## B9.2

# A combined continuum-tensegrity FE model to describe the mechanical behaviour of a chondrocyte cell: definition, identification and validation by means of AFM indentation and micropipette aspiration

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The mechanical properties of human cells and their subcomponents play a key role in the mechanotransduction of external stimuli into physiological processes such as proliferation, differentiation and migration. As a result, the interest in the mechanical behaviour of living cells has drawn a lot of attention within the scientific community in recent years. Indeed, the experimental investigation of their mechanical properties has always been challenging since many parameters can affect the in-vivo as well as in-vitro tests. Moreover, these issues are particularly relevant in the study of tumour cells due to their intra and inter tumour variability. For the above reasons, the use of computational models might become a helpful and powerful tool in addressing cell biomechanics.

Here we present a Finite Element (FE) Model (Abaqus/CAE 2019, Dassault Systems) to illustrate the mechanical behaviour of a cell, by simulating both an AFM indentation and a micropipette aspiration. The cell has been described combining a continuous part (nucleus, cytoplasm and membrane) and a tensegrity structure (cytoskeleton). This approach has been applied in previous works [1], providing the main features of cells mechanics, e.g., the strain hardening due to the cytoskeleton prestress.

The model parameters were identified with AFM indentation experimental data on chondrocytes and chondrosarcoma cells (e.g. [2]) and then validated by simulating micropipette aspiration of living cells and comparing the results with experimental observations from the literature [3].

Our results and validations suggest that this model may represent both the experimental setups with a good deal of accuracy. Indeed, this FE model represents a useful tool for the mechanical investigation of both living and cancer cells also in the studies of the mechanical processes that undergo during the different stages of tumour cells.

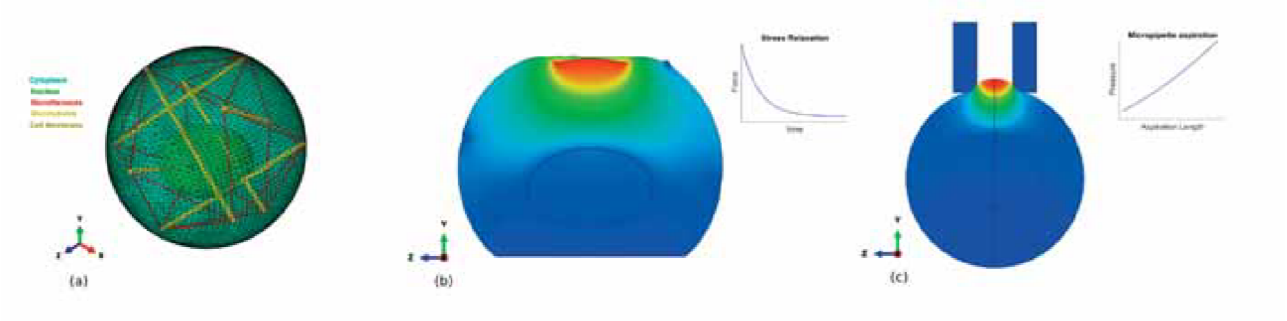


*Figure caption: (a) Chondrocyte discretization with a continuum-tensegrity approach, (b) Displacement contour field during AFM indentation and stress relaxation data, (c) Displacement contour during micropipette aspiration and length vs aspiration data.*

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**References:**

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