

## Nathan Tedford

15 Lovell Street, Apt. 2, Somerville, MA 02144 (617) 233-0315, ntedford@mit.edu  
Massachusetts Institute of Technology, Biological Engineering Division, 16-451, (617) 253-7594

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### Education

Bachelor of Science in Biomedical Engineering with a concentration in Chemical Engineering, May 2001  
The Johns Hopkins University, Baltimore, MD  
Grade Point Average: 3.9 (of 4.0)

Undergraduate Thesis: "Incorporation of Cell Binding Motifs in Genetically Engineered Protein Polymers"

Doctor of Philosophy in Biological Engineering (expected June 2006)

Massachusetts Institute of Technology, Cambridge, MA

Grade Point Average: 4.9 (of 5.0)

Ph.D. Thesis: "Quantitative Analysis of Non-viral Gene Delivery in a Three-dimensional Liver Bioreactor"

### *Pertinent Course Work:*

#### Johns Hopkins University

Organic Chemistry I and II

Transport Phenomena I and II

Biomedical Polymers

Controlled Drug Delivery

Physiological Foundations I and II

Chemical Engineering Thermodynamics

Chemical Kinetics and Reactor Design

Topics in Cellular Engineering

#### Massachusetts Institute of Technology

Fields Forces and Flows in Biological Systems

Biomolecular Kinetics and Cellular Dynamics

Analysis of Transport Phenomena

Biological Chemistry

Perspectives in Biological Engineering

Molecular, Cellular, and Tissue Biomechanics

Chemical Reactor Engineering

Eukaryotic Cell Biology: Principles and Practice

### Academic and Work Experience

Oct 2001- Present     Doctoral Thesis Candidate in the Biological Engineering Division and Biotechnology Process Engineering Center at MIT

Currently studying the dynamic processes involved in the trafficking of non-viral gene delivery vectors within primary hepatocyte culture systems. This work includes the development of quantitative assays and sub-cellular fractionation techniques to gain insight as to how specific polymer/DNA plasmid complexes travel to the nucleus. This data is then used to generate experimentally driven computational models that can identify the major barriers to successful gene expression, which can aid in the development of more efficient, next generation polymer carriers. New three-dimensional, perfused liver bioreactor systems are also being developed and refined in hopes of attaining a more clinically relevant experimental system for comparison to more traditional two-dimensional primary hepatocyte culture set-ups in the context of these gene delivery assays.

Sept 2002- Dec 2002     Graduate Teaching Assistant in the Biological Engineering Division  
Course: Biomolecular Kinetics and Cellular Dynamics

Served as the sole TA for one of the Biological Engineering Division's core courses for 1<sup>st</sup> year PhD and Meng students. Conducted recitations, review, and help sessions regarding cell binding kinetics, protein-protein interactions, mathematical modeling, and computational modeling using Matlab. Helped in formulation of HW and exam problems and wrote mathematical models for a number of papers that were discussed in class. Also took full responsibility for grading duties throughout the semester.

Aug 1999- Undergraduate researcher in the JHU Chemical Engineering Department  
July 2001

Performed work for the genetic engineering of protein polymers for the development of novel pH and temperature dependant reversible hydrogels. Carried out extensive recombinant DNA work and overall design for the incorporation of cell binding motifs in reversible hydrogels for tissue engineering scaffolds and new drug delivery systems. Optimized protein purification and analysis schemes and formulated post production assays to evaluate hydrogel performance and interaction with specific cell types.

July 1996- Director and Head Sailing Instructor at the Crescent Yacht Club, Chaumont, NY  
Aug 2000

Taught and coordinated sailing lessons for over 150 students each summer, and served as director and coach of the CYC children's sail school and junior racing team. Oversaw five senior employees and ten junior assistants.

## **Skills**

### *Experimental*

Experience working with plasmid DNA and DNA oligos, restriction enzymes and ligation schemes, gel analysis. PCR and quantitative real-time PCR for plasmid quantitation and mRNA expression. Experience with column chromatography, protein analysis via Western blots, spectrometry, fluorescence and ELISA assays in multiple single cuvette and 96 well plate formats.

### *Computer*

Microsoft Office, Matlab, Femlab, Familiarity with C++, All Windows OS Platforms, Familiarity with Linux and Mac Platforms

### *Languages*

English, Proficient in Spanish, Read and Write French

## **Honors, Awards, and Organizations**

### *Honors and Awards*

National Science Foundation Graduate Fellow, 2002-Present  
Presidential Fellow, Division of BEH, 2001  
Alpha Eta Mu Beta (National Biomedical Engineering Honor Society), 1999 to 2001  
Golden Key National Honor Society, 1999 to 2001  
Alpha Epsilon Delta (Premedical Honor Society), 1999 to 2001  
Tau Beta Pi (National Engineering Honor Society), 1999 to 2001  
Henry Scott Baker Scholar, Whiting School of Engineering, 1998 to 2001  
JHU Balanced Man Scholar, 1998 to 1999

### *Organizational Involvement and Leadership Positions*

BPEC Student Leadership Council, President, 2002 to Present  
Biological Engineering Diversity Group Coordinator, Fall 2003 to Present  
Biological Engineering Division Student Board, Academic Representative, Summer 2003 to Present  
Member of the MIT Varsity Hockey Team, 2001-2003  
Tau Beta Pi, President (National Engineering Honor Society), 2000 to 2001  
Biomedical Engineering Society, 1997 to present  
Coach and Captain of the JHU Men's Ice Hockey Team, 1997 to 2001  
Team Leader, JHU BME Design Team, 2000 to 2001  
BME Curriculum Committee Member, 1999 to 2001  
First Year Advocate and Student Advisor, JHU Orientation, 1998 to 2000

## **Publications and Conference Proceedings**

“Quantitative Comparison of Polyethylenimine Formulations and Adenoviral Vectors in Terms of Intracellular Gene Delivery Processes.” C.V. Varga, N.C. Tedford, M. Thomas, A.M. Klibanov, L.G. Griffith, D.A. Lauffenburger. *Gene Therapy* (In Press).

“Microreactors for High Performance Liver Tissue Engineering.” L.G. Griffith, K. Domansky, A. Sivaraman, N.C. Tedford, R.A. Arnaout, D.B. Stolz. *Micro Total Analysis Systems 2004*. Malmo, Sweden, September 2004.

## **Presentations**

Quantitative Analysis of Non-viral Gene Delivery in a Three-dimensional Liver Bioreactor. *National Science Foundation Engineering Research Centers Annual Meeting*, November 2004, Washington, DC (poster).

Quantitative Analysis of Non-viral Gene Delivery in a Three-dimensional Liver Bioreactor. *American Society for Gene Therapy*, June 2004, Minneapolis, MN (poster).

Quantitative Analysis of Non-viral Gene Delivery in a Three-dimensional Liver Bioreactor. *National Science Foundation Engineering Research Centers Annual Meeting*, November 2003, Washington, DC (poster and presentation).

Quantitative Analysis of Non-viral Gene Delivery in a Three-dimensional Liver Bioreactor. *American Society for Gene Therapy*, June 2003, Washington, DC (poster).

Quantitative Analysis of Rate Limiting Processes in Non-viral Gene Delivery. *National Science Foundation Engineering Research Centers Annual Meeting*, November 2002, Washington, DC (poster).

## **References**

Available upon request.