

Nam-Joon Cho, Ph.D.

Postdoctoral fellow

Division of Gastroenterology and Hepatology
School of Medicine
Stanford University

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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 Jan. 2007~Present
Postdoctoral fellow
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 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

Sponsored Research and Projects

1. Beckman Interdisciplinary Translational Research Proposal Award (ITRP), 2006-2008
"Translating hydrogel technology into novel engineered liver tissues"
Recipient: **Nam-Joon Cho** PI: Jeffrey S. Glenn, Co-PI: Curtis W. Frank
Funding Amount: \$ 150,000
2. Spectrum Pilot Project Grant through Stanford's NIH CTSA grant, 2007
"A novel HCV agent based on AH2 peptide function"
Recipient: **Nam-Joon Cho** PI: Jeffrey S. Glenn
Funding Amount: \$ 50,000
3. Spectrum Pilot Project Grant through Stanford's NIH CTSA grant, 2009
"A novel HCV agent based on PIP2 inhibition function"
Recipient: **Nam-Joon Cho** PI: Jeffrey S. Glenn
Funding Amount: \$ 50,000
4. NIDDK National Institute of Diabetes and Digestive and Kidney Diseases R01, NIH.
"A novel HCV agent based on PIP2 inhibition function"
PI: Jeffrey S. Glenn, 2009-2014

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)

Publications Under Review

N.J. Cho, J.A. Jackman, M. Liu, C.W. Frank. “Controlling the self-assembly of supported lipid platforms via pH: a comparative study on silicon oxide and titanium oxide”. Submitted. 2010.

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. 2010.

Selected Publications

W.J. Lee, **N.J. Cho**, A. Xiong, J.S. Glenn, C.W. Frank. “Hydrophobic nanoparticles improve permeability of cell-encapsulating poly(ethylene glycol) hydrogels while maintaining patternability”. **Proceedings of the National Academy of Science**. 2010. **Accepted**. Ph.D. mentoring project,

N.J. Cho, and C.W. Frank. “Novel strategy to form a planar lipid bilayer on titanium oxide”. **Langmuir**. 2010, **In press**.

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**. 2010. 5, pp. 1096–106.

*Denotes Shared Corresponding Authorship

- Highlighted as cover image on Nature Protocols website from May 27th to June 3rd

N.J. Cho, H. Dvory-Sobol, C.H. Lee, S.J. Cho, J.S. Glenn. “Identification of a novel class of HCV inhibitors directed against the nonstructural protein NS4B”. 2010 Jan 20; 2(15), **Science Translational Medicine**.

- Highlighted by leading international news organizations including Reuters, BusinessWeek, MSN Health Yahoo News, and The Independent (UK) as well as the Stanford University website homepage

C.J. Huang*, **N.J. Cho***, C.J. Hsu*, P.Y. Tseng, C.W. Frank, Y.C. Chang. “Type I collagen-functionalized supported lipid bilayer as a cell culture platform”. **Biomacromolecules**. 2010, 11 (5), 1231-40. *Denotes Shared First Authorship

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**. 2010 Mar 16; 26(6): 4103-12. 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”. **Antiviral Research**. 2010 87(1): 1-8.

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”. **ACS Chemical Biology**. 2009 Dec 18; 4(12): 1061-7.

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”. **Biomaterials** 2009 Dec; 30(34): 6648-54. 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**. 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.

Book Chapter

N.J. Cho, and C. W. Frank, "Biomimetic thin films as a QCM-D sensor platform to detect macromolecular interactions." Included in Volume III: Analysis and Applications of Ultrathin Films of book series "Functional Polymer Thin Films", Under Review by Wiley-VCH, 2010.

Presentations and Posters

N.J. Cho, "Viral Peptide Isolated From the Hepatitis C Virus (HCV): Interactions with Lipid Assemblies and Biotechnological Applications" **AIChE**, Salt Lake City, Utah Education, Meet the Faculty Candidate Session, 2010, **Poster**

N.J. Cho, "Reconstitution of a functionally-active full length Hepatitis C Virus polymerase on a biomimetic membrane platform", Roche Global Symposium, Basel, Switzerland, 2010, **Invited talk**

N.J. Cho, "Reconstitution of a functionally-active full length Hepatitis C Virus polymerase on a biomimetic membrane platform", 17th International Meeting on Hepatitis C Virus and Related Viruses at Yokohama, Japan, 2010, **Invited talk**

N.J. Cho, “Viral Peptide Isolated from the Hepatitis C Virus (HCV): Interactions with Lipid Assemblies and Biotechnological Applications”, National University of Singapore Department of Chemical and Biomolecular Engineering, 2010, **Invited talk**

N.J. Cho, “Viral Peptide Isolated from the Hepatitis C Virus (HCV): Interactions with Lipid Assemblies and Biotechnological Applications”, Nanyang Technological University School of Chemical and Biomedical Engineering, 2010, **Invited talk**

N.J. Cho, “Viral Peptide Isolated from the Hepatitis C Virus (HCV): Interactions with Lipid Assemblies and Biotechnological Applications”, Academia Sinica Genomics Research Center, 2010, **Invited talk**

N.J. Cho, “Viral Peptide Isolated from the Hepatitis C Virus (HCV): Interactions with Lipid Assemblies and Biotechnological Applications”, National Taiwan University Department of Chemical Engineering, 2010, **Invited talk**

N.J. Cho, “Viral Peptide Isolated from the Hepatitis C Virus (HCV): Interactions with Lipid Assemblies and Biotechnological Applications”, Hong Kong University of Science and Technology Department of Chemical and Biomolecular Engineering, 2010, **Invited talk**

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 *Peptides, Chemistry & Biology Of Antimicrobial Peptides*, 2010, **Poster**

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

Hydrogels with Increased Permeability for Cell Encapsulation
Ref.: 128-S09-010

Screening for Inhibitors of HCV Amphipathic Helix (AH) Function
Ref.: S08-13, STAN-615WO
Licensed to Eiger BioPharmaceuticals Inc.

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

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 published in the journal **Langmuir**. In addition, we have investigated how solution pH can be employed to control the self-assembly of different model membrane platforms on oxide substrates. The results of this work have been submitted to **Biophysical Journal**. Josh is now a National Science Foundation Graduate Fellow in the Ph.D. program in Medical Engineering and Medical Physics at the **Harvard-MIT Division of Health Sciences and Technology**.

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. More details can be found at <http://www.stanford.edu/~ncho/>.

The principal ongoing project is the development of **InfollutionZero.org**, which is a movement to raise public awareness of "*infollution*" ("information" + "pollution") and digital inequality.

Personal Information

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