

Nam-Joon Cho, Ph.D.

Postdoctoral fellow

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Education

Stanford University, Palo Alto, CA

May 2003~Dec. 2006

Ph.D. in Chemical Engineering

Advisor: Curtis W. Frank, Ph.D.

Thesis Title: *Development, QCM-D Analysis and Applications of a Membrane on a Chip*

Stanford University

Aug. 2001~May 2003

M.S. in Material Science and Engineering

Advisor: Curtis W. Frank, Ph.D.

University of California-Berkeley, Berkeley, CA

Dec. 1996

B.S. in Civil Engineering

Academic and Professional Experiences

Stanford University

Postdoctoral fellow

Jan. 2007~Present

Division of Gastroenterology and Hepatology, School of Medicine

Advisor: Jeffrey S. Glenn, Ph.D., M.D.

- *Characterization of the roles of viral and cellular proteins involved in hepatitis C virus (HCV) replicase assembly and mechanism of inhibition of novel compounds targeting the assembly process*

To establish assays for the measurement of HCV replicase assembly, and to study the mechanism of action of specific inhibitors

- *Hepatitis C virus (HCV) nonstructural proteins: Molecular virology and antiviral targeting by engineered biomimetic platforms*

To characterize the mechanism of the NS5A protein's N-terminal alpha-helix (AH)-mediated membrane association by using surface sensitive techniques such as QCM-D and SPR, and to develop simple and robust biomimetic, self-assembly based platforms to identify high affinity peptide ligands of this specific AH peptide and evaluate the ligands' effects on HCV replication

- *Translating hydrogel technology into novel engineered liver tissues*

To determine the optimal conditions for promoting 3-D growth of hepatocytes in hydrogels, to use customized mask templates to design 3-D networks that mimic liver architecture, and to characterize the liver-specific structures and markers present in 3-D tissue cultures

Stanford University

Research assistant
Department of Chemical Engineering
Advisor: Curtis W. Frank, Ph.D.

Sep. 2002~Dec. 2006

- *Phospholipid-based macromolecular assemblies on solid supports*

Characterized the development of phospholipid-based macromolecular assemblies by utilizing quartz crystal microbalance with dissipation monitoring (QCM-D), surface plasmon resonance (SPR), dynamic light scattering (DLS), atomic force microscope (AFM), and fluorescence microscopy

- *Binding dynamics of an AH peptide derived from the hepatitis C virus' NS5A protein to cell and model membranes*

Developed a biomimetic, self-assembly based platform that allows for quantitative, label-free detection of viral peptide *in vitro* and in real time

- *Employing an amphipathic viral peptide to create a lipid bilayer on Au and TiO₂*

Utilized the biological interaction between a specific viral peptide and a phospholipid-based macromolecular assembly to create a model, supported bilayer on various solid substrates that were previously unusable for such studies despite their attractive biocompatibility and electrical properties

Samsung Advanced Institute of Technology, Seoul, South Korea

Research fellow
Micro Electronic Laboratory

Jan. 2001~Apr. 2001

- Developed lab-on-a-chip devices performing most or all of traditional lab functions such as immunoassays, DNA and protein identification on a chip

Ministry of Finance and Economy, Seoul, South Korea

Research fellow
International Economic Policy and Cooperation Division

Sep. 2000~Dec. 2000

- Developed and edited speeches and government reports regarding the economies of developing countries

Korea International Cooperation Agency, ChangChun, China

Instructor
North Normal University

Apr. 1998~Aug. 2000

- Lectured advanced-level computer and English courses to undergraduate students

Hosoda Girls' Senior High School, Tokyo, Japan
English teacher

Sep. 1997–Mar. 1998

- Taught English conversation to high school students

Fellowships and Awards

Global Roche Postdoctoral Fellowship, 2009-Present
Human Frontier Science Program Short Term Postdoctoral Research Fellowship, 2008
American Liver Foundation Postdoctoral Award, 2008
15th International Symposium on Hepatitis C Virus and Related Viruses Travel Award, 2008
Stanford University Dean's Fellowship, 2007-2008
Spectrum Pilot Project Grant through Stanford's NIH CTSA grant, 2007
Beckman Interdisciplinary Translational Research Proposal Award (ITRP), 2006-2008

