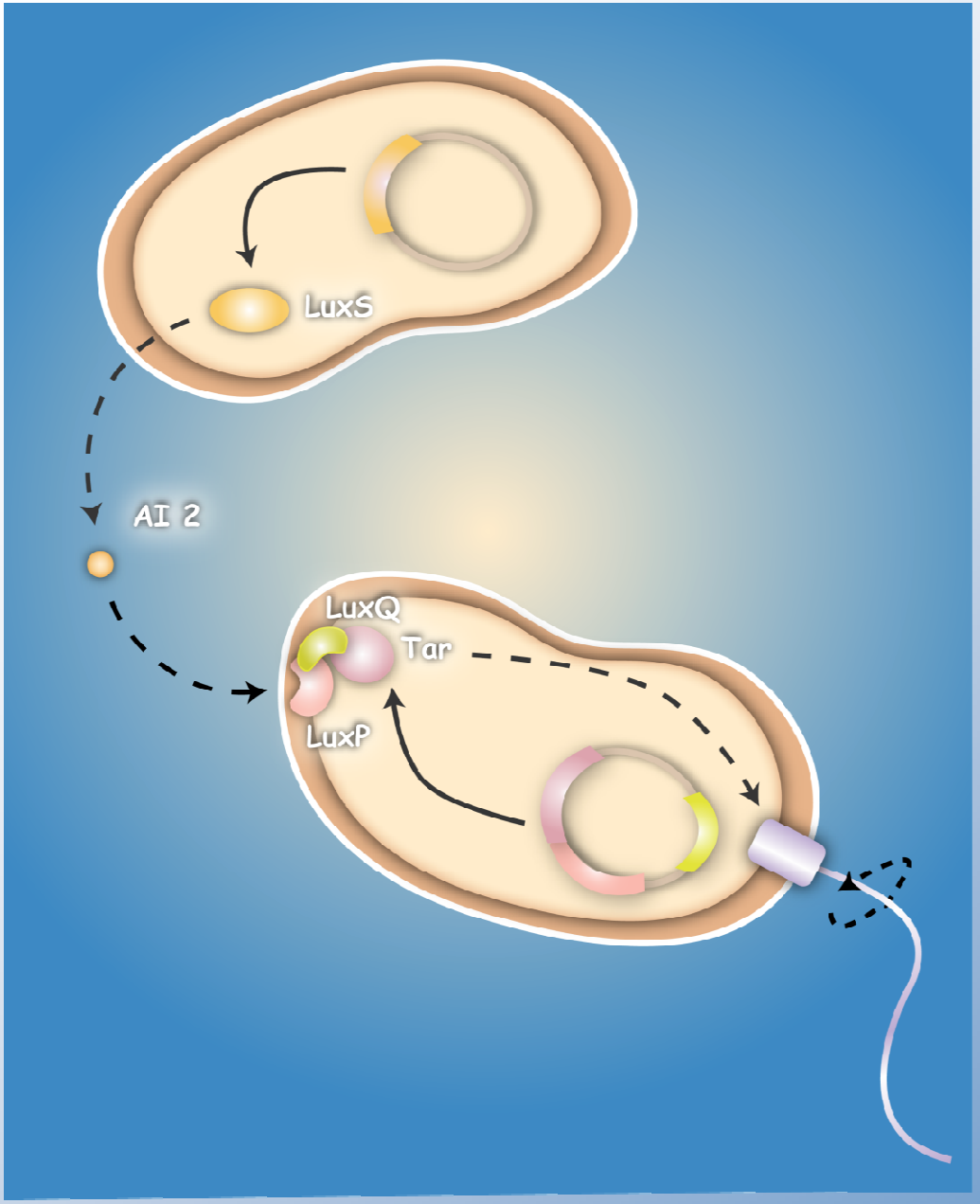
2) **Killing**: Töten der Krankheitserreger durch zwei Killingsysteme
   a) Colicine
   b) Viren (Bakteriophagen)

