Influence of Fiber Sheet on Tail Fiber

Article Overview

Fiber sheets can provide mechanical support and influence the structural stability and functional dynamics of viral tail fibers.

Mechanical Stabilization

Viral tail fibers, such as the T4 phage long tail fibers (LTFs), are elongated, flexible, and trimeric proteins that mediate host recognition and attachment . When adsorbed onto a substrate like a fiber sheet, the fibers experience mechanical stabilization, which can affect their bending, stretching, and overall rigidity. Atomic Force Microscopy studies of gp37 fibers on mica revealed a radial stiffness of ~0.08 N/m and a breaking force of ~120 pN, with a Young's modulus of ~20 MPa . These parameters suggest that a supporting sheet can prevent excessive deformation and maintain the fibers' functional conformation.

Functional Implications

Tail fibers interact dynamically with bacterial receptors, such as lipopolysaccharide (LPS) and outer membrane protein C (OmpC), using a ball-shaped tip that acts as a molecular pivot . A fiber sheet can modulate the angle and position of fiber attachment, potentially influencing the efficiency of reversible binding and the virus's ability to "walk" on the bacterial surface. By providing a stable platform, the sheet may reduce Brownian motion-induced detachment, enhancing the probability of successful host recognition .

Structural Considerations

Recent structural modeling and segmentation approaches, such as RBPseg combined with AlphaFold2-multimer, show that tail fibers are modular and contain multiple domains . A fiber sheet could interact differently with each domain, potentially affecting domain flexibility and inter-domain communication, which are critical for conformational changes during infection. This suggests that the substrate can influence both the mechanical and functional properties of the fibers.

Summary

In essence, a fiber sheet acts as a mechanical scaffold that can stabilize tail fibers, maintain their functional architecture, and potentially enhance host attachment efficiency. This effect is particularly relevant for experimental studies using AFM or for designing engineered phages where fiber orientation and stability are critical for infection or therapeutic applications .

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Fiber layering improves fill"s strength features as a result of the coupling of fiber improvement of microscopic pore

Here, we introduce RBPseg, a method that combines monomeric ESMFold predictions with a structural-based domain

In addition, T4 phage possesses short and long tail fibers at the baseplate and a head whisker at the head-to-tail

Despite the wide occurrence of Tfa proteins, their functional mechanism has not been elucidated. Here, we investigate

Surface treatment of cattail, a lignocellulosic renewable fiber, was investigated to determine the conditions that would reduce

The complicated nature of fiber structures necessitates the participation of intra- or intermolecular chaperones for their

In this study, we report the cryo-EM structure of the simplified tail fiber complexed with its chaperone from the

Abstract Normal particles of bacteriophage T4 have six long tail fibers attached to a hexagonal baseplate. T4 particles

The myophage T4 long tail fibre is the most extensively characterized tail fibre system. This fibre is composed of four different

Here, we discuss the molecular mechanisms and models of the tail fibers of the well-characterized T4 phage"s interaction with host

The aim of this work is to present the development of a bio-inspired approach for a robotic tail using Macro Fiber

This study investigates the effect of mechanical, morphological, and frequency damping properties of a fish tail palm

Additionally, we conducted a structural classification of 67 fibers and their domains, which identified 16 well-defined

Our findings suggest the existence of modular fibers as well as fibers with different sequences and shared structure,

Using homology modeling with the structurally characterized T7 phage, they generated the tail fiber structure of T3

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