Tao Xu, Ph.D.

Assistant Professor of Biomedical Engineering

Department of Mechanical Engineering, University of Texas at El Paso

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Adjunct Assistant Professor

Paul L. Forest School of Medicine, Texas Tech University Health Sciences Center

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EDUCATION

3/2005-7/2008 **Post Doctorate in Tissue Engineering and Regenerative Medicine**
Wake Forest Institute for Regenerative Medicine (WFIRM) and Wake Forest University School of Medicine, Winston-Salem, North Carolina

9/2001-1/2005 **Ph.D. in Bioengineering**
Clemson University, Clemson, South Carolina

9/1997-5/2000 **Nuclear Medicine**
China Institute of Atomic Energy, Beijing, China

9/1990-5/1994 **B.S. in Polymeric Materials & Composites**
Beijing University of Aeronautics & Astronautics, Beijing, China

PROFESSIONAL EXPERIENCE

2008 – Present **Assistant Professor**, Department of Mechanical Engineering, University of Texas at El Paso, El Paso, TX
Research interests include:

- Tissue fabrication and regeneration
- Biomimetic materials development
- Stem cell engineering
- Development of photovoltaic cells for biomedical applications

2009 – Present **Adjunct Assistant Professor**, Department of Biomedical Sciences, Paul L. Forest School of Medicine, Texas Tech University Health Sciences Center

2005 – 2008 **Research Scientist ,** Wake Forest Institute for Regenerative Medicine and Wake Forest University Health Sciences, Winston Salem, NC

2001 –2005 **Research Assistant,** Department of Bioengineering, Clemson University, Clemson, SC

2000 –2001 **R&D engineer,** China Institute of Atomic Energy, Beijing, China

1994 – 1997 **R&D engineer,** Beijing Composites Materials Co., Ltd., Beijing, China

HONORS AND AWARDS

1. "**Best Interactive Paper Display**", Digital Fabrication 2006 Conference, Denver, CO, 2006
2. "**Best Young Researcher Award**", The Second International Workshop on Bioprinting, Biopatterning & Bioassembly, Charleston, SC, 2005

3. "**Graduate Student Gold Award**", Materials Research Society, Boston, MA, 2004
4. "**The 1st place in the Poster Competition**", NC Tissue Engineering and Regenerative Medicine Meeting, Winston-Salem, NC, 2007
5. "**Silver Award**", 2006 Resident's and Fellow's Research Day, Wake Forest University Baptist Medical Center, Winston-Salem, NC, 2006
6. "**Excellence in Research**", Clemson University, Clemson, SC, 2005
7. "**Excellence in Research**", Clemson University, Clemson, SC, 2002
8. "**Whitaker Foundation Travel Award**", Whitaker Foundation , Charleston, SC, 2005
9. "**NIH Travel Support**", National Institute for Biomedical Imaging and Bioengineering (NIBIB), National Institute of Health (NIH), Anaheim, CA, 2004

PATENTS

1. Boland T, Wilson WC, **Xu T**. "Inkjet printing of viable cells". U.S. patent (US 7,051,654)
2. Yoo JJ, **Xu T**, Atala A. "Inkjet printing of tissues". U.S. Provisional Patent Application (60/794,033). International Patent Application (PCT/US2007/009612)
3. **Xu T**, Yoo JJ. Atala A. "Inkjet gene printing". ". U.S. Provisional Patent Application (60/942,549), International Patent Application (PCT/US2008/007158)
4. **Xu T,** Yoo JJ, Atala A, Denise D. "Inkjet printing of tissues and cells". U.S. Provisional Patent Application (61/028,761), Intentional Patent Application (PCT/US2009/00940)

Pending Invention Disclosures:

1. **Xu T**, Zubia D, Terreros D. "Solar Cells/Biological Cells Hybrid System".
2. **Xu T**, Pirela-Cruz M, Terreros D. "Combined negative pressure /living tissue scaffolding approach for would repair and regeneration".
3. Pirela-Cruz M, Terreros D. **Xu T** "The second generation nerve conduit for nerve repair and regeneration".
4. Sarkodie-Gyan T, Terreros D, **Xu T**. "Biodynamic Evaluation and Assessment for Early Detection of Breast Cancer".

