Technology Offer

LITESEC - Light-controlled protein delivery into eukaryotic cells with high spatial and temporal resolution

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The LITESEC-T3SS (Light-induced translocation of effectors through sequestration of endogenous components of the T3SS) system represents a novel, fast, specific, and reversible method to control protein secretion into eukaryotic cells, enabling various medicinal and biotechnological applications, such as targeted drug delivery for tumor therapy.

Background

The bacterial type 3 secretion system (T3SS) enables the targeted delivery of bacterial virulence proteins into eukaryotic host cells. Transport through T3SS is fast and efficient: a single injectisome can transfer several thousand effector proteins in few seconds. Using this mechanism, many human pathogens such as Salmonella, Shigella and E.coli are causing several millions deaths per year and the T3SS is a drug target in order to cure and prevent bacterial infections.
Alternatively, scientists utilize this bacterial nanomachine to deliver protein cargo into various eukaryotic cells for vaccination, immunotherapy, and gene editing. Yet, a major drawback was the lack of target specificity, as the T3SS uncontrollably injects effector proteins as soon as it touches the eukaryotic host cell. This obstacle was hindering many therapeutic applications such as for tumor therapy until now.

Technology

Scientists from the Max-Planck-Institute for Terrestrial Microbiology have developed a molecular light switch controlling the T3SS injectisome, allowing targeted protein delivery into eukaryotic cells with a precise spatial and temporal resolution.

In 2017, it was already demonstrated that the protein export of the T3SS was controlled by a dynamic network of soluble cytosolic proteins (1). Using optogenetics, our scientists now achieved to regulate the dynamic cytosolic component SctQ by light, allowing a controlled firing of the injectisome (2).

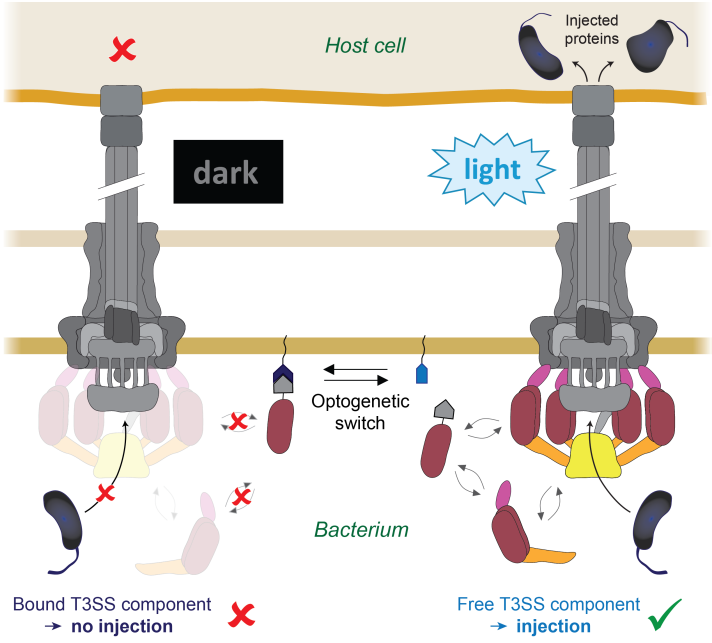

Figure: **Scheme of the LITESEC system**. In the dark state, the dynamic T3SS component (red) is bound to the bacterial membrane via an optogenetic switch. Upon illumination, the component is released and activates the injectisome to translocate the target proteins (black) into the host cell.

The invented LITESEC-T3SS (Light-induced translocation of effectors through sequestration of endogenous components of the T3SS) system thus represents a novel, fast, specific, and reversible method to control protein secretion into eukaryotic cells, enabling various medicinal and biotechnological applications such as targeted drug delivery for tumor therapy (2).

We are now looking for either a licensing or collaboration partner for this exciting project.

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Patent Information

A PCT application was filed in March 2020.

References

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(2) Lindner, F., Milne-Davies, B., Langenfeld, K. *et al.* LITESEC-T3SS - Light-controlled protein delivery into eukaryotic cells with high spatial and temporal resolution. *Nat Commun* **11,** 2381 (2020). https://doi.org/10.1038/s41467-020-16169-w

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