

Cell-Cell Communication, Sensing and Chemotaxis

N Kuldell for 20.020

Spring 2009

Heidelberg iGEM 2008: ecolicense to kill

Part 1: Sensing



Courtesy of DKFZ/Univ. Heidelberg/iGEM Team Heidelberg. Used with permission.

Background information

Cell-Cell Communication

natural context: Cuttlefish and *Vibrio harveyi*

Cuttlefish: master of camouflage

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See video at <http://video.nytimes.com/video/2008/02/13/science/1194817111131/cuttlefish-camouflage.html>

The New York Times. "Cuttlefish Camouflage."

During the day they lie buried in the bottom of the ocean; at night they swim and hunt for food.



Courtesy of [Richard Ling](#) on Flickr.

Cell-Cell Communication

natural context: Cuttlefish and *Vibrio harveyi*

Few cells:
Autoinducers diffuse
away

More cells:
Autoinducers initiate
signaling, transcription

Image removed due to copyright restrictions.

See Figure 4 in Schauder, S., and B. L. Bassler. "[The Languages of Bacteria.](#)"

Genes & Dev 15: (2001) 1468-1480.



Photo from B. Bassler, Fig from:

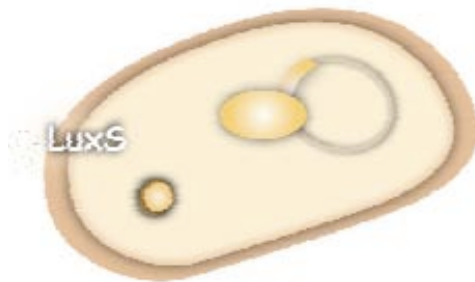
Genes & Dev. 2001. 15: 1468-1480

doi: 10.1101/gad.899601

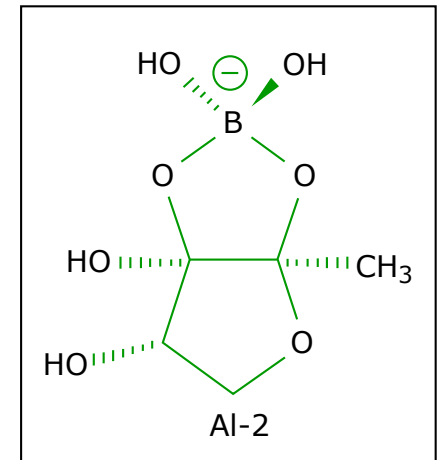
Cell-Cell Communication

iGEM context: “prey” pathogen, “predator” killer

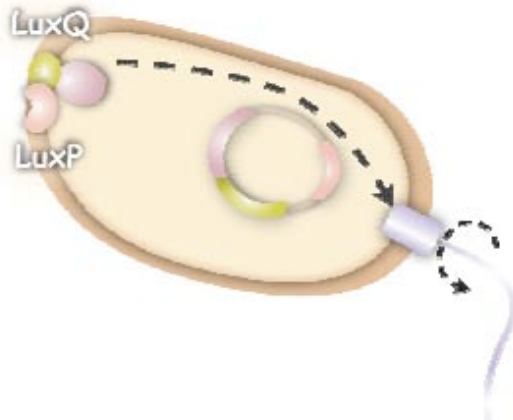
Prey Cell



LuxS= enzyme that produces autoinducer 2 (AI2)...diffuses through the media



Predator Cell



LuxP, LuxQ = receptor that binds (AI2)...induces chemotaxis....how?

Figure by MIT OpenCourseWare.