3) **Modeling**: Simulation des Systems am PC

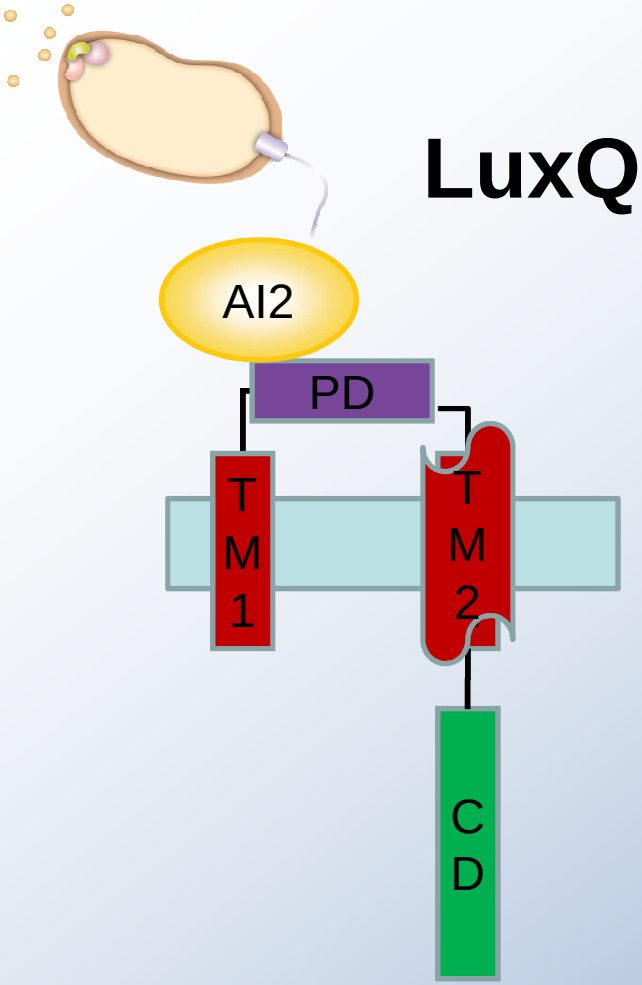
Chemotaxis- random walk



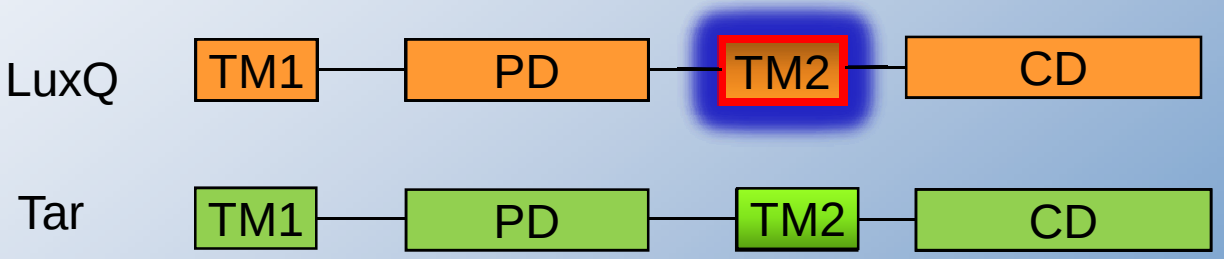
Sensing System



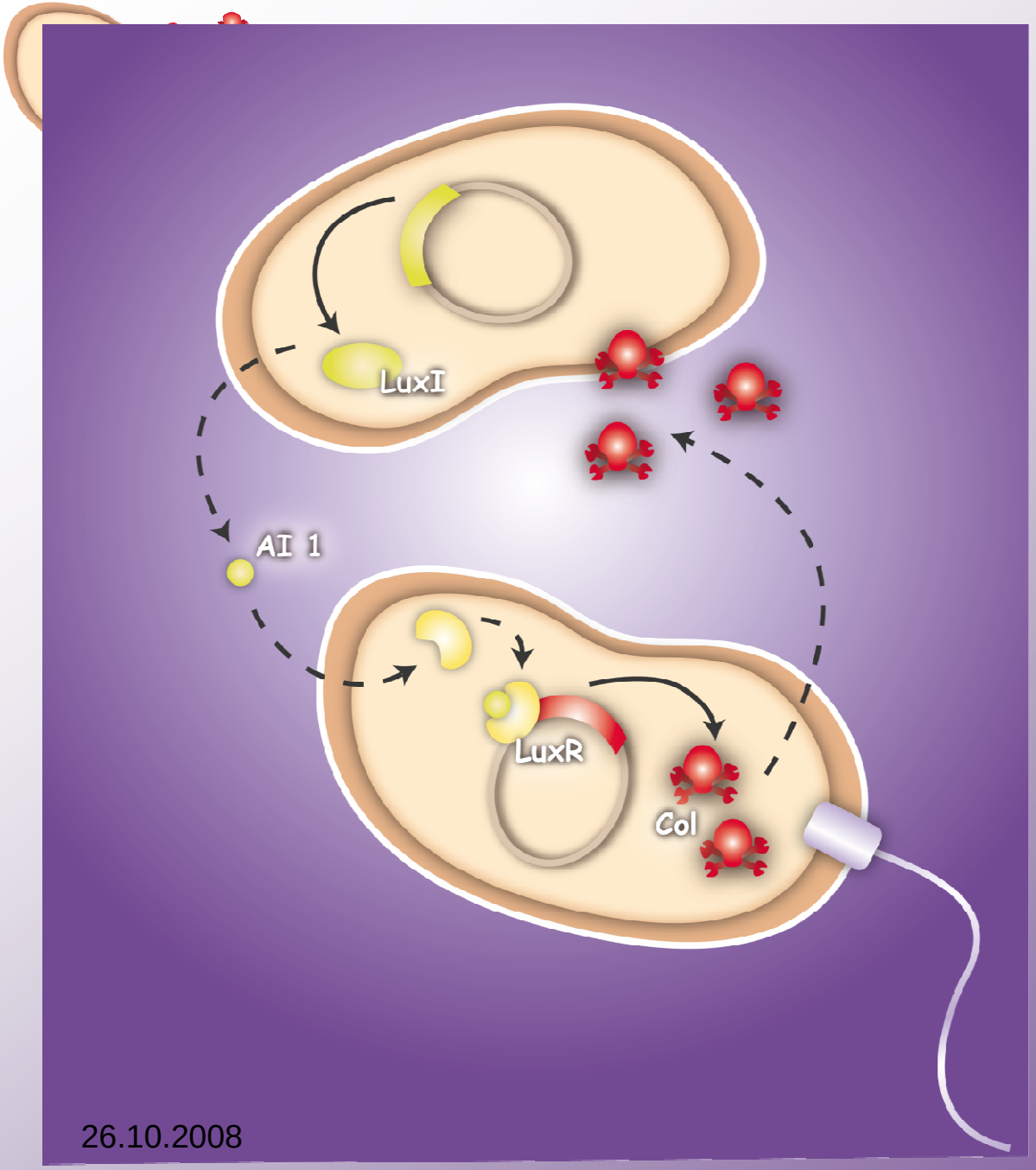
LuxQ and Tar Fusions-Protein



