International Journal of Infection
ISSN 1972-6945 / 2025 vol. 9, ISSUE N. 2, May-August

Letter to the Editor

THE PROTEASOME IS CRUCIAL FOR THE DEGRADATION OF VIRAL AND BACTERIAL PROTEINS

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KEYWORDS: *Proteasome, virus, bacteria, infection, inflammatory response*

INTRODUCTION

The 26S proteasome is an intracellular protein complex implicated in the immune response against infections that is responsible for the degradation of viral and bacterial proteins (1). This proteasome exerts its biological action on ubiquitin-tagged proteins, degrading them into small peptides (2). This effect is crucial for the recycling of damaged proteins, the regulation of cell signaling proteins, and the control of the cell cycle and apoptosis. The proteasome degrades both viral and bacterial proteins in infectious diseases.

DISCUSSION

The 26S proteasome, which recognizes the polyubiquitin chain, is composed of a 20S core and two 19S regulatory subunits (3). The latter recognize the removed ubiquitin chain and unwind target proteins, translocating them to the 20S catalytic core. In degradation, the 20S core has protease activity (via the subunit) similar to chemotrypsin, trypsin, and peptide-glutamyl peptidases. The protein is degraded into peptides of approximately 8–10 amino acids (4).

When a virus or intracellular bacterium infects a cell, the proteins are released into the cytosol and translated within the host cell. The proteins are recognized as foreign and degraded by the proteasome. The peptides resulting from degradation are transported to the endoplasmic reticulum via the transporter associated with antigen processing (TAP) and loaded onto major histocompatibility complex class I (MHC-I) (5). These peptides are exported to the cell membrane and recognized by CD8+ lymphocytes. This mechanism is important for the immune system and triggers a cytotoxic response (Fig.1).

Received: 30 May, 2025
Accepted: 02 July, 2025

1972-6945 (2025)
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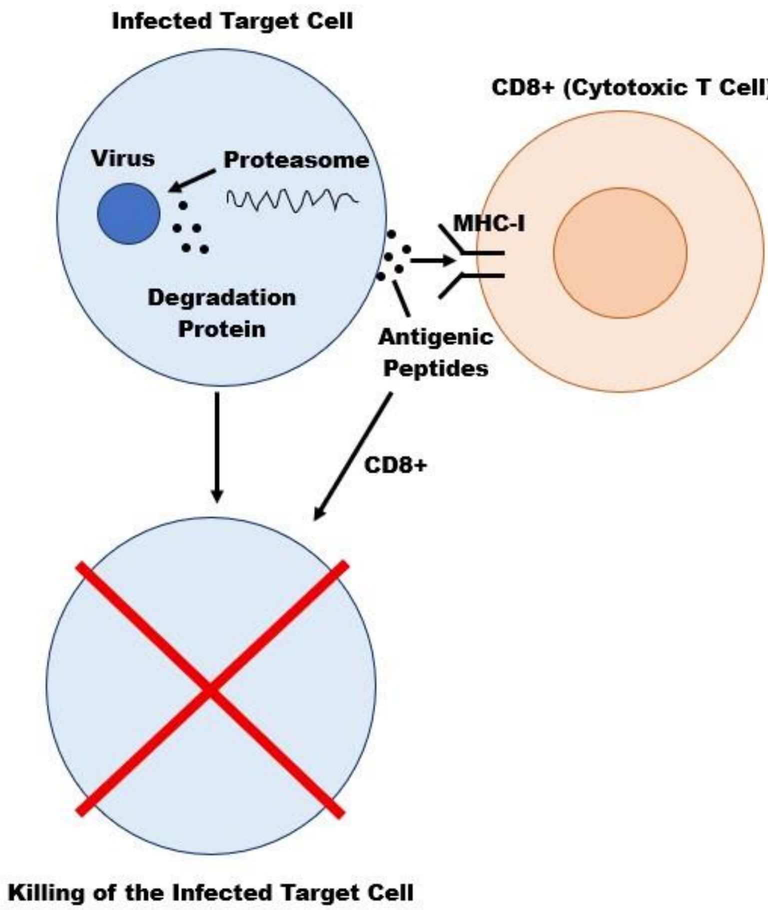

Fig. 1. *When the target cell is infected by intracellular viruses, proteasomes degrade viral proteins. Antigenic peptides from the degraded proteins are exposed on the target cells and are recognized by major histocompatibility complex class I (MHC-I) on CD8+ cells. When activated, CD8+ immune cells kill the viral-infected target cells.*

After degradation, the peptides are transported to the endoplasmic reticulum via TAP, where they bind to MHC-I, which exposes the peptides to the cell surface. At this point, cytotoxic cells recognize these antigenic peptides and lyse virus-infected cells. During inflammation, the immunoproteasome facilitates the production of peptides for antigen presentation.

In the inflammatory response, the proteasome regulates the degradation of the inhibitory protein inhibitor of kappa B (IkB). The 26S proteasome plays an important role in controlling the quality of proteins, including viral and bacterial proteins which enter the cytosol and are tagged with ubiquitin, a small protein covalently linked to lysine residues of the target protein. Tagging occurs through the action of three enzymes: E1, E2, and E3 (6). E1 activates ubiquitin, E2 conjugates ubiquitin, and E3 creates a specific substrate binding that confers specificity.

Viruses and bacteria can activate an evasive strategy to avoid their lysis. For example, they can inhibit the ubiquitin-proteasome system. Another method of microbial evasion involves inhibiting TAP or even preventing peptide loading onto MHC-I.

CONCLUSIONS

In conclusion, the 26S proteasome plays an important role in the immune response against intracellular viruses and bacteria by degrading pathogenic proteins and contributing to antigen presentation. In the immune response against viruses, the proteasome is crucial for protein processing and the production of antigenic peptides that are presented to MHC-I and recognized by cytotoxic CD8+ cells.

Conflict of interest
The author declares that they have no conflict of interest.

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