Gwangju Institute of Science and Technology
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Professor Jongho Lee's research team develops a skin-type micro LED patch that can supply power in the body

☐ A technology in the form of a simple patch has been developed that can actively supply power to a health care device that is inserted into a human body using light as a medium. GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Mechanical Engineering Professor Jongho Lee's research team has developed a flexible micro LED patch for power transmission in the human body.

- With this research result, it is expected that the micro LED patch will be attached to the skin for treatment and beauty purposes as well as the development of multi-functional high-performance healthcare devices that can enhance life expectancy and quality of life through stable power supply.

☐ Lack of power in the human body is one of the biggest limitations for the emergence of multi-functional high-performance human-inserted healthcare devices. To this end, research on human-inserted solar cells capable of absorbing and generating ambient light has been conducted recently, but there is a limit that sufficient power cannot be produced due to insufficient light when indoors, at night, or when the inserted parts are covered with clothes.

☐ The micro LED patch developed by Professor Jongho Lee's research team can be attached directly to the skin to actively supply power to human-implanted devices with integrated solar cells.

- The research team produced a red micro LED (wavelength: 670 nm) patch based on the fact that light in the red and near-infrared regions (wavelength: 650 nm or more) has a relatively high bio-transmittance. The light generated by the patch penetrates the biological tissue and reaches the solar cell to generate a photocurrent*. This active process enables power supply in vivo regardless of weather, indoors, or at night. The patch can be made using commercially available batteries without complicated circuitry.

  * photocurrent: electric current produces as the result of exposure to light

- Design and manufacturing processes have been developed to solve irritation, burns, and sweat issues that can occur when attached to the skin. On top of thin film, an interconnect designed for increased flexibility. In addition, a patch was manufactured by directly bonding a thin film micro LED (thickness: 4 μm) to a relatively wide heat sink*. The micro patch has a radius of 3mm and does not break even when bent repeatedly, and when attached to the skin, the temperature is kept below 41.2°C, which is within the ambient temperature of low temperature (less than 44°C for 6 hours).

  * heat sink: structures for efficiently removing heat generated from electronic devices

- Through animal experiments, it was confirmed that the micro LED patch attached to the skin of the rat can supply 8.2 μW of power to a small area (0.11 cm^2) solar cell inserted subcutaneously. This is already enough power to drive some commercial pacemakers* (power consumption: 1 to 10 μW), and a simple method to increase the area can further increase the amount of electricity.

  * pacemakers: an implantable healthcare device that can give periodic electrical impulses to treat heart arrhythmia

□ Professor Jongho Lee said, "As a result of this research, an active power supply method using light as a medium that is simple can be expected to contribute to the development of new and diverse technologies that support the functions in the human body by providing power whenever necessary."

□ This research was led by GIST Professor Jongho Lee (corresponding author) and conducted by Dr. Juho Kim with support from the National Research Foundation of Korea and the GIST Research Institute and was published on July 6, 2020, in the *Proceedings of the National Academy of Sciences* of the United States of America (PNAS).

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