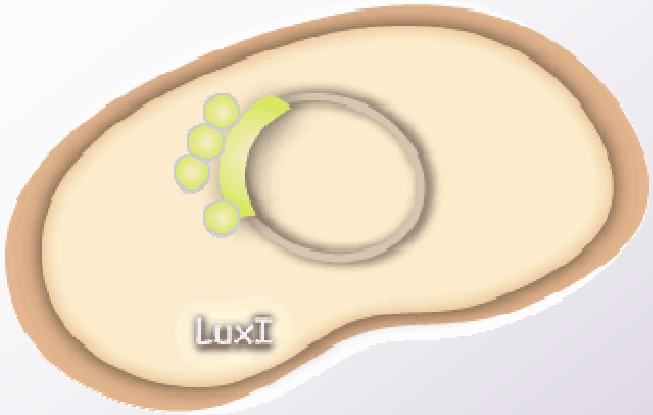
Struktur von LuxQ und Tar



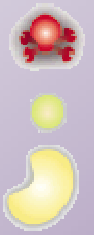
Fusionsrezeptor



1) Colicin Killingmodul



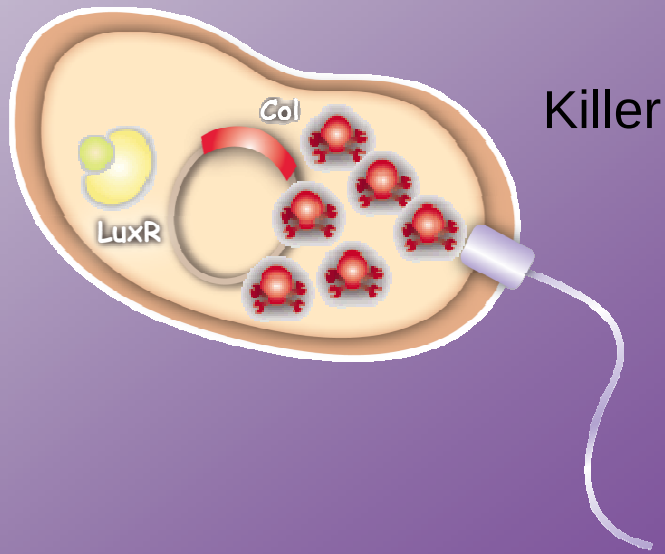
Prey



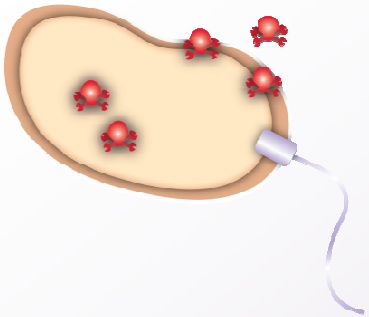
