Jayoung Kim, Ph.D.

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ACADEMIC APPOINTMENT

2022 - **Assistant Professor, University of North Texas Health Science Center**
Department of Pharmaceutical Sciences, College of Pharmacy
Research interests: gene delivery / therapy, precision medicine, cell-mediated delivery, personalization, machine learning, ophthalmology, transplant, cancer

EDUCATION AND TRAINING

2021 - 22 **Research Associate,** School of Engineering and Applied Sciences, Harvard University
Project (Principal Investigator): gene therapy using red blood cell-adsorbed vectors
Funding: Sponsored research and license agreement with Hitch Bio, Inc.

2019 - 21 **Certificate in Data Science**, Harvard Extension School

2018 - 22 **Postdoctoral Fellow,** School of Engineering and Applied Sciences, Harvard University
Faculty Advisor: Professor Samir Mitragotri
Project 1: Deep eutectic solvent-based intravenous formulation of chemotherapeutic
Project 2: *In situ* self-emulsifying formulation for controlled release of small molecules
Project 3: Deep eutectic solvent-enabled enhanced bioavailability of biomacromolecules
Project 4: Red blood cell-adsorbed adeno-associated virus for enhanced gene therapy

2013 - 18 **Ph.D. in Biomedical Engineering**, Johns Hopkins University
Thesis: Engineering polymeric drug delivery vehicles for enhanced tissue targeting
Faculty Advisor: Professor Jordan Green
Funding: Samsung Scholarship
Project 1: Poly(ethylene glycol)-modified poly(β-amino ester) polyplex for gene delivery
Project 2: Anti-angiogenic peptide-loaded poly(lactic-co-glycolic) particles
Project 3: DNA barcode-based high-throughput *in vivo* screening of polyplexes

2011 - 13 **M.S.E. in Biomedical Engineering**, Johns Hopkins University
Thesis: Investigation of cellular uptake of poly(β-amino ester) polyplexes
Faculty Advisor: Professor Jordan Green
Funding: Samsung Scholarship

2011 **Research Intern,** Neuroscience, Korea Institute of Science and Technology
Faculty Advisor: Dr. Changjun Justin Lee
Project: Behavioral study on addiction to identify the role of μ-opioid receptor

2003 - 07 **B.S. in Bioengineering**, University of California, Berkeley.

TEACHING & ADVISING

Teaching Assistant

Fall 2014 **Systems Bioengineering 1**, Johns Hopkins University
Description: core course for undergraduate/graduate students in biomedical engineering
Size: 131 students
Responsibilities: leading discussion sections, holding office hours, grading all assignments
Evaluation: 3.97/5.0

Sp 2015 **Cell and Tissue Engineering Lab Module**, Johns Hopkins University
Description: elective course for undergraduate/graduate students in biomedical engineering
Size: 20 students
Responsibilities: supervising lab experiments, leading office hours, grading lab reports

Pedagogical Training

Fall 2016 **Hopkins Engineering Applications & Research Tutorials**, Johns Hopkins University
Description: paid teaching opportunity ($2000) for a Ph.D. student to be the instructor of record in a course of one's own design
Course title: *Drug Shipments: How Medications Move Through the Body*
Size: 12 undergraduate students
Responsibilities: leading lectures/discussions, holding office hours, grading all assignments
Evaluation: 4.18/5.0

Advising Experience

2021 - 22 **Mentor**, Científico Latino's Graduate Student Mentorship Initiative
2020 **Judge**, Mass STEM Hub Week Challenge
2018 - 19 **Research Mentor,** 1 undergraduate and 1 graduate student at Harvard University
Output: 2 co-authored publications, 1 doctorate thesis
2013 - 18 **Research Mentor,** 5 undergraduate students at Johns Hopkins University
Output: 4 co-authored publications, 2 undergraduate research awards

PUBLICATIONS

- Summary: 36 peer-reviewed articles, 13 first-author (* co-first), 1042 citations, 19 h-index

