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## **GORDANA VUNJAK-NOVAKOVIC**

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### **EDUCATION**

- 1980 Ph.D, Chemical Engineering, University of Belgrade, Serbia
- 1986-1987 Fulbright Fellow, Massachusetts Institute of Technology, Cambridge MA

### **ACADEMIC POSITIONS**

- 2005-present Professor, Department of Biomedical Engineering, Columbia University, New York NY
- 2005-present Director, Laboratory for Stem Cells and Tissue Engineering
- 2007-present Professor of Biomedical Engineering in Surgery, College of Physicians and Surgeons, Columbia University, New York NY
- 2007-present Professor of Biomedical Engineering & Dental and Craniofacial Bioengineering (in Dentistry), College of Dental Medicine, Columbia University, New York NY
- 2002 - present Adjunct Professor, Department of Biomedical Engineering, Tufts University, Medford MA
- 2005-present Visiting Scientist, Div. of Health Sciences and Technology, M.I.T., Cambridge MA
- 1993- Professor, Department of Chemical Engineering, University of Belgrade, Serbia
- 1999 – 2005 Principal Research Scientist, Div. of Health Sciences and Technology, M.I.T., Cambridge MA
- 1993-1998 Research Scientist, Whitaker College, Massachusetts Institute of Technology, Cambridge MA
- 1987-1992 Associate Professor, Department of Chemical Engineering, University of Belgrade, Serbia

### **AWARDS/HONORS (SELECTED)**

- 2008 Hall of Fame, Women in Technology (one of 5 leaders in science and technology in 2008)
- 2008 US Section Head for the Musculoskeletal Repair & Regeneration Section in the Faculty 1000 of Medicine
- 2007 Director's lecture, NIH, October 17, 2007; the first woman engineer to receive this distinction (the lecture and discussion can be viewed at <http://videocast.nih.gov/PastEvents.asp?c=3&s=31>)
- 2007-2012 Editor, new series of Biomedical Engineering books, John Wiley
- 2007 Keystone Symposium on tissue engineering and Developmental Biology (D4), Chair and organizer (the symposium ranked #6 among all Keystone symposia in the last year)
- 2006 Editor, Tissue Engineering journal, special issue: Tissue engineering - the next generation, December 2006
- 2005 The Association of Orthopedic Research, Switzerland; team award " for the best science in orthopaedics" (with L. Meinel, L. Ziechner, R. Fajardo and D. Kaplan)
- 2005 Boston Museum of Science: "Tissue engineering and the challenges of imitating nature," evening with the research group, live televised event, March 18, 2005
- 2005: Biography in the book *Extraordinary Women Engineers* by Kendall Andersen (in press, February 2006); photograph on the book cover
- 2003-2007 Space Life Sciences Council
- 2003 Outstanding Performance Medal, World Congress of In Vitro Biology
- 2004-present Faculty of 1000 Medicine (<http://www.f1000medicine.com>), Regenerative Medicine Section
- 2003-2005 Four NASA awards for bioengineering patents
- 2000 - present, American Institute for Medical and Biological Engineering, Elected Fellow
- 2000: Outstanding performance certificate, NASA, Ames Research Center
- 1997 Medal of recognition, Centennial of the Serbian Chemical Society

### **PROFESSIONAL ACTIVITIES (SELECTED)**

- 2009 Course Co-Director, Cell Therapy for Cardiovascular Disease, New York NY, January 14-16, 2009
- 2009 The 5<sup>th</sup> Annual International Conference on Cell Therapy for Cardiovascular Diseases. Conference co-director. New York NY, Jan 14-16, 2009
- 2008 Executive Committee of the Cardiovascular Research Institute (CVRI) of the Dean of Medicine, formed to foster collaborations in cardiovascular studies, recruitment of faculty, and dedicating a building for the CVRI
- 2008 - 2010 Chair, NIH Study section on Biomaterials and Biointerfaces (BMBI)
- 2008 NIAMS Board of Scientific Councilors, January 22-23, 2008
- 2008 Cardiovascular Research & Technology (CRT) 2009 March 4-6, Washington D.C. Course Co-Director
- 2008 Stem Cell Day, Columbia University, May 5, 2008. Co-organizer, Team leader for Tissue Engineering, imaging and technologies
- 2008 NIH workshop on Transforming Regenerative Medicine, Chair of the "3D models" session, Washington DC, May 19-20, 2008
- 2008 Cardiovascular Revascularization Therapies, February 11-13, 2008, Washington DC, Course co-director