Professional Associations

Materials Research Society (MRS)
American Chemistry Society (ACS)
American Liver Foundation (ALF)
American Society of Virology (ASV)
American Society of Cell Biology (ASCB)
Electrochemical Society (ECS)

Selected Publications

N.J. Cho, C.H. Lee, P.S. Pang, J.S. Glenn. "*Phosphatidylinositol 4,5-bisphosphate is a ligand of HCV NS5A and mediates viral genome replication*". Submitted. 2009.

N.J. Cho*, C.W. Frank, B. Kasemo, F. Hook*. "Quartz crystal microbalance with dissipation monitoring of supported lipid bilayers on various substrates". **Nature Protocols**. 2009. First review back, Favorable to publish with minor revision *Denotes Shared Corresponding Authorship

N.J. Cho, H. Dvory-Sobol, A. Xiong, C.W. Frank, J.S. Glenn. "*The mechanism of an amphipathic α -helical peptide's antiviral activity involves size-dependent virus particle lysis*". **In press, ACS Chemical Biology**. 2009.

J.A. Jackman, **N.J. Cho**, R.S. Duran, C.W. Frank. "*Interfacial binding dynamics of bee venom phospholipase A₂ investigated by dynamic light scattering and quartz crystal microbalance*". **Langmuir** 2009 Accepted and Undergraduate mentoring project

P.D. Bryson, **N.J. Cho**, S. Einav, C.H. Lee, V. Tai, J. Bechtel, M. Sivaraja, C. Roberts, U. Schmitz, J.S. Glenn. "*A small molecule inhibits HCV replication and disrupts NS4B subcellular localization*". Submitted. 2009.

W.J. Lee, **N.J. Cho**, A. Xiong, J.S. Glenn, C.W. Frank. "*Poly(lactic-co-glycolic acid) nanoparticles improve the viability of liver-derived cells encapsulated in a poly(ethylene glycol) hydrogel*". Submitted. 2009. Ph.D. mentoring project

N.J. Cho, H. Dvory-Sobol, C.H. Lee, S.J. Cho, J.S. Glenn. "Identification of a novel class of HCV inhibitors". **Science Translational Medicine**. 2009. Accepted with minor revision

W.J. Lee, M. Wiseman, **N.J. Cho**, J.S. Glenn, C.W. Frank. "The reliable targeting of specific drug release profiles by integrating arrays of different albumin-encapsulated microsphere types". **In press, Biomaterials**. 2009. Ph.D. mentoring project

N.J. Cho, G. Wang, M. Edvardsson, F. Hook, C.W. Frank. " α -helical peptide-induced vesicle rupture reveals new insight into the vesicle fusion process as monitored in situ by QCM-D and reflectometry". 2009 May 21; 81(12):4752-61. **Analytical Chemistry**.

S.M. Yoon, **N.J. Cho**, K.K. Kanazawa and C.W. Frank. "Analyzing spur-distorted impedance spectra for the QCM". 259746; 2009 Apr 10, **Journal of Sensors**. 2009. Undergraduate mentoring project

K.K. Kanazawa and **N.J. Cho**. "Quartz crystal microbalance as a sensor to characterize macromolecular assembly dynamic". 824947; 2009 Apr 26, **Journal of Sensors**. Invited Review Paper

N.J. Cho, M. Elazar, A. Xiong, W.J. Lee, E. Chiao, E.J. Baker, C.W. Frank, J.S. Glenn. "Viral infection of human progenitor and liver-derived cells encapsulated in three-dimensional PEG-based hydrogel". 4(1):11001, **Biomedical Materials**, 2009. **Cover illustration and Feature article**.