Selected Publications

1. Zhao, Z.*, **Kim, J.***, Chandran Suja, V., Kapate, N., Gao, Y., Guo, J., Muzykantov, V.R., Mitragotri, S. Red blood cell anchoring enables targeted transduction and re-administration of AAV-mediated gene therapy. *Adv. Science*. DOI: 10.1002/advs.202201293, 2022.
2. **Kim, J.,** Gao, Y., Zhao, Z., Rodrigues, D., Tanner, E.E.L., Ibsen, K., Sasmal, P.K., Jaladi, R., Alikunju, S., Mitragotri, S. A deep eutectic-based, self-emulsifying subcutaneous depot system for apomorphine therapy in Parkinson's disease. *PNAS*. 119(9):e2110450119, 2022.
3. **Kim, J.*,** Vaughan, H.J.*, Zamboni, C.G., Sunshine, J.C., Green, J.J. High-throughput evaluation of polymeric nanoparticles for tissue-targeted gene expression using barcoded plasmid DNA. *J. Control Release* 337:105-116, 2021.
4. Shen, J., **Kim, J**., Tzeng, S.Y., Ding, K., Hafiz, Z., Long, D., Wang, J., Green, J.J., Campochiaro, P.A. Suprachoroidal gene transfer with nonviral nanoparticles. *Sci. Adv.* 6(27):eaba1606, 2020.

5. **Kim, J.***, Mirando, A.C.*, Popel, A.S., Green, J.J. Gene delivery nanoparticles to modulate angiogenesis. *Adv. Drug Deliv. Rev.* 119:20-43, 2017.

Additional Publications

6. **Kim, J.,** Shi, Y., Kwon, C.J., Gao, Y., Mitragotri S. A deep eutectic solvent-based approach to intravenous formulation. *Adv. Healthc. Mater.* DOI: 10.1002/adhm.202100585, 2021.
7. Gao, Y., Vogus, D., Zhao, Z., He, W., Krishnan, V., **Kim, J.**, Shi, Y., Sarode, A., Ukidve, A., Mitragotri, S. Injectable hyaluronic acid hydrogels encapsulating drug nanocrystals for long-term treatment of inflammatory arthritis. *Bioeng. Transl. Med.* 7:e10245, 2021.
8. Sallam, M.A., Shields IV, W.C., Prakash, S., **Kim, J.**, Pan, D.C., Mitragotri, S. A dual macrophage polarizer conjugate for synergistic melanoma therapy. *J. Control Release* 335: 333-4, 2021.
9. Zhao, Z., Tanner, E.E.L., **Kim, J.**, Ibsen, K., Gao, Y., Mitragotri, S. Ionic liquid-enabled topical delivery of immunomodulators. *ACS Biomater. Sci. Eng.* 7(6): 2783-90, 2021.
10. Shi, Y., Zhao, Z., Peng, K., Gao, Y., Wu, D., **Kim, J.**, Mitragotri, S. Enhancement of anticancer efficacy and tumor penetration of sorafenib by ionic liquids. *Adv. Healthc. Mater.* 10(2):e2001455, 2021.
11. Zhao, Z., Ukidve, A., Kirshnan, V., Fehnel, A., Pan, D.C., Gao, Y., **Kim, J.**, Evans, M.A., Mandal, A., Guo, J., Muzykantov, V.R., Mitragotri, S. Systemic tumour suppression via the preferential accumulation of erythrocyte-anchored chemokine-encapsulating nanoparticles in lung metastases. *Nat. Biomed. Eng.* 5(5): 441-54, 2021.
12. Wu, D., Zhao, Z., **Kim, J.**, Razmi, A., Wang, L.L., Kapate, N., Gao, Y., Peng, K., Ukidve, A., Mitragotri, S. Gemcitabine and doxorubicin in immunostimulatory monophosphoryl lipid A liposomes for treating breast cancer. *Bioeng. Transl. Med.* 6(1):e10188, 2020.
13. Pan, D.C., Krishnan, V., Salinas, A.K., **Kim, J.**, Sun, T., Ravid, S., Peng, K., Wu, D., Nurunnabi, M., Nelson, J.A., Niziolek, Z., Guo, J., Mitragotri, S. Hyaluronic acid-doxorubicin nanoparticles for targeted treatment of colorectal cancer. *Bioeng. Transl. Med.* 6(1):e10166, 2020.
14. Zhao, Z., Pan, D.C., Qi, Q.M., **Kim, J.**, Kapate, N., Sun, T., Shields IV, W.C., Wang, L.L., Wu, D., Kwon, C.J., He, W., Guo, J., Mitragotri, S. Engineering of living cells with polyphenol-funcionalized biologically active nanocomplexes. *Adv. Mater.* 32(49):e2003492, 2020.
15. Wu, D., Pusuluri, A., Vogus, D., Krishnan, V., Shields IV, W.C., **Kim, J**., Razmi, A., Mitragotri, S. Design principles of drug combinations for chemotherapy. *J. Control Release* 323:36-46, 2020.
16. Zhao, Z., Ukidve, A., **Kim, J.**, Mitragotri, S. Targeting strategies for tissue-specific drug delivery. *Cell* 181(1): 151-67, 2020.
17. **Kim, J.**, Mondal, S.K., Tzeng, S.Y., Rui, Y. Al-Kharboosh, R.,Kozielski, K.K., Bhargav, A.G., Garcia, C.A., Quiñones-Hinojosa, A., Green, J.J. Poly(ethylene glycol)-poly(beta-amino ester)-based nanoparticles for suicide gene therapy enhance brain penetration and extend survival in a preclinical human glioblastoma orthotopic xenograft model. *ACS Biomater. Sci. Eng.* 6(5):2943-55, 2020.
18. Choi, J., Rui, Y., **Kim, J.**, Gorelick, N., Wilson, D.R., Kozielski, K., Mangraviti, A., Sankey, E., Bren H., Tyler, B., Green, J.J., Jackson, E.M. Nonviral polymeric nanoparticles for gene therapy in pediatric CNS malignancies. *Nanomedicine* 23:102115, 2020.
19. Zhao, Z., Ukidve, A., Gao, Y., **Kim, J.**, Mitragotri, S. Erythrocyte leveraged chemotherapy (ELeCt): nanoparticle assembly on erythrocyte surface to combat lung metastasis. *Sci. Adv.* 5(11):eaax9250, 2019.
20. **Kim, J.***, Lima e Silva, R.*, Shmueli, R.B.*, Mirando, A.C., Tzeng, S.Y., Pandey, N.B., Ben-Akiva, E., Popel, A.S., Campochiaro, P.A., Green, J.J. Anisotropic poly(lactic-co-glycolic acid) microparticles enable sustained release of a peptide for long-term inhibition of ocular neovascularization. *Acta Biomater.* 97: 451-460, 2019.
21. Shamul, J.G., Shah, S.R., **Kim, J.**, Schiapparelli, P., Vazquez-Ramos, C.A., Lee, B.J., Patel, K.K.,

