The molecular basis of the physical properties of plant cell walls, in general remain poorly understood. Ongoing studies are providing more evidences against the model of an independent cellulose-hemicellulose network embedded in pectic matrix and support the idea that pectins are more intimately linked into cellulose microfibrils than previously suspected. Recently, in the Department of Microstructure and Mechanics of Biomaterials in the Institute of Agrophysics PAS, it was discovered that in fresh fruits and vegetables such as carrot, apples or pears, diluted alkali soluble fraction of pectin (DASP) form regular interlinked network on mica. The structural features of pectin were further investigated to identify the underlying mechanism responsible for self-assembly phenomenon of diluted alkali soluble fraction. Our studies showed that characteristic bend points observed when DASP was deposited on mica originated from a single rhamnose residues interspersed within the homogalacturonan chains. It is suspected that this regular structure has a great importance for cell wall integrity and therefore texture and firmness of the whole fruits and vegetables. **The goal of this research is to identify the mechanical role of single rhamnose residues interspersed within the homogalacturonan regions of diluted alkali soluble fraction pectin extracted from plant cell wall.**

The key aspect of the proposed research is utilization of the enzymes, which are a part of bacterial and fungus rhanmnogalacturonan-I-degrading systems, to investigate the role of specific structural feature of pectin. This will allow for precise control of occurrence of rhamnose residues interspersions and thus enable to study the rheological and gelling properties of this structure in isolated system. Effect of enzymatic treatment on rhamnose residues interspersions will be studied by means of atomic force microscopy. Mechanical role of single rhamnose residues interspersed within the homogalacturonan regions will be studied using bacterial cellulose plant cell wall analogues with incorporated modified pectin. Finally the above described mechanisms and outgoing rheological properties of studied system will be modeled using novel numerical simulation methods. Models based on principles of dissipative particle dynamics will be employed to investigate the effect of rhamnose residue interspersions on aggregation and rheological properties of pectin.

The basic knowledge obtained during the proposed research, will be the knowledge of the functional role of specific molecular structure of cell wall polysaccharides which are part of the DASP fraction. The proposed research project based on enzymatic modifications of pectic matrix combined with AFM imaging, computational chemistry and development of plant cell wall analogues will provide new approach to studying localized pectin structure that may increase our knowledge of the biological functions and functional properties of pectin.