TISSUE ENGINEERING IN RECONSTRUCTIVE UROLOGY, DREAMS AND REALITY

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Introduction
Tissue engineering and biomaterials science currently offer the technology needed to replace the urinary tract wall and kidneys. This review addresses current achievements and barriers for the regeneration of the urinary tract and kidney.

Materials and Methods
Medline was search for urinary tract tissue engineering, regenerative medicine and stem cells. In this review we analyzed history of urinary tract tissue engineering together with current attempts in urinary tract elements construction using tissue engineering methods. Based on literature and our own experience we presented problems and future perspectives related to the artificial urinary tract elements.

Results and Discussion
The availability of kidney and other organs from matching donors is not enough for many patients on demand for organ transplant. The most important achievements in the field of regenerative medicine of kidney, which were mentioned and described here, are currently cumulated in 4 areas of interest: stem cell-based therapies, neo-kidneys with specially designed scaffolds or cell-seeded matrices, bioartificial kidneys and innovative nanotechnologically bioengineered solutions. Regenerative medicine is still insufficient to completely replace current therapy methods used in patients with chronic kidney disease [1]. Large ureter damages are difficult to reconstruct. Current techniques are complicated, difficult to perform, and often associated with failures. The ureter has never been regenerated thus far. Therefore the use of tissue engineering techniques for ureter reconstruction and regeneration seems to be a promising way to resolve these problems. For proper ureter regeneration the following problems must be considered: the physiological aspects of the tissue, the type and shape of the scaffold, the type of cells, and the specific environment [2,3]. Numerous studies to develop a substitute for the native urinary bladder wall using the tissue engineering approach are ongoing. The idea of urinary bladder regeneration through tissue engineering is an old one. Many natural and synthetic biomaterials were used for urinary bladder regeneration with a wide range of outcomes. Stem cells combined with biomaterials open new treatment methods, including even de novo urinary bladder construction. Recent progress in the tissue engineering field suggest that in vitro engineered bladder wall substitutes may have expanded clinical applicability in near future but preclinical investigations on large animal models with defective bladders are necessary to optimize the methods of bladder reconstruction by tissue engineering in humans [4,5]. There are still many issues before advances in tissue engineering should be introduced before clinical application [6]. One of the most important is stem cells aging and their application for urinay bladder reconstruction [7]. Expression of cytokines and MMPs during bladder regeneration can influence the final result [8]. The histological presence of a regenerated all layers of the urinary bladder do not guarantee proper urinary bladder function [9]. Urine is a highly cytotoxic agent, which influences stem cell therapies in urology [10]. Finally, stem cells harvest from oncological patients carry potential risk cancer development after regenerative therapy [11]. Artificial urinary conduit has a great chance to become the first commercially available product in urology constructed by regenerative medicine methods [12].

Conclusions
Numerous studies to develop a substitute for the urinry tract elements using the tissue engineering approach are ongoing. Stem cells combined with biomaterials open new treatment methods. Before tissue engineering techniques could be recognize as effective and safe for patients, more research studies performed on large animal models and with long follow-up are needed to carry on in the future.

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