UNIVERSITY OF WYOMING
RESEARCH PRODUCTS CENTER

Engineered Near-Infrared Light Activated Proteins

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Patent Status:
Patent Pending

Description of Technology

University of Wyoming researchers have developed a method for controlling cellular processes in live animals, plants, or microbial organisms via genetically engineered near-infrared light activated proteins. The near-infrared light activated proteins (NIRLAPs) sense light and can be introduced as genes into organisms where their cellular processes can be controlled by the intensity of light, and turned off by near-infrared light or a different wavelength than the activating light. By using light-inducible NIRLAPs one can regulate diverse cellular processes with highly specialized and temporal precision, in a nontoxic manner, often using external light sources.

The use of near-infrared light carries several advantages over UV or visible light, which are sensed by all other types of photoreceptor proteins and most photocaged compounds. Near-infrared light is capable of superior penetration of biological tissues (cm scale) and lacks toxicity. Activities of NIRLAPs can be controlled in tissues that are not accessible to UV-visible light (e.g. most animal tissues) and can be controlled not only by implantation but in some cases by external light sources (e.g. by lasers or LEDs).

Additional advantages of NIRLAPs involve their capacity for instant photo-inactivation and lack of known toxicity.

Applications

NIRLAPs can be used in various medical applications. A near-infrared light activated executor (effector) caspase, can be introduced into tumors (or cells carrying viruses) to cause cell death, which would represent a noninvasive gene therapy of cancer (or viral diseases). NIRLAPs may also be used to photoactivate immune cells at desired locations (e.g. tumor or infection sites).

Human cells expressing hormones (e.g. insulin) in a near-infrared light controlled manner can also be used to treat hormone deficiencies (e.g. diabetes).

NIRLAPs can be used to convert prodrugs into active drugs in irradiated tissues/organs or used as drugs directly (e.g. by light-activated binding and control of cellular receptors). NIRLAPs can be used in cell-based nano-manufacturing and in industrial applications (e.g. light-induced dissolution of bacterial biofilms formed in the presence of engineered near-infrared light sensitive cells that secrete biofilm-dispersion agents)

Features & Benefits

- Non-toxic method for regulating cellular processes
- Large application potential within the medical field
- Superior penetration of biological tissues
- Capable of instant photo-inactivation

Market Opportunity

The ability to precisely activate or inactivate desired proteins in vivo offers unprecedented insights into understanding diverse-biological processes. However, current genetic and pharmaceutical approaches do not provide the ability to accurately interrogate cellular functions in vivo. As the medical field progresses this method has the potential to be developed into gene therapy treatments and other medical applications.

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