**Title of the project**

Mechanobiology of the Urinary Bladder: Mathematical Models and Devices to Manage Dysfunction

**Category (translational/bioengineering/biodesign):** Translational research

**Investigators (IISc and clinical institutions)**

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**Statement of research**

The urinary bladder is a hollow muscular organ which performs important functions of urine storage without leakage under low pressures, and voiding, or micturition, which requires a well-coordinated rapid contraction of the bladder and relaxation of the urethra. Changes in the bladder properties generally occur through changes in the mechanical loading of the organ over a long time duration. These alter the local mechanical milieu of the cells comprising the organ which leads to fibrosis in specific cases and dysfunction in the cell activity. Dysfunction of the bladder affects many people, compromises their quality of life, and may have psycho-social biases. In particular, bladder dysfunction in the elderly have several causes that could include differences in the expression of genes/molecular pathways of smooth muscle cells in an age dependent manner and related differences in tissue properties.

The goals of this project are to characterize the pressure-volume relationships in young and old bladders. We propose to characterize constitutive properties of bladder tissues from older patients undergoing surgery, and study the whole genome expression profile of the bladder smooth muscle cells isolated from bladder biopsies of individuals of different age groups. Bioreactor studies, using cells seeded on 3D scaffolds, will be used to expose specific mechanical stimuli on the cells to characterize changes in the mechanobiology in response to altered biochemical and mechanical stimuli. Mathematical models of the bladder and investigations on the combined roles of mechanics and growth factors on mechanobiology of the detrusor smooth muscle cells will be explored to understand the evolution of the bladder tissues due to aging and those due to disease.

![Mechano-biochemical feedback in the urinary bladder](image)