Wake Forest Institute for Regenerative Medicine

Regenerative Medicine: New Approaches to Health Care

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Organ transplant wait list and number of transplants
Regenerative Medicine

- Cells
- Cells and Scaffolds
- Enabling Technologies
Cell Therapy Human Clinical Trials: Skeletal Muscle

1. Small sample of tissue from the patient
2. Expand muscle cells in tissue culture
3. Inject cells in damaged area in same patient
1. **Small tissue sample**
2. **Extract cells**
3. **Increase cell number in a dish**
4. **Place cells on resorbable scaffold and mature**
5. **New Urethra**
Large Defects Require Scaffolds and Cells
Tissue-engineered autologous urethras for patients who need reconstruction

March 2011
Resorbable Materials
Engineered Blood Vessel
Engineered Heart Valve

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Hollow Non-Tubular Organs: Bladder

"Tissue-engineered autologous bladders for patients needing cystoplasty"

April 2006
Solid Organs: Kidneys

Kidney biopsy

Normal kidney cells expanded outside the body

Kidney cells inserted back into the diseased kidney
Regeneration of Kidney Tissue

Native region

Regenerated region
ITOP: Integrated Tissue and Organ Printing System

- Unique Bioprinting system designed at WFIRM over the last 14 years
- Allows for tissues and organs to be printed with structural integrity while maintaining function long term

Nature Bio, March 2016
Strategies For Tissue and Organ Engineering

- Level I: Flat Tissue - cartilage, muscle, skin
- Level II: Tubular - blood vessels, esophagus, fallopian tubes, intestine, trachea, ureter, urethra
- Level III: Hollow Non-Tubular - bladder, stomach, vagina
- Level IV: Solid Organs - heart, kidney, liver, lung

Image by: C Harrington & LB Olive
***WFIRM MULTI-DISCIPLINARY TEAM***

- Growth factor biology (molecular biologists)
- Cell growth and expansion (cell biologists)
- Biomaterial production (material scientists)
- Cell-Biomaterial interactions (bio-engineers)
- Small & large animal models (physiologists, biochemists, veterinarians)
- Clinical trials (physicians, epidemiologists, statisticians, regulatory specialists)
A national consortia funded by the Department of Defense to advance regenerative medicine technologies to our wounded warriors

1. Burns
2. Extremity Injuries
3. Craniofacial
4. Composite Tissue Allo-transplantation
5. Genitourinary injuries