PUBLICATIONS

Peer-Reviewed Publications

Journal articles

1. **Xu T**, Baicu C, Aho M, Zile M, Boland T. "Fabrication and characterization of bio-engineered cardiac pseudo tissues". Biofabrication 1(3): 035001 (2009).
2. **Xu T**, Molnar P, Gregory C, Das D, Boland T, Hickman JJ. "Electrophysiological characterization of embryonic hippocampal neurons cultured in a 3D collagen hydrogel" Biomaterials. 30(26):4377-83.(2009) (2008 JCR Impact factor: 6.646)
3. **Xu T**, Rohozinski J, Zhao W, Crafton E, Atala A, Yoo JJ. "Inkjet mediated gene transfection into living cells combined with targeted delivery. Tissue Engineering. 15(1):95-101. (2009). (2008 JCR Impact factor: 4.699)
4. **Xu T**, Olson J, Zhao W, Atala A, Zhu JM, Yoo JJ. "Characterization of cell constructs generated with inkjet printing technology using in vivo magnetic resonance imaging". Journal of Manufacturing Science and Engineering. 130 (2): 021013 (2008) (2008 JCR Impact factor: 0.740)
5. **Xu T**, Kincaid H, Atala A, Yoo JJ "High Throughput Production of Single Cell Microparticles Using an Inkjet Printing Technology". Journal of Manufacturing Science and Engineering. 130 (2):021017 (2008)

(2008 JCR Impact factor: 0.740)

6. De Coppi P, Bartsch G, Siddiqui MM, **Xu T**, Santos CC, Perin L, Mostoslavsky G, Serre AC, Snyder EY, Yoo JJ, Furth ME, Soker S, Atala A. "Isolation of clonal amniotic stem cell lines with potential for Therapy". Nature Biotechnology, 25(1):100-106 (2007). **Cover Story on Nature Biotech.** (2008 JCR Impact factor: 22.297)
7. Boland T, **Xu T**, Damon BJ, Manley B, Kesari P, Jalota S, Bhaduri S. "Drop-on-demand printing of cells and materials for designer tissue constructs". Materials science & engineering. C, Biomimetic materials and Supramolecular Systems. 27(3): 372-376 (2007) (2008 JCR Impact factor: 1.812)
8. **Xu T**, Zhang N, Nichols HL, Shi D, Wen X. "Modification of nano-structured materials for biomedical applications". Materials science & engineering. C, Biomimetic materials and Supramolecular Systems. 27(3): 579-594 (2007) (2008 JCR Impact factor: 1.812)
9. Boland T, **Xu T,** Damon B, Cui X. "Application of inkjet printing to tissue engineering". Biotechnology Journal. 1(9):910-7 (2006)
10. **Xu T,** Gregory C, Peter M**,** Cui X, Jalota S, Bhaduri SB, Boland T. "Viability and electrophysiology of neural cell structures generated by the inkjet printing method". Biomaterials. 27(19):3580-8 (2006) (2008 JCR Impact factor: 6.646)
11. Varghese D, Deshpande M, **Xu T**, Kesari P, Ohri S, Boland T. "Advances in tissue engineering: cell printing". Journal of Thoracic and Cardiovascular Surgery. 129 (2): 470-472 (2005) (2008 JCR Impact factor: 3.037)
12. **Xu T**, Jin J, Gregory C, Hickman JJ, Boland T. "Inkjet printing of viable mammalian cells". Biomaterials. 26(1): 93-99 (2005) (2008 JCR Impact factor: 6.646)
13. Roth EA, **Xu T**, Das M, Gregory C, Hickman JJ, Boland T. "Inkjet printing for high-throughput cell patterning". Biomaterials. 25 (17): 3707-3715 (2004) (2008 JCR Impact factor: 6.646)
14. **Xu T**, Petridou S, Lee EH, Roth E, Vyavahare N, Hickman JJ, Boland T. "Construction of high-density bacterial colony arrays and patterns by the ink-jet method. Biotechnology & Bioengineering". 85 (1): 29–33 (2004) (2008 JCR Impact factor: 2.936)
15. Wu FB, Han SQ, **Xu T**, He YF. "Sensitive time-resolved fluoroimmunoassay for simultaneous detection of serum thyroid-stimulating hormone and total thyroxin with Eu and Sm as labels". Analytical Biochemistry 314(1): 87-96 (2003) (2008 JCR Impact factor: 3.088)
16. Wu FB, Xu YY, **Xu T**, Wang YS, Han SQ. "Time-resolved fluorescence immunoassay of thyroxine in serum: Immobilized antigen approach". Analytical Biochemistry 276(2): 171-176 (1999) (2008 JCR Impact factor: 3.088)
17. **Xu T**, Han Shiquan and Wang Yishan. "Study of covalent immobilization of bio-molecules in solid phase immunoassay". Guowai Medical Science: Clinical Biochemistry and Medical Diagnosis. 21(5): 244 (2000)
18. Wu D and **Xu T**. "Preparation of amino acid with high-temperature solid-state catalytic isotope exchange method". Atomic Energy Science & Technology. 34: 175 (2000)
19. **Xu T** and Wu FB. "Application of plastics in immunoassay". China Plastics, 67(10):1 (1999) (in Chinese)
20. **Xu T** and Gao K. "Development of automotive fiber reinforced plastics wind shield by the RTM technology". Automobile Technology & Material. 121(1):19 (1999)

