

Mechanotransduction in the urothelium

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Abstract

The urothelium, which covers the inner surface of the bladder, is continuously exposed to a complex physical environment where it is stimulated by and responds to a wide range of mechanical cues. Mechanically activated ion channels allow the urothelium to convert mechanical stimuli into biochemical events that influence its surface area and the suburothelial tissues, including afferent nerve fibres, interstitial cells of Cajal (ICCs) and detrusor smooth muscle cells. This process ensures normal urinary function during the cycles of filling and voiding. However, under prolonged and abnormal pathological conditions, improper mechanotransduction may contribute to bladder dysfunction, such as overactive bladder. In this review, we summarize developments in the understanding of urothelial mechanotransduction. First, we describe the adaptation of the urothelium to variations in bladder volume during the micturition cycle via mechanotransduction processes. Then, we review the effect of urothelial mechanotransduction on suburothelial tissues. Finally, we focus on mechanically activated ion channels present in the urothelium, primarily transient receptor potential (TRP) channels and mechanosensitive Piezo channels, and the potential pathophysiological role of these channels in the bladder. A more thorough understanding of the urothelial mechanotransduction function may inspire the creation of new therapies for lower urinary tract diseases.

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Figure 1

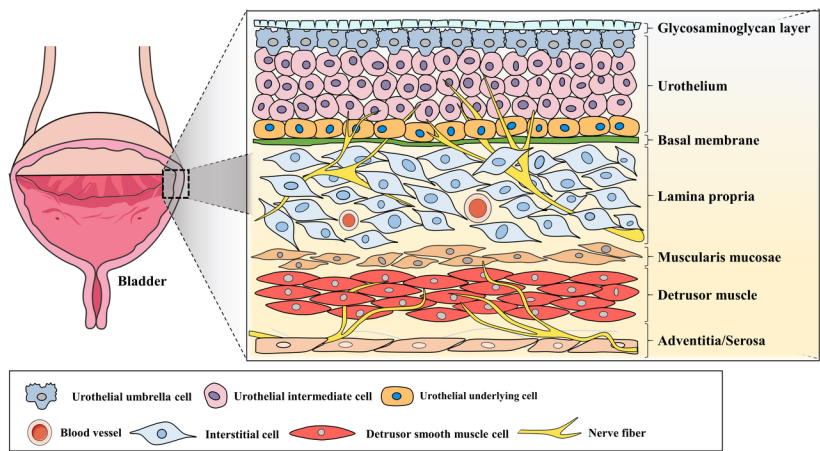


Figure 2

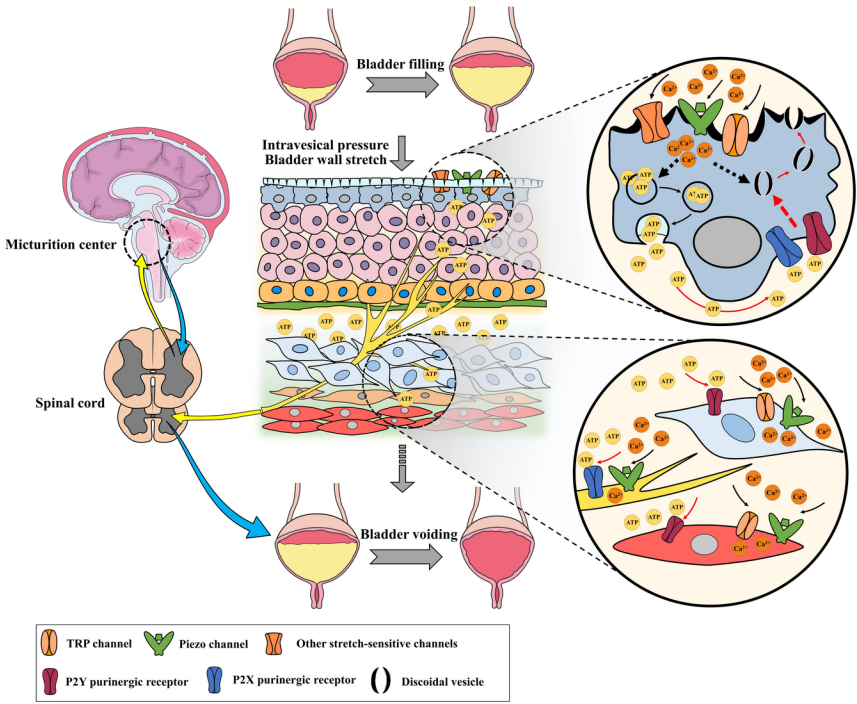


Figure 3

