## Literature Talk

## Photocontrol of biological systems -

## **Optical control of antibacterial activity**

18/02/2014

## Photocontrol of biological systems



Taken from: B. L. Feringa and coworkers, *Chem. Rev.* 2013, 113, 6114-6178.

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#### **Classical targets of antibacterial active compounds**



Taken from: C. Walsh, Nat. Rev. Microbiol. 2003, 1, 65-70.

 <u>evolutionary pressure</u> (only low levels of preexisting antibioticresistant bacteria before the widespread use of antibiotics)



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- alteration of target side (e.g., alteration of PBP)



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- *reduced drug accumulation* (e.g., increased efflux)



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# One Example:

- S. Loewenberg; India reports cases of totally drugresistant tuberculosis; *The Lancet* **2012**, 379, 205.

#### Photopharmacology



Taken from: B. L. Feringa and coworkers, *J. Am. Chem. Soc.* **2014**, *136*, 2178-2191.

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#### **Development of the photoswitchable agents**



Taken from: B. L. Feringa and coworkers, Nat. Chem. 2013, 5, 924-928.

#### UV properties of photoswitchable agent



#### Taken from: B. L. Feringa and coworkers, Nat. Chem. 2013, 5, 924-928.

#### Syntheses of the photoswitchable agents



Taken from: B. L. Feringa and coworkers, Nat. Chem. 2013, 5, 924-928.

#### Control of bacterial growth with photoswitchable agents



Taken from: B. L. Feringa and coworkers, Nat. Chem. 2013, 5, 924-928.

#### **Biological activity of the photoswitchable agents**





#### Table 1 | *Trans:cis* ratios in water and MIC values of the nonirradiated and irradiated photoswitchable quinolones 1-9.

Compound	Non- irradiated ( <i>trans:cis</i> )	Non- irradiated MIC (µgml <sup>−1</sup> )	Irradiated ( <i>trans:cis</i> )	Irradiated MIC (μg ml <sup>-1</sup> )
1	100:0	8	15:85	16
2	95:5	>64*(16 <sup>†</sup> )	11:89	16(2 <sup>†</sup> )
3	100:0	>64*	40:60	>64*
4	100:0	>64*	48:52	32
5	91:9	16	34:66	16
6	100:0	>64*	29:71	64
7	96:4	>64*	41:59	32
8	93:7	16	46:54	16
9	100:0	64	44:56	64

The largest difference in activity between the irradiated and non-irradiated antibiotic was observed for compound 2 on *E. coli* CS156 and was also confirmed for *M. luteus.* \*MIC values were determined up to 64 µg ml<sup>-1</sup> due to limited solubility.

<sup>†</sup>MIC values determined for *M. luteus*.

Taken from: B. L. Feringa and coworkers, Nat. Chem. 2013, 5, 924-928.







#### Auto-inactivation of the photoswitchable agent











## **Bacterial patterning with light**

Agar plate with compound **2** was incubated under light (365 nm)



Taken from: B. L. Feringa and coworkers, Nat. Chem. 2013, 5, 924-928.

# Thank you very much for your attention!

#### Photoswitches introduced into biomolecules



Taken from: B. L. Feringa and coworkers, Chem. Rev. 2013, 113, 6114-6178.

#### Synthesis of azobenzenes (I)



#### Synthesis of azobenzenes (II)



Taken from: E. Merino, Chem. Soc. Rev. 2011, 40, 3835-3853.

#### **Bacterial growth**

