

عنوان مقاله:

A Computational Study on the Effect of Base Geometry of Cilia in Its Response to Fluid Flow

محل انتشار:

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خلاصه مقاله:

Cilia are extrusions that egress from cell body into extracellular matrix. Experiments had shown that primary cilia were flow sensors and they were deflected under fluid flow, This event caused a cascade of molecular events. The present study focuses on the basic geometry of the cilia, which is connected to the cell surface through a thin elastic layer called spring foundation. The primary cilia is simulated with a linear elastic material and finite element method was performed along with fluid-solid interaction techniques to solve the fully coupled governing equations. Graphs of maximum stress in the primary cilia base versus spring constant of the thin layer for two different fillet radius show that change in fillet radius from $0.1\ \mu\text{m}$ to $0.15\ \mu\text{m}$ leads to a decrease in displacement of the tip cilia from $3.3\ \mu\text{m}$ to $2.8\ \mu\text{m}$ and an increase in stiffness of spring foundation. The obtained results show that increasing fillet radius makes pivoting movement of the primary cilia is more difficult than initial fillet radius. So, in cilia modeling, the fillet radius should be considered and it can be used to justify pivoting movement of the primary cilia and choose reliable stiffness of spring foundation

کلمات کلیدی:

Primary Cilium; Mechanosensation; Fluid-Structure Interaction; Cell Mechanics

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