Colicin

AI-1

LuxR

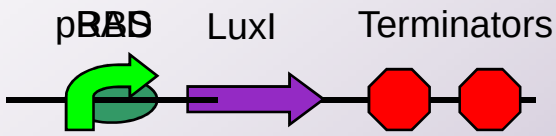


Killer

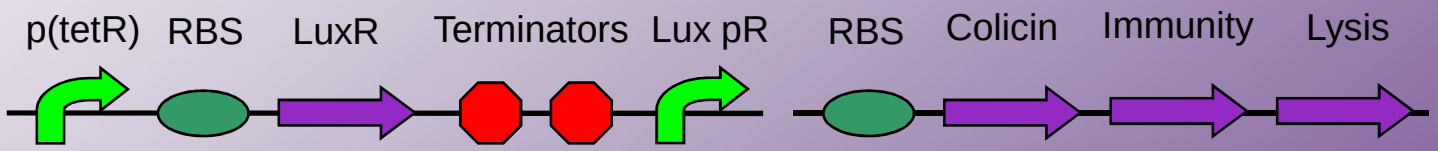


Cloning Strategy

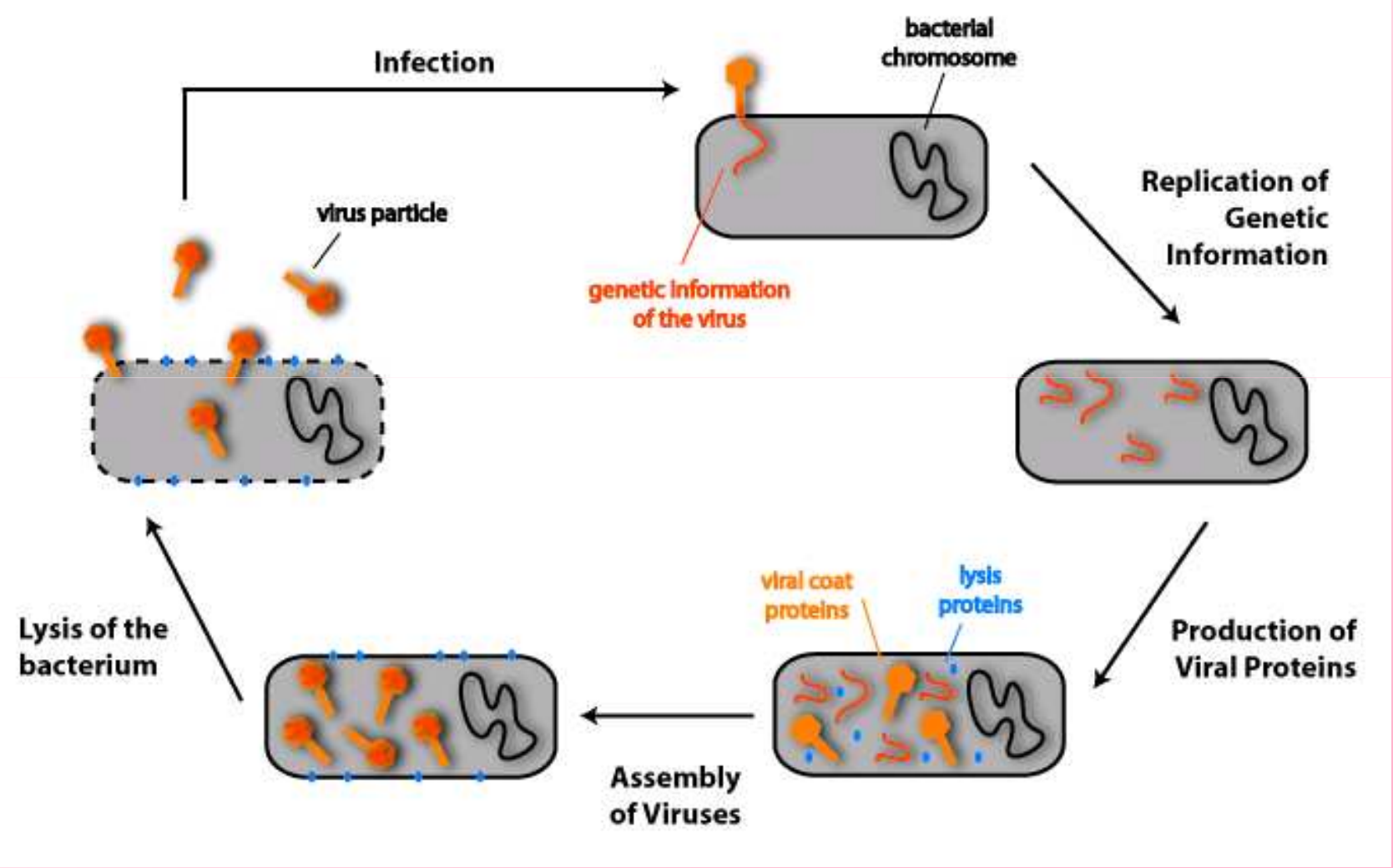
- Sender hinter konstitutiven Promotor klonieren