N.J. Cho, K. Kanazawa, J.S. Glenn, C.W. Frank. "Employing two different quartz crystal microbalance models to study changes in viscoelastic behavior upon transformation of lipid vesicles to a bilayer on a gold surface". **Analytical Chemistry**. 2007 Sep 15; 79(18): 7027-35. **Cover illustration**.

N.J. Cho, S.J. Cho, K.H. Cheong, J.S. Glenn, C.W. Frank. "Employing an amphipathic viral peptide to create a lipid bilayer on Au and TiO₂". **Journal of the American Chemical Society**. 2007 Aug 22; 129(33): 10050-1.

N.J. Cho, K.H. Cheong, C.H. Lee, C.W. Frank, J.S. Glenn. "Binding dynamics of hepatitis C virus' NS5A amphipathic peptide to cell and model membranes". **Journal of Virology**. 2007 Jun; 81(12): 6682-9.

N.J. Cho, S.J. Cho, J.O. Hardesty, J.S. Glenn, C.W. Frank. "Creation of lipid partitions by deposition of amphipathic viral peptides". **Langmuir**. 2007 Oct 9; 23(21): 10855-63.

N.J. Cho, J.N. D'Amour, J. Stalgren, W. Knoll, K.K. Kanazawa, C.W. Frank. "Quartz resonator signatures under Newtonian liquid loading for initial instrument check". **Journal of Colloid and Interface Science**. 2007 Nov 1; 315(1): 248-54.

Presentations and Posters

N.J. Cho, G. Wang, M. Edvardsson, J.S. Glenn, F. Hook, C.W. Frank. "Quartz Crystal Microbalance-Dissipation and Reflectometry to Monitor in Situ the Structural Transformation of Lipid Vesicles to a Bilayer on a Gold Surface". Materials Research Society (MRS), 2009, **Talk**

W.J. Lee, **N.J. Cho**, J.S. Glenn, C.W. Frank "Employing a Matrix Equation to Target Specific Drug Release Profiles". Materials Research Society (MRS) 2009, **Poster**

W.J. Lee, **N.J. Cho**, M. Elazar, J.S. Glenn, C.W. Frank. "Poly(lactic-co-glycolic acid) Nanoparticles Improve the Viability of Liver-derived Cells Encapsulated in a Poly(ethylene glycol) Hydrogel". Materials Research Society (MRS), 2009, **Talk**

N.J. Cho, H. Dvory-Sobol, C.W. Frank, J.S. Glenn. "Identification of a novel class of HCV inhibitors". The Gordon Research Conference on Antimicrobial Peptides, 2009, **Poster**

N.J. Cho, H. Choongho Lee, Phil Pang, Kay K. Kanazawa, C.W. Frank, J.S. Glenn. "Phosphatidylinositol 4,5-bisphosphate is a ligand of HCV". American Society for Cell Biology (ASCB), 2008, **Poster**

N.J. Cho, H. Choongho Lee, Phil Pang, Kay K. Kanazawa, C.W. Frank, J.S. "Phosphatidylinositol 4,5-bisphosphate is a ligand of HCV NS5A and mediates viral genome replication". Materials Research Society (MRS), 2008, **Talk**

N.J. Cho, H. Dvory-Sobol, C.W. Frank, J.S. Glenn, "Identification of small molecule inhibitors of HCV replication targeting membrane associated nonstructural proteins using a biomimetic lipid-based platform". The 15th International Symposium on Hepatitis C Virus and Related Viruses, 2008, **Talk**

P.D. Bryson, **N.J. Cho**, S. Einav, C.H. Lee, V. Tai, J. Bechtel, M. Sivaraja, C. Roberts, U. Schmitz, J.S. Glenn "A small molecule inhibits HCV replication and disrupts NS4B subcellular localization". The 15th International Symposium on Hepatitis C Virus and Related Viruses, 2008, **Poster**

N.J. Cho, K.K. Kanazawa, C.W. Frank, J.S. Glenn. "Electrochemical-QCM investigation of solid-supported lipid bilayer formed by AH peptide derived from HCV's nonstructural protein". Annual meeting of the Electrochemical Society (ECS), 2008, **Talk**

