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Indian Scientists Develop “CLEAR” Technology for Advanced Protein Imaging

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Indian scientists have developed an advanced imaging platform called CLEAR (Cleavable Light-Erased Antibody Reporter) that can significantly improve protein imaging and disease detection. The breakthrough technology has been developed by researchers at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute under the Department of Science and Technology (DST). The innovation is expected to strengthen research and diagnosis related to cancer, neurological disorders, immunology, and precision medicine.

Key Highlights

The CLEAR technology enables scientists to visualize and map a very large number of proteins within the same biological sample using only a single fluorescent marker. Traditionally, imaging multiple proteins inside tissues and cells while preserving their natural spatial arrangement has been technically difficult. CLEAR overcomes this challenge by repeatedly erasing and reusing fluorescent signals during imaging.

Researchers explained that after imaging one set of proteins, a gentle pulse of 365-nanometre LED light removes the fluorescent signal, allowing another set of proteins to be imaged in the same sample. This repeated process helps create highly detailed protein maps of tissues and cells.

Importance of the Technology

The technology is considered a major advancement because proteins are essential indicators of biological activity and disease progression.

Detailed protein mapping can help doctors and researchers:

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Detect cancers at earlier stages

Understand neurological diseases

Improve precision medicine

Develop targeted therapies

Advance immunology and biological research.

The technology could particularly improve high-resolution spatial proteomics, which studies the arrangement and interaction of proteins inside tissues.

About JNCASR

Jawaharlal Nehru Centre for Advanced Scientific Research is an autonomous multidisciplinary research institution established in 1989 under the Department of Science and Technology (DST), Ministry of Science and Technology.

It focuses on advanced scientific research in areas such as:

Materials Science

Chemical Sciences

Biological Sciences

Engineering

Computational Sciences.

About CLEAR Technology:

Full Form: Cleavable Light-Erased Antibody Reporter.

Developed by: Researchers led by Prof. Sarit S. Agasti at JNCASR.

Uses a single fluorescent marker for repeated protein imaging.

Works through light-based erasing and relabelling of protein signals.

About Proteins:

Proteins are essential biomolecules responsible for:

Cell structure

Metabolism

Immunity

Disease signalling.

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Proteins are major targets for medicines and disease diagnostics.

Related Scientific Concepts:

Proteomics: Study of proteins and their functions.

Spatial Proteomics: Study of protein arrangement within tissues and cells.

Fluorescence Imaging: Imaging technique using fluorescent dyes or markers.

About the Department of Science and Technology (DST):

Established: 1971

Ministry: Ministry of Science and Technology

Objective:

Promote scientific research

Develop new technologies

Support innovation in India.

Important Personalities

Union Minister of Science and Technology: Jitendra Singh

Lead Researcher: Sarit S. Agasti