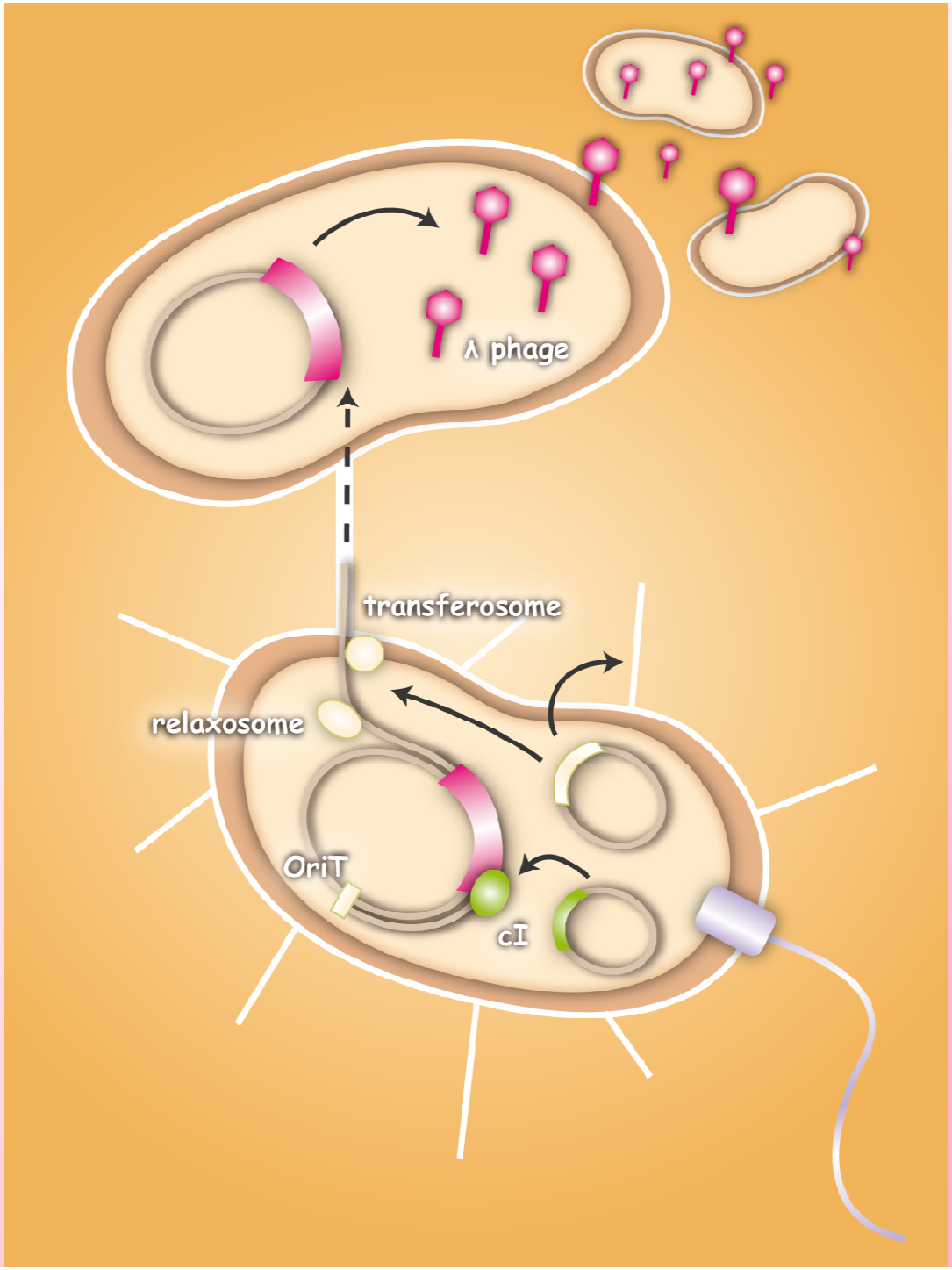


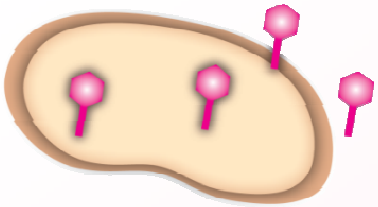
- Empfänger vor das Colicin-Gen schalten