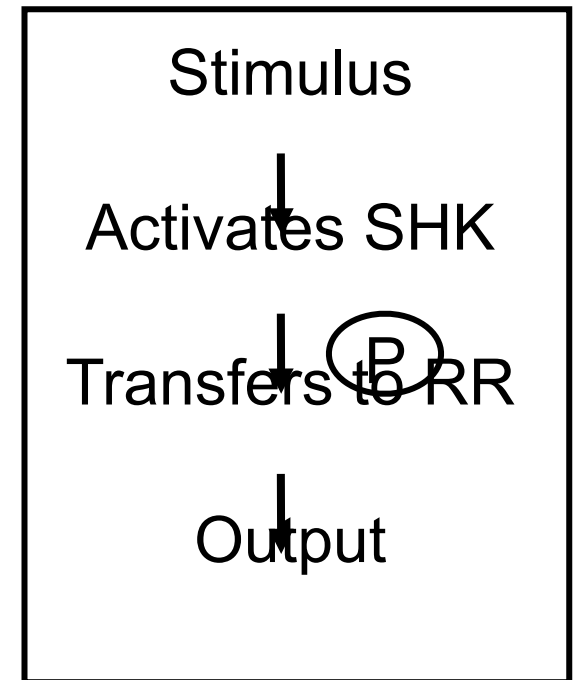
Sensing and Signaling Cascades

natural context: “TCS” 2 component signaling

Image removed due to copyright restrictions.

See Figure 4 in Schauder, S., and B. L. Bassler. "The Languages of Bacteria."

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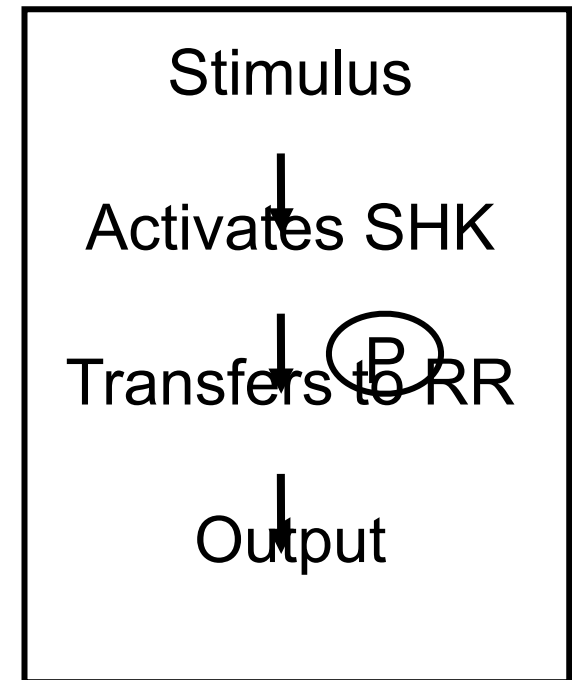
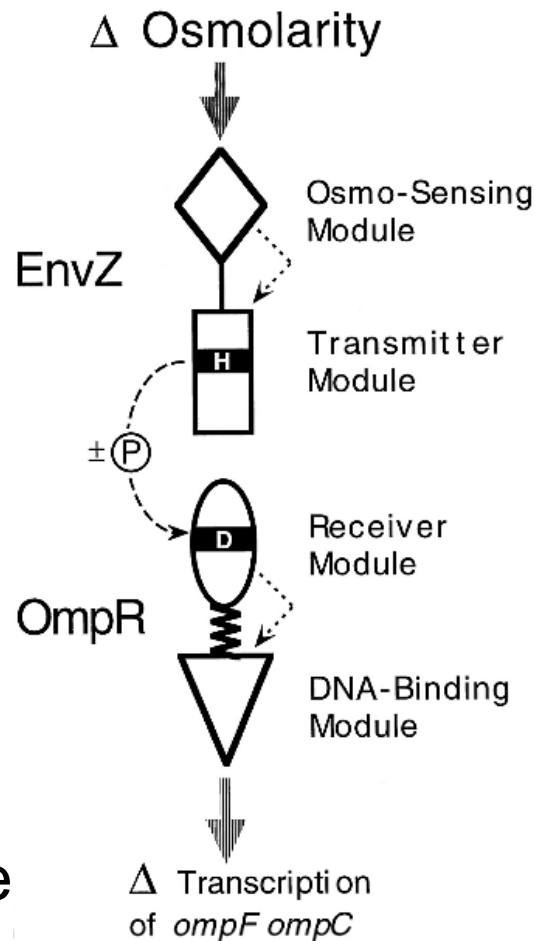
TCS