Book chapters

21. **Xu T**, Lee SJ, Yoo JJ. "Three-Dimensional Tissue Printing Technology". Book chapter in "Manual in Biomedical Research-Vol.4: a Manual for Biomaterials/scaffold Fabrication Technology" World

Scientific Press. Page 181-191 (2007)

22. **Xu T,** YY Yuan, Yoo JJ, "Cell Sources for Printed Biomaterials". Book chapter in "Printed Biomaterials: Rapid Prototyping in Medicine and Surgery". Springer. In press.
23. **Xu T** "Stem Cells Based Biofabrication". Book chapter in "Stem Cells Engineering". CRC Press. Accepted.

Conference Proceeding Papers

24. **Xu T,** Yoo JJ. "Inkjet printing for regenerative medicine". NIP24/Digital Fabrication 2008, Technical Program and Proceedings. Pages: 7-9 (2008)
25. **Xu T**, Hipp J, Atala A, Yoo JJ, Van Dyke ME. "Genomic guided ECM biomaterials development for regenerative medicine applications". Tissue Engineering Part A. 14(5) Pages: 739-739 (2008)
26. **Xu T** , Rohozinski J, Zhao W, Moorefield E, Atala A, Yoo JJ. "Inkjet gene printing: A novel approach to achieve gene modified cells for tissue engineering". Tissue Engineering Part A. 14(5) Pages: 869-870 (2008)
27. Xu T, Zhao W, Zhu JM, Atala A, Yoo JJ. "Bio-printing of living organized tissues using an inkjet technology". FASEB JOURNAL**.** Volume: **21** Issue: **5** Pages: A636-A636 (2007)
28. **Xu T**, Zhao W, Atala A, Yoo JJ. "Bio-printing of living organized tissues using an inkjet technology". Digital Fabrication 2006 (ISBN / ISSN: 0-89208-264-X): P131-134 (2006)
29. **Xu T**, Jalota S, Manley B, Bhaduri S, Zile M, Baicu C, Boland T. "Drop-on Demand Printing of Cell and Materials for Designer Hybrid Cardiovascular Biomaterials". Digital Fabrication 2005 (ISBN / ISSN: 0-89208-258-5):P 178-178 (2005)
30. **Xu T,** Bacui C, Manley B, Zile M, Boland T. "A finite element model for drop-on-demand printing of designer hybrid cardiovascular constructs". Proceedings of American Society of Mechanical Engineers, IMECE2005-79082, (2005)
31. **Xu T**, Gregory C, Molnar P, Boland T. "Fabricating neural and cardiomyogenic stem cell structures by a novel rapid prototyping — the inkjet printing method". Materials Research Society proceeding, volume 845, AA1.4, 2005
32. Kesari P, **Xu T**, Boland T. "Layer-by-layer printing of cells and its application to tissue engineering". Materials Research Society proceeding, volume 845, AA4.5. (2005)