2) Phagen (Virus) Killingmodul

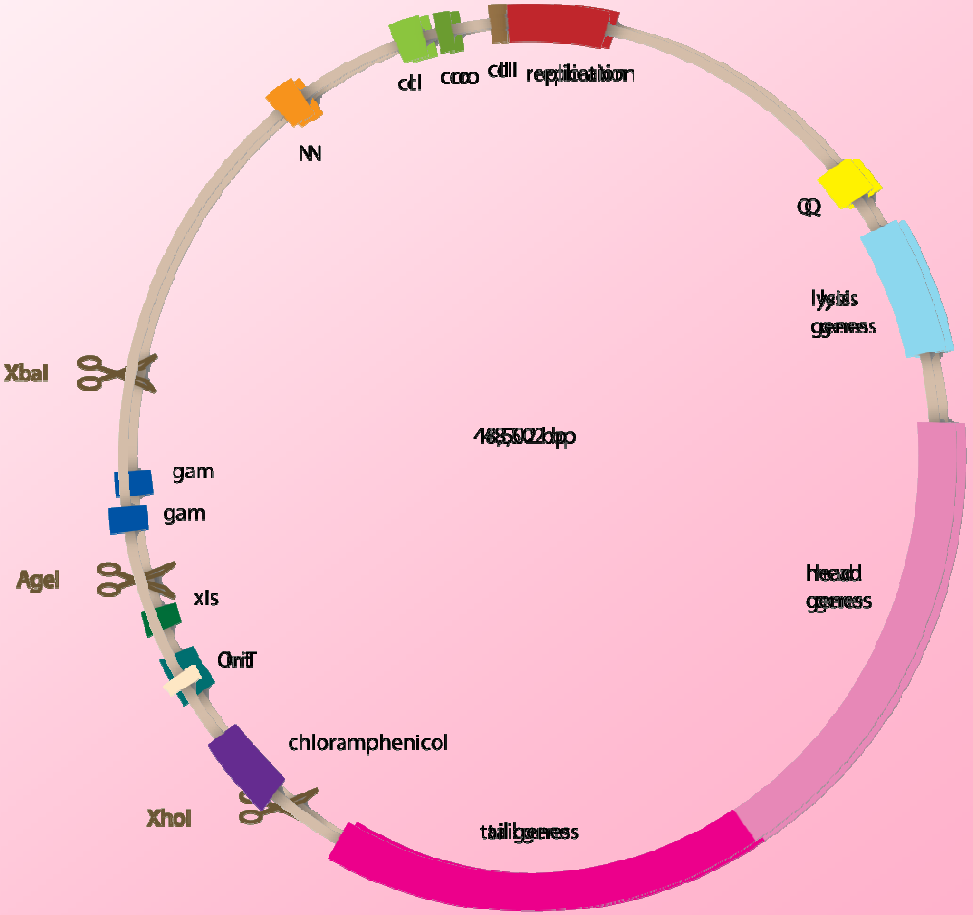


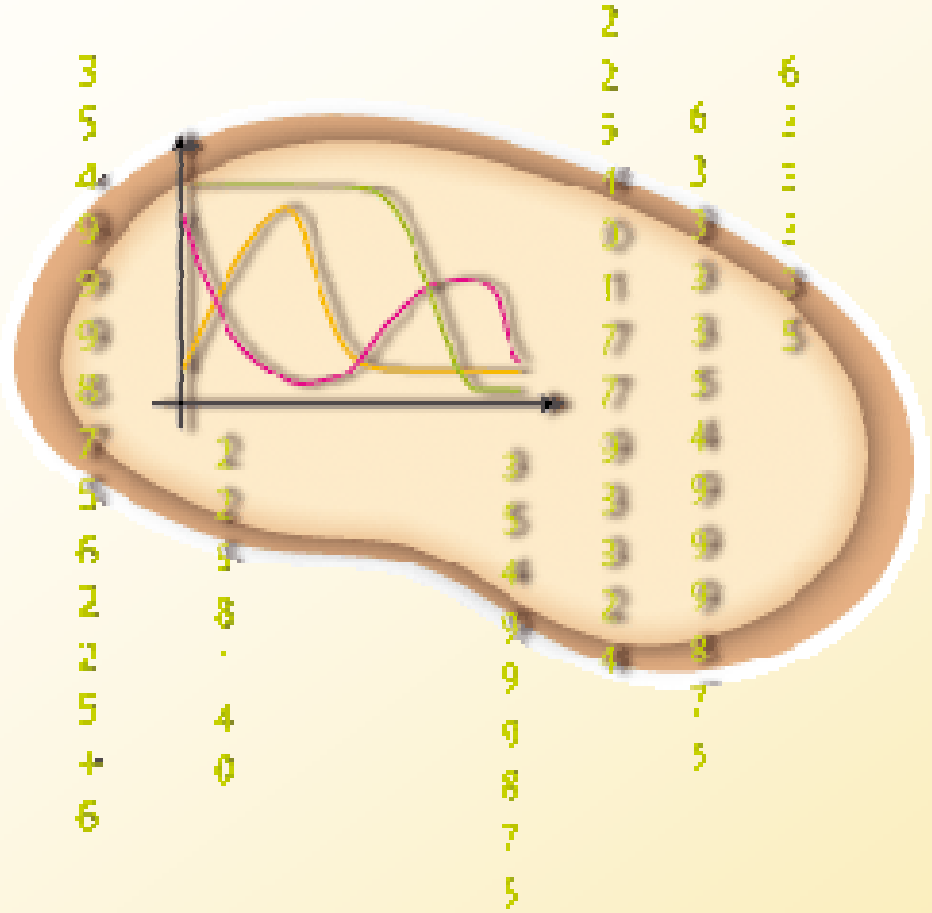

λ phage
transferosome
relaxosome
OriT
cI



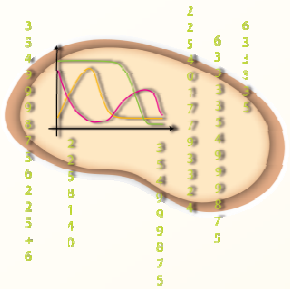
Recombinantes Virus - Genom

- Virus erzeugen, der nicht ins Wirtsgenom integrieren kann
- OriT: Killerbakterium überträgt Phagen auf Krankheitserreger





