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Biomedical Engineering  
Neo – Bladder

The national waiting list for organ donation is rising at an alarming rate of a new name every ten minutes, with 91,547 people currently on the list (3/23/06). An average of 18 men, women, and children die every day waiting for an organ transplant. Anthony Atala, M.D., director of the Institute for Regenerative Medicine at Wake Forest University School of Medicine hopes that his techniques will help alleviate the shortage of organs. He is currently working on 20 different tissues and organs. “We have shown that regenerative medicine techniques can be used to generate functional bladders that are durable,” said Atala.



“This suggests that regenerative medicine may one day be a solution to the shortage of donor organs in this country for those needing transplants.” Regenerative medicine is a revolutionary approach capable of curing conditions rather than treating them. It is a method of applying tissue science, and tissue engineering to fix damaged tissues and organs. This new field embraces innovative tactics to treat diseases and restore biological function by means of: therapies to encourage the body to regenerate damaged tissues autonomously, tissue engineered implants prompt regeneration, and transplantation of healthy tissue directly into damaged environments. Patients with end-stage bladder disease can be treated with cystoplasty using

gastrointestinal segments. These segments in urinary tract are linked to several complications. Thus, they searched for a substitute approach by means of autologous engineered bladder tissues for reconstruction. The research team at Children's Hospital in Boston did the first procedure in 1999 but wanted to make sure it would work on others. 7 patients with myelomeningocele aged 4–19 years, with high-pressure or poorly compliant bladders, were chosen for cystoplasty. Bladder biopsies were attained from each. Urothelial and muscle cells were grown in a culture, and seeded on a biodegradable bladder-shaped scaffold made of collagen, or a compound of collagen and polyglycolic acid. Seven weeks after, biopsy autologous engineered bladders were used for reconstruction and implantation. Post-operatively, the bladder leak point pressure decreased at capacity. Bowel function returned quickly after surgery. Built bladders were 3 times more elastic and better at holding urine. No effects to metabolism were noted, urinary calculi did not form, mucus production remained normal, and renal function was conserved. Engineered bladder biopsies confirmed ample structural architecture and phenotype. In all seven patients, kidney function was preserved. The patients must still empty their bladders regularly with a tube but can avoid leaking in between.

■ **Scientific Publications**

- ⑩ Tissue-engineered autologous bladders for patients needing cystoplasty  
Atala A, Bauer SB, Soker S, Yoo JJ, Retik AB  
The Lancet
- ⑩ [Tissue engineering and regenerative medicine: concepts for clinical application.](#)  
Atala A.  
Rejuvenation Research, 7 (1), pp. 15-31, 2004
- ⑩ **Press Releases**
- ⑩ [April 3, 2006: Tengion: Advancing Clinical Development of Laboratory-Grown Human Organs from a Patient's Own Cells](#)
- ⑩ [January 9, 2006: Collaboration Established Between Wake Forest University Health Sciences and Tengion to Advance Regenerative Medicine Research](#)