INVITATED PRESENTATINOS

1. "Organ Printing for Regenerative Medicine". **Invited talk**. Sun Yat-Sen University, Guangzhou, China. January 2010.
2. "Organ Printing for Tissue Engineering". **Invited talk**. South China University of Technology, Guangzhou, China. January 2010.
3. "Organ Printing for Regenerative Medicine". **Invited talk.** Institute of Chemistry, Chinese Academy of Sciences, Beijing. December 2009.
4. "Neurovascular tissue engineering". **Invited talk**. The XXIX US Colombian Medical Association Congress. Las Vegas, NV. July, 2009.
5. "Inkjet technology for regenerative medicine". **Invited talk**. NIH-NSF Bioengineering and Bioinformatics Summer Institute and NASA-REU SSBR, Clemson, SC, July, 2008
6. "Organ Printing using Inkjet Technology for Regenerative Medicine". **Invited talk**. Clark-Morrison Children's Urological Center, University of California at Los Angeles. Invited by Professor Bernard Churchill. Los Angeles, CA, June 2008.

7. "Bio-printing of living organized tissues using an inkjet technology". **Invited talk**, NC Tissue Engineering and Regenerative Medicine 2006 Meeting, Raleigh, NC, August 2006
8. "Organ Printing". **Invited student presentation**. 2003 National NSF EPSCoR Conference. Las Vegas. NV. September 2003.
9. "Cell Printing for Tissue Engineering". Guest lecture to MBA students in *Commercializing Innovation* at Wake Forest University Babcock Graduate School of Management, February 2008. Invited by Professor Tom Clarkson and Mr. Dean Stell.

CONFERENCE PRESENTATIONS

1. "Neurovascular tissue engineering". Invited talk. The XXIX US Colombian Medical Association Congress. Las Vegas, NV. July, 2009.
2. "Bioprinting for Regenerative medicine". Invited talk. 2009 TTU-UT Biomedical Symposium. El Paso, TX. May 2009.
3. "Inkjet technology for regenerative medicine". Invited talk. NIH-NSF Bioengineering and Bioinformatics Summer Institute and NASA-REU SSBR, Clemson, SC, July, 2008
4. "Bio-printing of living organized tissues using an inkjet technology". Invited talk, NC Tissue Engineering and Regenerative Medicine 2006 Meeting, Raleigh, NC, August 2006
5. "Generation of durable tissue constructs using a novel hybrid printing system". Oral presentation. Tissue Engineering and Regenerative Medicine International Society – North America 2008 meeting, San Diego. 2008.
6. "High-throughput production of single-cell hydrogel microparticles using inkjet printing technology". Oral Presentation. Tissue Engineering and Regenerative Medicine International Society – North America 2008 meeting, San Diego. 2008.
7. "*"In vivo* Generation of Functional Tissues using the Inkjet Printing Technology for Pediatric Reconstructive Surgery". Poster presentation. The American Academy of Pediatrics (AAP) 2008 National Conference, Boston, October, 2008
8. "Genomic Guided Stem Cell Differentiation Urological Tissue Regeneration Applications". Poster presentation. The American Academy of Pediatrics (AAP) 2008 National Conference, Boston, October, 2008
9. "Inkjet mediated gene transfection", poster presentation. TERMIS-EU 2008 meeting, Porto, Portugal, June, 2008
10. *"In vivo* Generation of Functional Tissues using the Inkjet Printing Technology", oral presentation. The 6th Combined Meeting of the Orthopedic Research Societies. Honolulu, Hawaii, October, 2007
11. *"In vivo* Generation of Functional Tissues using the Inkjet Printing Technology", oral presentation. TERMIS-EU 2007 meeting, London, UK, September, 2007
12. "Inkjet Gene Printing: A Novel Approach to Achieve Gene Modified Cells for Tissue Engineering", oral presentation. TERMIS , Toronto, Canada, June, 2007
13. *"In vivo* Generation of Functional Tissues using the Inkjet Printing Technology", oral presentation. TERMIS, Toronto, Canada, June, 2007
14. "High Throughput Genomic Guided ECM Screening for Regenerative Medicine Applications", oral presentation. TERMIS, Toronto, Canada, June, 2007
15. "Bio-printing of living organized tissues using an inkjet technology", oral presentation. Experimental Biology 2007. Washington DD, April, 2007