- 2008 NIBIB workshop Bioengineering and Imaging Research Opportunities BIROW V, January 17-18, 2008, Bethesda
- 2008 Course Co-Director, The 4<sup>th</sup> Annual International Conference on Cell Therapy for Cardiovascular Diseases. New York City, January 16-18, 2008
- 2008 Chair and organizer, Tissue Engineering Session, The 4<sup>th</sup> Annual International Conference on Cell Therapy for Cardiovascular Diseases. New York NY, Jan 16-18, 2008
- 2008 Course Co-Director, Angiomyogenesis & Cell Therapy, Washington DC, Feb. 12-13, 2008
- 2007, 2008 NIH Director's New Innovator Award, Special Emphasis Panel
- 2006 - 2010 Permanent member, NIH Study section on Biomaterials and Biointerfaces (BMBI)
- 2006 Chair, NIH Special Emphasis Scientific Review Group 2007/01 ZRG1 CVS-P (50) (S), November 20-21, 2006
- 2005 - present, Editorial Board, *Tissue Engineering*
- 2005 Chair, World Congress of In Vitro biology, Baltimore, MD
- 2005 Workshop on the future directions of NIBIB. Atlanta GA, June 2005, resulted in Enabling Technologies RFA
- 2005 Convener and Chair (with David Kaplan) of Tissue Engineering 2020, workshop for the National Institutes of Health
- 2004 Society for In Vitro Biology, Board of Directors
- 2004 Expert group for the assessment of bioengineering needs in Vietnam, National Science Foundation
- 2003 - present, Founder & Board of Directors, Greenfuel, Cambridge MA
- 2003-2004 Tufts University Dental School, External Advisory Board
- 1996-97 Space study of cartilage tissue engineering aboard *Mir* (with NASA Johnson Space Center and L. E. Freed as the PI)
- 1996 Scientific oversight of the development and testing of the cell culture system for the International Space Station

### PROFESSIONAL ORGANIZATIONS (SELECTED)

- American Association for the Advancement of Science
- American Institute for Medical and Biological Engineering, Fellow
- Association of Fulbright Scholars
- American Chemical Society
- American Institute of Chemical Engineers
- Biomaterials Research Society
- Biomedical Engineering Society
- European Tissue Engineering Society
- Orthopaedic Research Society
- Society for in vitro Biology (Cellular Toxicology Section, Chair, 2000-2004)
- Society for in vitro Biology (Board of Directors, 2002-2006)
- Society for Physical Regulation in Biology and Medicine
- TERMIS (Tissue Engineering and Regenerative Medicine Society)

### BOOKS

- Vunjak-Novakovic G. and I. Freshney: Culture of cells for tissue engineering. J. Wiley 2006
- Mao JJ, Vunjak-Novakovic G, Mikos A and Atala A (Editors) Translational Approaches in Tissue Engineering Artech House (in press 2007)