“SHK” sensor histidine kinase

“RR” response regulator

Sensing and Signaling Cascades

natural context: “TCS” 2 component signaling



TCS

“SHK” sensor kinase

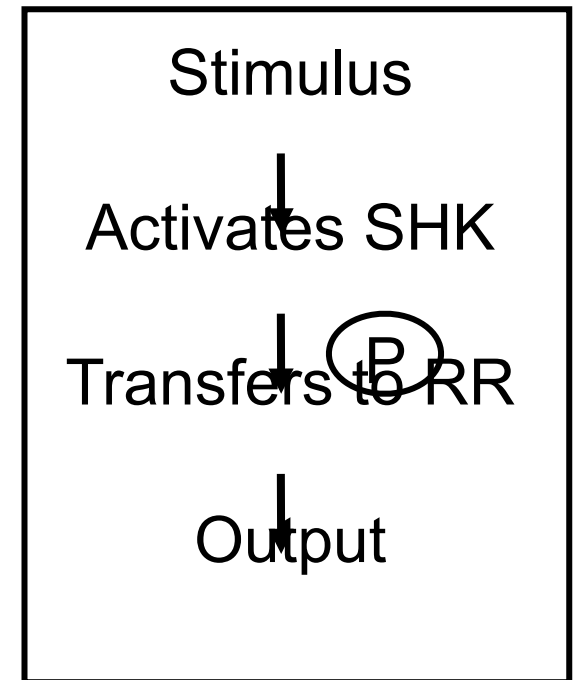
“RR” response regulator

Plant Physiol. (1998) 117: 723

Sensing and Signaling Cascades

natural context: “TCS” 2 component signaling

Diagram removed due to copyright restrictions. "Scheme of Protein-protein Interactions During Chemotactic Signal Transduction in Bacteria." Fig. 1 in Bren, A., and M. Eisenbach. "How Signals Are Heard during Bacterial Chemotaxis: Protein-Protein Interactions in Sensory Signal Propagation." *J Bacteriol* 182, no. 24 (2000): 6865-6873.



CCW, default, tumble

TCS

CW, signal, swim

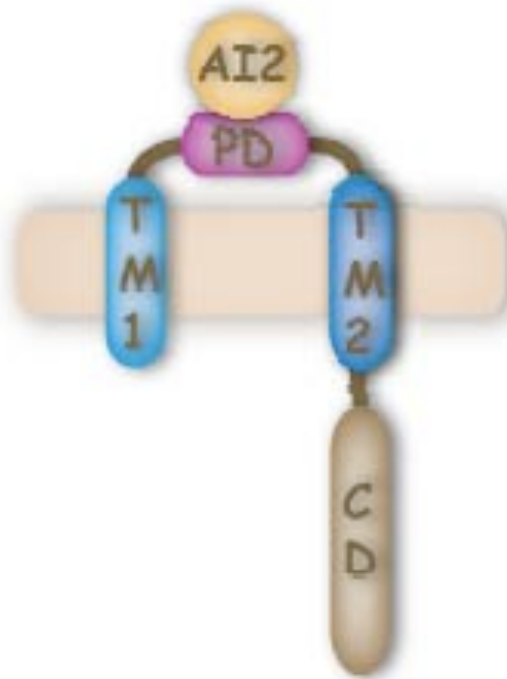
“SHK” sensor kinase

“RR” response regulator

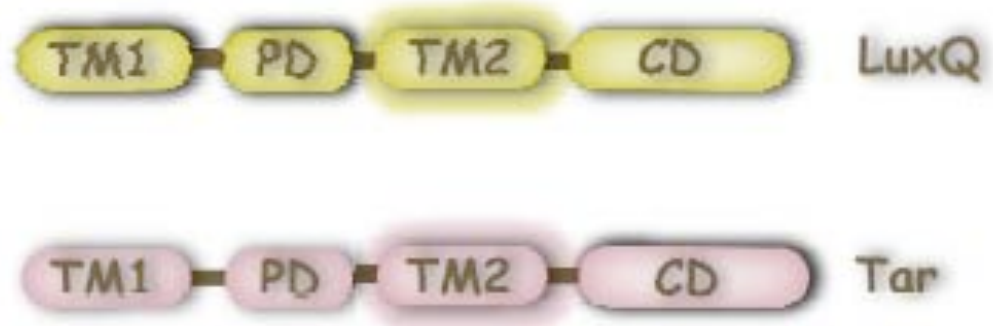
J Bacteriol. (2000)182: 6865

Sensing and Signaling Cascades

iGEM context: chimeric receptor



General structure
of LuxQ and Tar



Construct 1: TM2 from LuxQ

Construct 2: TM2 from Tar

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20.020 Introduction to Biological Engineering Design
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