16. "High Throughput Genomic-Guided Biomaterials Development for Regenerative Medicine Applications", oral presentation. Society for Biomaterials. Chicago, IL, April, 2007
17. "Bio-printing of living organized tissues using an inkjet technology", poster presentation. Society for Biomaterials. Chicago, IL, April, 2007
18. "Bio-printing of living organized tissues using an inkjet technology", poster presentation. Digital Fabrication 2006, Denver, CO, September, 2006
19. "Gene guided biomaterials development", oral presentation. NC TERM 2006 Meeting, Raleigh, NC, August 2006
20. "Gene guided biomaterials development", poster presentation. Society for Biomaterials, Pittsburgh, PA, April 2006
21. "Inkjet Printing of Distinct Cell Types and Collagen Gels to Generate Heterogeneous 3D Cellular Constructs", oral presentation. 2006 Regenerate World Congress, Pittsburgh, PA, April 2006
22. "Functional Evaluation of 3-Dimensional Cardiac Constructs Fabricated by Rapid Prototyping", oral presentation. 2005 American Heart Association Scientific Sessions. Dallas, Texas, 2005
23. "Layer-by-layer Printing of Cells and its Applications to Tissue Engineering", poster presentation. Society for Biomaterial, Memphis, TN, April, 2005
24. "Layer by Layer Printing of Bone", poster presentation. Society for Biomaterial, Memphis, TN, April, 2005
25. "Fabricating 3D Functional Cardiac and Neural Constructs by the Inkjet Printing Method", oral presentation. 2nd International Workshop on Bioprinting, Biopatterning & Bioassembly, Charleston, SC, March, 2005
26. "Towards Establishing Engineering Models for Tissue Printing", oral presentation. 2nd International Workshop on Bioprinting, Biopatterning & Bioassembly, Charleston, SC, March, 2005
27. "Drop-on Demand Printing of Cell and Materials for Designer Hybrid Cardiovascular Biomaterials", oral presentation. Digital Fabrication 2005, Baltimore, Maryland, September, 2005
28. "A finite element model for drop-on-demand printing of designer hybrid cardiovascular constructs", oral presentation. ASME IMECE annual meeting, Orlando, FL, 2005
29. "Printing bone using an ink jet printer", poster presentation. The 7th EFFORT Congress. Lisbon, Portugal, June, 2005
30. "Fabrication of 3D functional cardiac tissues by using the inkjet printing method", oral presentation. 2004 Materials Research Society Fall Meeting, Boston, MA. November 2004.
31. "Engineering of Functional Three Dimensional Cell Structures by Inkjet Printing", oral presentation. 51st AVS Annual Meeting. Anaheim, CA. November 2004.
32. "Cell Printing to Engineer Functional Freeform Structures". Oral presentation. 2004 Joint Meeting of TESI and the European TES, Lausanne, Switzerland. October 2004
33. "Fabrication of functional cardiac and neural tissues by the inkjet printing method", poster presentation. 2004 Palmetto Biotechnology Alliance Meeting, Columbia, SC, October 2004
34. "Organ Printing". **Invited talk**. 2003 National NSF EPSCoR Conference. Las Vegas. NV. September 2003.
35. "Patterned Construction of Three-dimensional Neuronal Networks Using Ink Jet Directed Layer-by-Layer Deposition", poster presentation. 49th AVS Annual Meeting. Denver, CO. November 2002.

RESEARCH GRANTS

Active:

1. PI: "**Collaborative Research: Fluid Dynamics Foundations of Cell Printing**". National Science Foundation (NSF), $400,000 in total. Period: 2009-2012 (in collaboration with Rui Qiao, Clemson University)
2. PI: "**Autologous Stem Cell Based and Oxygen Releasing Bio-printed Tissue Grafts for Myocardial Infarct Repair**." University of Texas System Research Institute. $5,000. Period: 01/2009-12/2009
3. Co-investigator: "**Special Focus Competition: Graduate Programs at Institutions Serving Hispanic Americans**". Department of Education, $300,000. Period: 2009-2011. (PI: Schoephoerster, Richard)
4. Co-Investigator: "**In-situ Bio-Printing of Skin for Battlefield Burn Injuries**". Armed Forces Institute of Regenerative Medicine (AFIRM) Burn Program, U.S. Army, $1,000,000. Period: 2008-2013. (PI. James J. Yoo, Wake Forest)