## PUBLICATIONS (SELECTED FROM >240)

- Vunjak-Novakovic G., G. Jovanovic, Lj. Kundakovic and B. Obradovic, Flow Regimes and Liquid Mixing in a Draft Tube Gas-Liquid-Solid Fluidized Bed, *Chemical Engineering Science*, 47 (13-14), 3451-3458, 1992.
- Freed, L.E., G. Vunjak-Novakovic and R. Langer, Cultivation of Cell-Polymer Cartilage Implants in Bioreactors, *Journal of Cell Biochemistry* 51, 257-264, 1993
- Bugarski B., Q. Li, M.F.A. Goosen, D. Poncelet, R. Neufeld G. Vunjak-Novakovic, Electrostatic Droplet Generation: Mechanism of Polymer Droplet Formation, *Journal of the American Institute of Chemical Engineers* 40 (6) 913-1092, 1994.
- Freed, L.E., G. Vunjak-Novakovic, R. Biron, D. Eagles, D. Lesnoy, S. Barlow and R. Langer, Biodegradable Polymer Scaffolds for Tissue Engineering, *Bio/Technology (precursor of Nature Biotechnology)* 12, 689-693, 1994.
- Vunjak-Novakovic, G., L.E. Freed, R.J. Biron and R. Langer, Effects of Mixing on Tissue Engineered Cartilage, *Journal of the American Institute of Chemical Engineers* 42 (3) 850-860, 1996.
- Freed, L.E., Langer, R., Martin, I., Pellis, N., Vunjak-Novakovic, G. Tissue engineering of cartilage in space, *Proceedings of the National Academy of Sciences USA*, Vol. 94: 13885-13890, 1997; commentary in same issue on pp. 13380-13382.
- Vunjak-Novakovic G., Obradovic B., Bursac P., Martin I., Langer R., Freed L.E., Dynamic Seeding of Polymer Scaffolds for Cartilage Tissue Engineering, *Biotechnology Progress* 14: 193-202, 1998.
- Freed, L.E., Hollander, A.P., Martin, I., Barry, J.R., Martin, I., Vunjak-Novakovic, G. Chondrogenesis in a Cell-Polymer-Bioreactor System, *Experimental Cell Research* 240: 58-65, 1998.
- Riesle J., Hollander A.P., Langer R., Freed L.E. and Vunjak-Novakovic G. Collagen in Tissue Engineered Cartilage: Types, Structure and Crosslinks. *Journal of Cellular Biochemistry* 71: 313-327 1998.
- Vunjak-Novakovic G., Martin I., Obradovic B., Treppo S., Grodzinsky A.J., Langer R., Freed L. Bioreactor Cultivation Conditions Modulate the Composition and Mechanical Properties of Tissue Engineered Cartilage, *Journal of Orthopedic Research* 17: 130-138, 1999.
- Carrier R., Papadaki M., Rupnick M., Schoen F.J., Bursac N., Langer R., Freed L.E, Vunjak-Novakovic G. Cardiac Tissue Engineering: Cell Seeding, Cultivation Parameters and Tissue Construct Characterization, *Biotechnology and Bioengineering* 64: 580-589, 1999.
- Bursac N., Papadaki M., Cohen R.J., Schoen F.J., Eisenberg S.R., Carrier R., Vunjak-Novakovic G., Freed L.E. Cardiac Muscle Tissue Engineering: Towards an In Vitro Model for Electrophysiological Studies. *American Journal of Physiology* 277 (Heart Circ. Physiol. 46): H433-H444, 1999.
- Martin I., Obradovic B., Freed L.E., Vunjak-Novakovic G. A Method for Quantitative Analysis of Glycosaminoglycan Distribution in Cultured Natural and Engineered Cartilage. *Annals of Biomedical Engineering* 27 (5) 1-7, 1999.
- Martin I., Obradovic B., Treppo S., Grodzinsky A., Langer R., Freed L.E., Vunjak-Novakovic G. Modulation of the mechanical properties of tissue engineered cartilage. *Biorheology* 37: 141-147, 2000.
- Obradovic B., Meldon J.H., Freed L.E., Vunjak-Novakovic G. Glycosaminoglycan deposition in tissue engineered cartilage: experiments and mathematical model. *Journal of the American Institute of Chemical Engineers* 46: 1860-1871, 2000.