Modelling



Sensing und Killing mit Colicinen

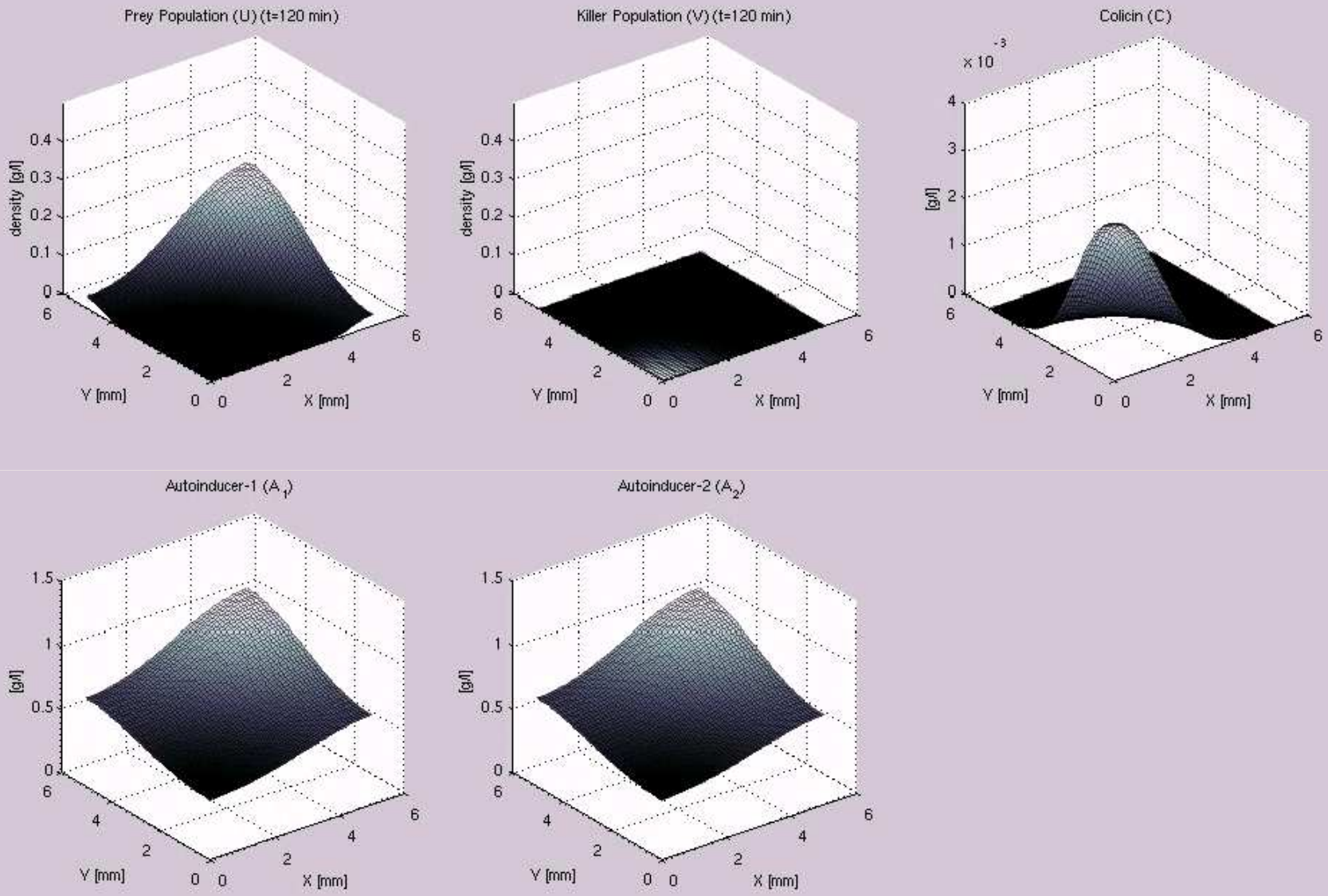
Einfaches Killing-Modell

Beutezellen → $$u_t = D_u \Delta u - \nabla \left(\chi \left(C \right) u \nabla C \right) + \rho u - k_u S$$

AI-2 → $$C_t = D_c \Delta C + \beta_c \frac{u^2}{\mu_c + u^2}$$

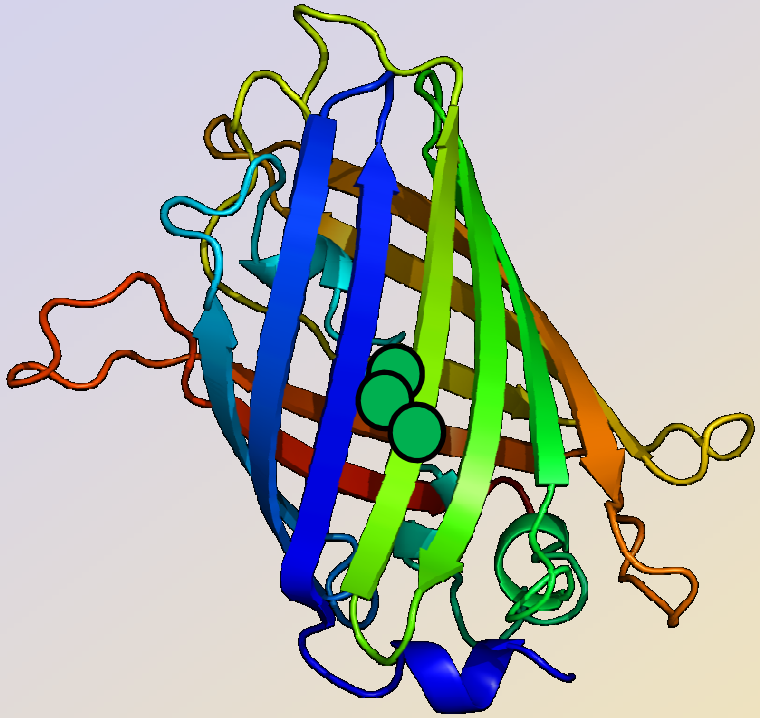
Killerzellen → $$v_t = D_v \Delta v - \nabla \left(\chi \left(C \right) u \nabla C \right)$$

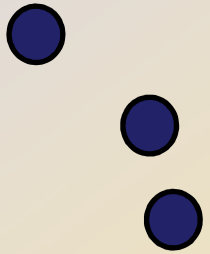
Colicine → $$S_t = D_s \Delta S + \beta_s \frac{v^2}{\mu_s + v^2}$$



5equations_2h_a.avi

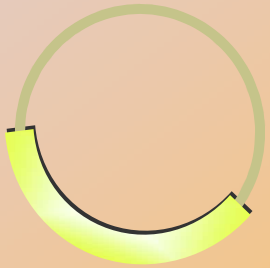
Wie funktionniert GFP?



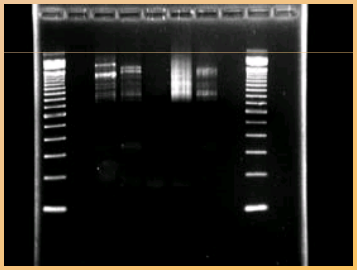


Nobelpreis in One Day- Parcour

1) Plasmid mit GFP-Gen aus E. coli isolieren: Biobrick



2) Plasmid-DNA auf einem Gel auftragen um Biobrick zu visualisieren



3) Bakterien mit GFP-Plasmid live unter dem Mikroskop betrachten