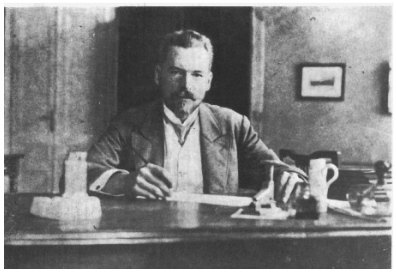

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# The role of tissue in micro indentation tests of a plant cell

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Classical measuring methods used in material engineering are not suited for biological tissues, especially in microscale. It is almost impossible to produce a homogenous specimen of biological material for a classical tensile test. Indentation experiments are much easier to perform on a microscopic object like a cell. However, this comes at a cost: interpretation of the results. Extracting material properties from an indentation experiment is a serious issue, and it becomes more difficult for inhomogeneous "materials," for example cells. And for a system as complex as tissue, there is no other method for extracting material properties than the one utilizing finite element simulations. In these simulations, it is crucial to know in what range the indentation experiment affects the tissue to optimize simulations.
Plant tissue works mechanically like an inflatable mattress. The rigidity comes from pressure exerted on the internal side of cell walls. The pressure of the cytoplasm is crucial to the tissue's mechanical behavior. There are two approaches to modeling the pressure. One is to exert constant pressure on the inner side and the other is to treat cytoplasm as incompressible liquid. The difference between the two models is exceptionally pronounced in the case of the 2D tissue-like epidermis. Here we present the results of the indentation of a 2D tissue of several sizes starting from a single cell. Comparison between the following models: constant pressure and hydrostatic, helps to understand how the force induced by indentation propagates along the tissue. This assessment of the maximal distance probed by the indentation experiment will help in the long-term goals of measuring the properties of the cells in tissue.

**Primary author:** KRZEMIEN, Leszek (Instytut Katalizy i Fizykochemii Powierzchni im. Jerzego Habera Polskiej Akademii Nauk)

**Co-author:** BARBASZ, Jakub (Instytut Katalizy i Fizyochemii Powierzchni im. Jerzego Habera PAN)

**Presenter:** KRZEMIEN, Leszek (Instytut Katalizy i Fizykochemii Powierzchni im. Jerzego Habera Polskiej Akademii Nauk)

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