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- Papadaki, M., Bursac, N., Langer, R., Merok, J., Vunjak-Novakovic, G., Freed, L.E. Tissue Engineering of Functional Cardiac Muscle: Molecular, Structural and Electrophysiological Evaluations *American Journal of Physiology, Heart Circ Physiol* 280: H168-H178, 2001 (cover article)
- Martin I., Shastri V.P., Padera R.F., Yang J., Mackay A.J., Langer R., Vunjak-Novakovic G., Freed L.E. Selective differentiation of mammalian mesenchymal progenitor cells cultured on three-dimensional polymer foams. *Journal of Biomedical Materials Research* 55: 229-235, 2001.
- Martin, I., Suetterlin, R., Baschong, W., Heberer, M., Vunjak-Novakovic, G., and Freed, L.E. Enhanced Cartilage Tissue Engineering by Sequential Exposure of Chondrocytes to FGF-2 During 2D Expansion and BMP-2 During 3D Cultivation. *J Cellular Biochemistry* 83: 121-128, 2001.
- Obradovic B., Martin, I., Padera, R.F., Treppo, S., Freed, L.E., and Vunjak-Novakovic, G. Integration of engineered cartilage. *Journal of Orthopedic Research* 19 (6): 1089-1097, 2001.
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- Schaefer D., Martin I., Jundt G., Seidel J., Heberer M., Grodzinsky A., Bergin I., Vunjak-Novakovic G., Freed L.E. Tissue engineered composites for the repair of large osteochondral defects. *Arthritis and Rheumatism* 46(9): 2524-2534 (2002)
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- Meinel L, Kareourgiou V, Fajardo R, Snyder B, Shinde-Patil V, Zichner L, Kaplan D, Langer R and Vunjak-Novakovic G, Bone tissue engineering using human mesenchymal stem cells: effects of scaffold material and medium flow. *Annals of Biomedical Engineering* 32: 112-122, 2004.
- Radisic M., Yang L., Boublik J., Cohen R.J., Langer R., Freed L.E., Vunjak-Novakovic G. Medium perfusion enables engineering of compact and contractile cardiac tissue. *American Journal of Physiology* 286: H507–H516, 2004.
- Vunjak-Novakovic G, Altman G and Kaplan D. Tissue engineering of ligaments. *Annual Review of Biomedical Engineering* 6: 131-156 (2004)
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- Gerecht-Nir S, Radisic M, Park H, Boublik J, Cannizzaro C, Langer R, Vunjak-Novakovic G. Biophysical regulation of cardiogenesis. *International Journal of Developmental Biology* 50(2-3):233-43, 2006.
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- Marolt D, Augst A, Vepari C, Farley M, Fajardo R, Patel N, Gray ML, Freed LE, Kaplan DL and Vunjak-Novakovic G. Bone and cartilage tissue constructs grown using human bone marrow stromal cells, silk scaffolds and rotating bioreactors. *Biomaterials* 27(36): 6138-6149, 2006.
- Wang Y, Kim H-J, Vunjak-Novakovic G and Kaplan DL. Stem cell based tissue engineering with silk biomaterials. Review article. *Biomaterials*, special issue on Stem Cells 27(36): 6064-6082, 2006
- Vunjak-Novakovic G. Transplants made to order, *The Scientist* 20(9): 35-41, 2006.
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- Freed LE, Guilak F, Guo XE 3, Gray ML, Tranquillo R, Holmes J, Radisic M, Sefton MV, Kaplan DL and Vunjak-Novakovic G. Advanced Tools: Scaffolds, Bioreactors, Signaling. *Tissue Engineering* 12(12) 3285-3306, 2006.
- Mikos A, Herring S, Elisseff JE, Lu H, Kandel R, Schoen FJ, Toner M, Mooney DL, Atala A, Kaplan DL and Vunjak-Novakovic G. Engineering Complex Tissues. *Tissue Engineering* 12(12) 3307-3340, 2006.
- Hunziker E, Spector M, Libera J, Gertzman A, Woo S L-Y, Ratcliffe A, Lysaght M, Coury A, Kaplan DL and Vunjak-Novakovic G. From Research to Applications: Translation. *Tissue Engineering* 12(12) 3241-3364, 2006.
- Khademhosseini A, Eng G, Yeh J, Kucharczyk S, Langer R, Vunjak-Novakovic G and Radisic M. Microfluidic patterning for fabrication of contractile cardiac organoids. *Biomedical Microdevices* 9(2): 149-157, 2007.
- Ferreira L, Gerecht-Nir S, Shieh H, Vunjak-Novakovic G and Langer R. Bioactive hydrogel scaffolds for controllable vascular differentiation of human embryonic stem cells. *Biomaterials* 28(17): 2706-2717 (2007) Highlighted in *Materials Today*: “Hydrogels make stem cells differentiate” 10(5): 10 (May 2007)

