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IIT Kanpur research reveals how promising vaccine booster switches on immune cells

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Scientists at the Indian Institute of Technology (IIT) Kanpur have revealed how an experimental molecule called EP67 switches on an important receptor found on human immune cells.

EP67 is a candidate "adjuvant", an ingredient added to vaccines to make them work better. The finding gives researchers the first clear, close-up view of EP67 gripping its target, and hands them a blueprint for designing safer vaccines and new immune-based treatments.

When we catch a bacterial or viral infection, our immune cells release a small protein called C5a, which primes the immune system to fight back. But too much of C5a for too long leads to inflammation that is harmful and can damage healthy tissue. To prevent this, the body uses enzymes in the blood to break C5a down quickly once the threat has passed.

The researchers at IIT Kanpur took a cue from this natural safety mechanism and built a stripped-down copy of C5a, a short chain of just ten amino acids named EP67, that keeps the useful part of C5a's activity but works in a gentler way. It wakes up two kinds of immune cells, dendritic cells and macrophages, which help the body build lasting protection. At the same time it barely affects neutrophils, the cells most responsible for the unwanted inflammation. This is exactly what is needed in a vaccine booster - a stronger, longer-lasting immune response without the collateral damage.

The detail of knowing precisely how EP67 fits its target has helped the team to redesign it, adjust the amino acid sequence to make the molecule sturdier and better at hitting its mark. From here onwards, the next steps would be refining the formulation and dosing in pre-clinical tests.

The research was supported by the Indian Council of Medical Research (ICMR), the Anusandhan National Research Foundation (ANRF), the Department of Biotechnology (DBT), and the Department of Science and Technology (DST). The high-resolution structure was determined at the National cryo-EM Facility at IIT Kanpur, set up with funding from ANRF.