C.H. Lee, **N.J. Cho**, P.H. Pang, C.W. Frank, J.S. Glenn. "PIP(4,5)P₂ is a ligand of HCV NS5A and mediates HCV genome replication". Annual meeting of the American Association for the Study of Liver Diseases (AASLD), 2008, **Poster**

N.J. Cho, C.W. Frank, J.S. Glenn "Binding dynamics of Hepatitis C Virus' Nonstructural proteins to Cell and Model Membranes". Annual meeting of The American Association for the Study of Liver Diseases (AASLD), 2008, **Poster**

N.J. Cho, H. Dvory-Sobol, A. Xiong, C.W. Frank, J.S. Glenn. "The antiviral effects and lysis potency of the AH peptide in the hepatitis C virus based on the intact vesicle model system". The American Society of Virology (ASV), 2008, **Talk**

N.J. Cho "Membrane on a CHIP analysis by QCM-D: development and applications". Inviter: Dr. Myoung-Hee Kim, Dean, College of Engineering, Ewha Womans University, 2007, **Invited talk**

N.J. Cho, C.W. Frank, J.S. Glenn "Translating hydrogel technology into novel engineered liver tissues". Interdisciplinary Translational Research Proposal Award Presentation (ITRP) Beckman Center, Stanford University, 2007, **Invited talk**

N.J. Cho, "Preparation-dependent vesicle aging effects on vesicle fusion and bilayer formation". Genencor Corporation, 2005, **Invited talk**

N.J. Cho, C.W. Frank, “*Lipid Bilayer Membrane on Gold & TiO₂ Solid Supports: From Liposomes to Supported, Planar Bilayers*”. Materials Research Society, 2005, **Poster**

R.A. Bauer, **N.J. Cho**, C.W. Frank, “*Influence of Vesicle Size on the Formation of Supported Lipid Bilayers*”. CPIMA conference, 2004, **Poster**

N.J. Cho, C.W. Frank, “*Effect of Ca²⁺ on Vesicle Fusion Measured by Dynamic Light Scattering and Zeta Potential*”. AICHE, 2003, **Poster**

N.J. Cho, J.R. Stalgren, C.W. Frank, “*Calcium Effect of Ion Binding and Membrane Lateral Tension of Supported Lipid Bilayers Studied by QCM*”. AICHE, 2003, **Poster**

N.J. Cho, H. Kim, C.W. Frank, “*Viscoelastic Properties of Ca²⁺ incorporated in Phospholipid Monolayer of Various Charged Headgroups*”. AICHE, 2003, **Poster**

N.J. Cho, L.Y. Hwang, C.W. Frank, “*Preparation-Dependence Vesicle Aging Effect on Vesicle Fusion and Bilayer Formation*”. CPIMA conference, 2003, **Talk**

Patents

Direct micro-patterning of lipid bilayers by employing amphipathic viral peptides to create a biocompatible barrier. S007-200. In Press.

Amphipathic peptide compositions as antiviral agents. S07-204; STAN-562PRV. In Press.
Licensed to Eiger BioPharmaceuticals, Inc.

Method of fabricating lipid bilayer membranes on solid supports. Application No.: PCT/US06/12085. Filing Date: 2006/110350

DLS-based screens for inhibitors of HCV amphipathic helix (AH) function. S007-220. In Press.
Licensed to Eiger BioPharmaceuticals, Inc.