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- Radisic M, Park H, Gerecht-Nir S, Cannizzaro C, Langer R., Vunjak-Novakovic G. Biomimetic approach to cardiac tissue engineering. Philosophical Transactions of the Royal Society of London – Biological Sciences 362 (1484):1357-1368, 2007.
- Figallo E., Cannizzaro C, Gerecht-Nir S, Burdick J, Langer R, Elvassore N and Vunjak-Novakovic G. Microbioreactor for controlled differentiation of human embryonic stem cells. Lab on a Chip7 (6): 710 - 719, 2007. Cover article.
- Gerecht S, Burdick JA, Ferreira LS, Townsend SA, Langer R. and Vunjak-Novakovic G. Propagation of undifferentiated human embryonic stem cells in hyaluronic acid hydrogels. PNAS 104(27): 11298-11303, 2007.
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- Chao PhG, Grayson W and Vunjak-Novakovic G. Engineering cartilage and bone using human mesenchymal stem cells. Journal of Orthopaedic Science 12(4):398-404. 2007.
- Lovett M, Cannizzaro C, Daheron L, Messmer B, Vunjak-Novakovic G and Kaplan DL. Silk fibroin microtubes for blood vessel engineering. Biomaterials 28(35):5271-5279, 2007.
- Gerecht S, Cannizzaro C, Figallo E, Elvassore N, and Vunjak-Novakovic G. Bioreactors for the 3D cultivation of human embryonic stem cells. Human Embryonic Stem Cells (ed. J. Masters, B. Palsson, J. Thomson), Human Cell Culture Series, Springer Verlag, Ch. 9, pp. 149-172, 2007.
- Jakab K, Damon B, Marga F, Neagu A, Besch-Williford CL, Kachurin A, Park H, Mironov V, Markwald R, Vunjak-Novakovic G and Forgacs G. Tissue engineering by self-assembly of cells printed into topologically defined structures. Tissue Engineering 14(3): 413-421, 2008.
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- Grayson WL, Chao GP, Marolt D, Kaplan DL and Vunjak-Novakovic G. Engineering custom designed osteochondral tissue grafts. Trends in Biotechnology 26(4): 181-189 (2008)
- Radisic M, Marsano A, Maidhof R, Wang Y and Vunjak-Novakovic G. Perfusion bioreactors for controlling cellular environments. Nature Protocols 3 (4): 719-738, 2008
- Grayson WL, Bhumiratana S, Cannizzaro C, Chao GP, Lennon D, Caplan AI and Vunjak-Novakovic G. Effects of initial seeding density and fluid perfusion rate on formation of tissue-engineered bone. Tissue Engineering Part A. 2008 Jul 11. [Epub ahead of print]
- Burdick JA and Vunjak-Novakovic G. Engineered microenvironments for controlled stem cell differentiation. Lead article for the special issue of Tissue Engineering on Technologies for enhancing tissue engineering: Materials and environments for guiding stem cell function. Tissue Eng Part A. 2008 Aug 11. [Epub ahead of print]
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- Vunjak-Novakovic G. Patterning stem cell differentiation. Cell Stem Cell 3 (4): 362-363, 2008
- Tandon N, Cannizzaro C, Chao P-hG, Marsano A, Maidhof R, Au H,

Radisic M, and Vunjak-Novakovic G. Electrical field stimulation of cultured cells and tissues Nature Protocols (in press)

- Cimetta E, Cannizzaro C, Elvasore N. and Vunjak-Novakovic G. Microarray bioreactors for steady-state and transient studies of stem cells. Tissue Engineering – Methods (in press)
- Godier AFG, Marolt D, Gerecht S, Tajnsek U, Martens TP and Vunjak-Novakovic G. Engineered microenvironments for human stem cells. Birth Defects Research Part C: Embryo Today (in press)
- Martens TP, Godier AFG, Parks JJ, Wan Q, Koeckdrt MS, Eng GM, Hudso BJ, Sherman W and Vunjak-Novakovic G. Percutaneous Cell Delivery into the Heart using Hydrogels Polymerizing in situ. Cell Transplantation (in press)

Please see the lab web site for a more complete list

RESEARCH INTERESTS Tissue engineering, human stem cells (adult and embryonic), advanced bioreactors, biophysical regulation of cell function and tissue development