Light can be utilized to control gene function

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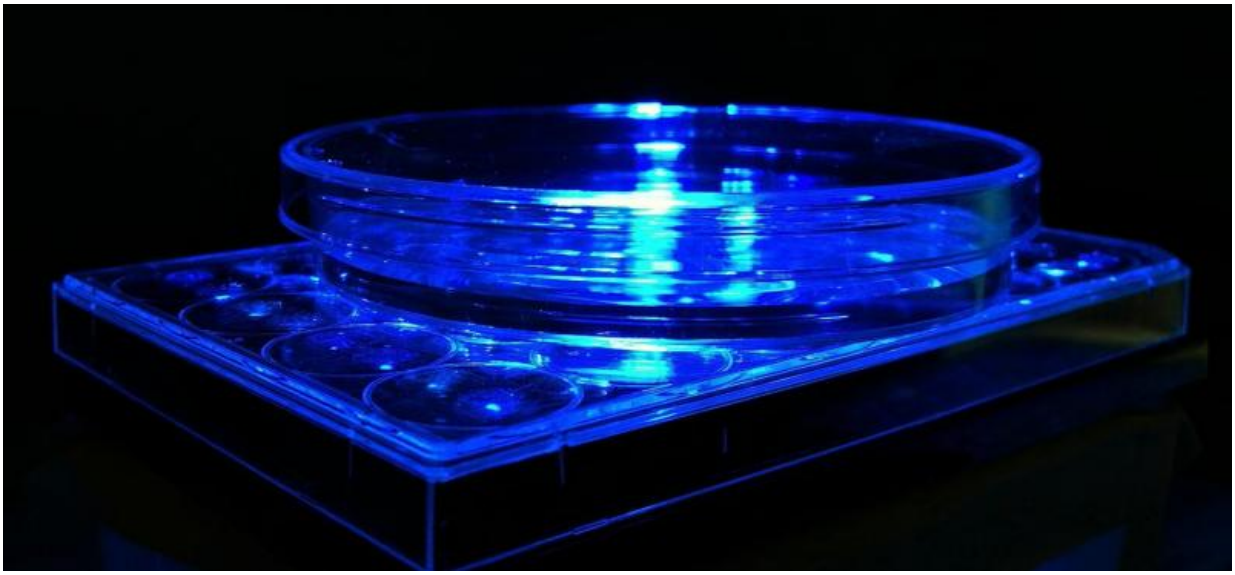

Optogenetics utilizes methods where light can be used to control cellular functions. Credit: Jari Rossi

Light can be used as an accurate method to control gene expression, shows groundbreaking optogenetics study by University of Colorado, Duke University and University of Helsinki researchers.

Optogenetics utilizes methods where light can be used to control cellular functions. In contrast to traditional methods, optogenetic methods allow more temporally and spatially accurate way to control cells. In brain research, these tools have been used successfully to regulate individual nerve cells in millisecond time scale using light instead of electrical

stimulus.

Optogenetic methods and tools have evolved fast, and in addition to be able to control cellular activity, researchers can now control the activity of gene function. In the study published in *Nucleic Acids Research*, the researchers were able to induce and inhibit the expression of genes in mammalian cell cultures and were able to regulate intracellular protein levels using light signals. The approach was also used to regulate gene transcription at endogenous genomic sites when combined with CRISPR/Cas9 technology.

"The research carried out in zebrafish unit of the University of Helsinki showed that in addition to cell cultures, these optogenetic tools worked also in living tissues," says Academy Research Fellow Jari Rossi.

The field has many medical applications, and it is possible that optogenetics may be applied in the future to treat human illnesses. First clinical studies are undergoing to restore vision in patients with retinitis pigmentosa.

"Although the medical applications utilizing light regulated gene expression are in the distant future, the first applications will be probably found among life science basic research areas which are in the need of accurate control of gene function" Dr. Rossi says. "I am myself interested in using these tools for example in obesity- and diabetes research."

On the other hand, the manufacturing of biopharmaceuticals still rely on using old technologies. "The pharmaceutical- and bioindustry might benefit from using these more up-to-date methods, which can be used to control pharmaceutical production processes in cell factories more accurately and efficiently," Dr. Rossi states.

More information: Gopal P. Pathak et al. Bidirectional approaches for optogenetic regulation of gene expression in mammalian cells using Arabidopsis cryptochrome 2, *Nucleic Acids Research* (2017). DOI: 10.1093/nar/gkx260

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