PIP-2 inhibition-based antiviral and anti-hyperlipidemic therapies. Application No.: PCT/US06/12085 . **Licensed to Eiger BioPharmaceuticals, Inc.**

Research Mentoring

As a member of the NSF-supported Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA) at Stanford, I have served as a research mentor to visiting undergraduates from various disciplines. The principal goals of CPIMA's ten-week Summer Undergraduate Research Experience (SURE) program are to provide invited undergraduates with the best possible research experience and guidance as they make future career decisions. As a research mentor, I help the students define their project goals by identifying a solvable question, designing the experiments, and teaching experimental techniques to help them generate and analyze data. At the end of the summer, I help the students create a poster to present at the annual CPIMA conference that highlights their summer work. In some extraordinary cases, my students have also written manuscripts, which I assist with through every stage of the writing and analysis processes, based on their work. In total, I have officially mentored six undergraduate students' summer projects. Below, I highlight some of the students whose work I feel especially reflects my abilities and dedication as a mentor:

Josh Jackman, Undergraduate, Biochemistry, University of Florida, Gainesville, Florida, **Beckman Scholars program** and **CPIMA program**, 2008-9

Duration: 9 months

Bee venom phospholipase A₂ (bvPLA₂) is part of the secretory phospholipase A₂ (sPLA₂) family whose members are active in biological processes such as signal transduction and lipid metabolism. While controlling sPLA₂ activity is of pharmaceutical interest, the relationship between their mechanistic actions and physiological functions is not well understood. Therefore, we investigated the interfacial binding process of bvPLA₂ in order to characterize its biophysical properties and gain insight into how membrane binding affects interfacial activation. Taken together, our findings provide evidence that bvPLA₂ interfacial binding is a dynamic process, shedding light on how membrane electrostatics can modulate interfacial activation. We wrote a manuscript entitled "*Interfacial Binding Dynamics of Bee Venom Phospholipase A₂ Investigated by Dynamic Light Scattering and Quartz Crystal Microbalance*" that was recently accepted by the journal **Langmuir**. In addition, Josh is currently a semifinalist for the Hertz Foundation Graduate Fellowship, and he is planning to continue his graduate school career in my research group.

Sae-Moon Yoon, Undergraduate, Electrical Engineering, Hanyang University, Seoul, South Korea, **CPIMA program**, 2007

Duration: 3 months

We studied a method that separates the spur resonance from the QCM's main resonance, permitting the parameters of the main resonance to be isolated from those of the spur. The corrected parameters of the main resonance can then be used with increased confidence in model analysis. The results of this work were published in the **Journal of Sensors** as part of a manuscript entitled "*Analyzing Spur-Distorted Impedance Spectra for the QCM.*" After successfully completing the CPIMA program, Sae-Moon is now attending the M.S. program in Electrical Engineering at **Columbia University**.

Renato Bauer, Undergraduate, Biochemistry, Stonehill College, Easton, Massachusetts, **CPIMA program**, 2004

Duration: 2 months

We studied the vesicle fusion process on solid substrates by using the QCM-D and DLS techniques. Based on the project's results, Renato presented a poster entitled "*Influence of Vesicle Size on the Formation of Supported Lipid Bilayers*" at the annual CPIMA conference. After successfully completing the CPIMA program, he is now attending the Ph.D. program in Chemistry at **Cornell University**.

Creative Solution Laboratory

I created the Creative Solution Laboratory to address issues in youth science education and information technology. Presented below are brief descriptions of the three ongoing entrepreneurial projects. More details can be found at <http://www.stanford.edu/~ncho/>.

InfollutionZero.org is a movement to raise public awareness of "*infollution*" ("information" + "pollution") and digital inequality. The idea and the related embedded software are patent protected.

Triple Z Project is aimed at developing toy and animation characters based on the life sciences for educational and entertainment purposes. The idea and characters are copyright protected.

pFurniture is a new concept for baby products that is inspired by cell biology. Our baby products will be made with eco-friendly, safe biomaterials that can be effectively manufactured at a low cost. This idea is patent protected.

Personal Information

Nationality:	South Korean (National Interest Waiver U.S. Green Card pending)
Birthday:	October 10 th , 1972
Marital Status:	Married with two children
Languages Skills:	Korean (Native) English (Fluent) Chinese (Fluent): Chinese Proficiency Test (HSK) Advanced 9 th degree, 2000 Japanese (Fluent): Japanese Language Proficiency Test, Level 1 (Highest), 1998