Pending:

PI

1. "Bio-printing stem cell based and oxygen releasing tissue grafts for myocardial infarction repair". Submitted to NIH.
2. "Bio-printing stem cell based and oxygen releasing tissue grafts for myocardial infarction repair". Submitted to American Heart Association

Co-PI

3. "Collaborative Education Research: Transforming iTech to eCE Through Agent-based Network System for STEM Learning Environment. submitted to NSF. (PI: Bill Tseng, UTEP)
4. "Assessment of Cerebral Plasticity following Peripheral Nerve Transfer/Repair" submitted to Norman Hackerman Advanced Research Program . (PI: Thompson Sarkodi-Gyan, University of Texas at El Paso).

PROFESSIONAL ACTIVITIES

Grant proposal review

- American Heart Association,
- National Institute of Health
- Advancing Hispanic Excellence in Technology, Engineering, Math and Science

Journal Manuscript Review

- Reviewer for professional journals: 1) *Tissue Engineering*, 2) *Nanotechnology*, 3) *Journal of Neural Engineering*, 4) *Journal of Biomaterials Science: Polymer Edition*, 5) *Journal of Micromechanics and Microengineering*, 6) *Journal of Physics D: Applied Physics*, and 7) *Biofabrication.*
- Reviewer for funding agencies: 1) *American Heart Association* and 2) *Advancing Hispanic Excellence in Technology, Engineering, Math and Science*

Professional members

- Tissue Engineering & Regenerative Medicine International Society
- Society for Biomaterials
- American Heart Association
- American Stroke Association
- Society for IS&T
- Materials Research Society
- AVS Science & Technology Society

PUBLIC ATTENTIONS AND COMMENTS ON OUR RESEARCH

- My paper: "Inkjet printing of viable mammalian cells, **Xu T**, Jin J, et al. Biomaterials. 26(1): 93-99 (2005)" received technical highlights on top scientific magazines, including *Science Magazine*, *The Scientists*, and *Chemistry World*.
- My paper: "Viability and electrophysiology of neural cell structures generated by the inkjet printing method. **Xu T,** Gregory C, et al. Biomaterials. 27(19):3580-8 (2006)" received technical highlights form more than 16 technical magazines, including *Science Magazine*, *Life Science Weekly*, *Science Letter*, *World Disease Weekly*, and *Health & Medicine Week.*
- My paper: "Inkjet printing for high-throughput cell patterning, Roth EA, **Xu T**, et al. Biomaterials. 25 (17): 3707-3715 (2004)" received technical highlights from more than 10 technical magazines, including *Health & Medicine Week*, *Biotech Business Week*, and *Life Science Weekly*.
- Our paper "Isolation of clonal amniotic stem cell lines with potential for Therapy". Nature Biotechnology, 25(1):100-106 (2007)" received national and international attentions from many leading media, including *CNN*, *NBC*, *ABC*, CBS, FOX, and *PBS*. This new human amniotic stem cell line which we discovered **ranked among the *TIME Magazine's* top 10 medical breakthroughs in 2007.**

COURSES

Advanced Engineering Mathematics, Graduate class. Fall 2008.
Engineering Analysis, Undergraduate class. Spring, Fall 2009, Spring 2010
Tissue Engineering, Graduate class and Undergraduate class. Spring 2010

FELLOWS AND STUDENTS SUPERISED

Post-doctoral scholars: R. Mesquita, MD (Spring 2008) and C. Fuellhase, MD (Spring 2008)
MD/PHD student: K. Binder (Summer 2007, 2008)
Graduate student: LG Holguin (current); G.V. Gonzalez Hernandez (current), Reyna Soriano, Daniel (current), Rodriguez, Jorge (current), Bravo, Carlos (current), Sunny Ambure (current)
Undergraduates: B. Horn (Summer 2003), B. Manley (Spring 2004), and J. Jin (Summer 2003) P. Morales (Spring 2009), SC Leung (Spring 2009), Hernandez, Luis A (current), Arteaga, Alexandra (current).