Mechanics in Medicine: Theramechanics for Cancer Therapy

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Oral contribution

This seminar will explore the emerging field of theramechanics in biology, focusing on numerical models developed to understand cell migration [1,2] and cancer invasion. Theramechanics involves mechanical interventions at molecular, cellular, and tissue scales to transform potentially destructive mechanical effects into positive outcomes, promoting recovery or slowing disease progression [3,4]. The talk will highlight the critical role of mechanics in biological processes, particularly in cancer invasion, where mechanical properties of cells and their environment significantly influence disease progression.

The seminar will present several numerical models developed to study cell migration in confined environments, a crucial aspect of cancer invasion and other biological phenomena [5]. These models simulate cell movement through sub-cellular and sub-nuclear constrictions, mimicking the complex geometries and mechanical properties of the extracellular matrix (ECM). By modulating the geometrical and mechanical properties of the nucleus, these models provide insights into how cells adapt their shape and migratory behavior to navigate through confined spaces.

Key findings from these models include the influence of nuclear stiffness and size on cell migration. These insights suggest potential theramechanical strategies for cancer treatment, such as stiffening or enlarging the nucleus to inhibit cell migration and slow down cancer invasion.

The seminar will also discuss the broader implications of theramechanics in biology. By understanding and manipulating the mechanical properties of cells and their environment, we can develop new therapeutic approaches for various diseases. The talk will conclude with future directions in theramechanics research, emphasizing the importance of interdisciplinary collaboration between biologists, engineers, and clinicians to advance this field.

References

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