Shin, A., Quiñones-Hinojosa, A., Green, J.J. Verteporfin-loaded anisotropic poly(beta-amino ester)-based micelles demonstrate brain cancer-selective cytotoxicity and enhanced pharmacokinetics. *Int. J. Nanomedicine*, 14:10045-60, 2019.

22. Karlsson, J., Rui, Y., Kozielski, K.L., Placone, A.L., Choi, O., Tzeng, S.Y., **Kim, J.**, Keyes, J.J., Bogorad, M.I., Gabrielson, K., Guerrero-Cazares, H., Quiñones-Hinojosa, A., Searson, P.C., Green, J.J. Engineered nanoparticles for systemic siRNA delivery to malignant brain tumours. *Nanoscale*, 11(42): 10045-57, 2019.
23. Kozielski, K.L., Ruiz-Valls, A., Tzeng, S.Y., Guerrero-Cazares, H., Rui, Y., Li, Y., Vaughan, H.J., Gionet-Gonzales, M., Vantucci, C., **Kim, J.**, Schiapparelli, P., Al-Kharboosh, R., Quiñones-Hinojosa, A., Green, J.J. Cancer-selective nanoparticles for combinatorial siRNA delivery to primary human GBM in vitro and in vivo. *Biomaterials*, 209:79-87, 2019.
24. Shah, S.R.*, **Kim, J.***, Schiapparelli, P., Vazquez-Ramos, C.A., Martinez-Gutierrez, J.C., Ruiz-Valls, A., Inman, K., Shamul, J.G., Green, J.J., Quiñones-Hinojosa, A. Verteporfin-loaded polymeric microparticles for intratumoral treatment of brain cancer. *Mol. Pharm*. 16(4):1433-43, 2019.
25. Nam, M, Han, K., Lee, J., Won, W., Koh, W., Bae, J.Y., Woo, J., **Kim, J.**, Kwong, E., Choi, T., Chun, H., Lee, S.E., Kim, S., Park, K.D., Choi, S., Bae, Y.C., Lee, C.J. Activation of astrocytic mu-opioid receptor causes conditioned place preference. *Cell Reports* 28(5):1154-66, 2019.
26. **Kim, J.***, Shamul, J.G.*, Shah, S.R.*, Shin, A., Lee, B.J., Quiñones-Hinojosa, A., Green, J.J. Verteporfin-loaded poly(ethylene glycol)-poly(beta-amino ester)-poly(ethylene glycol) triblock micelles for cancer therapy. *Biomacromolecules* 19(8):3361-70, 2018.
27. Min, S., Jin, Y., Hou, C.Y., **Kim, J.**, Green, J.J., Kang, T.J., Cho, S.W. Bacterial tRNase-based gene therapy with poly(beta-amino ester) nanoparticles for suppressing melanoma tumor growth and relapse. *Adv. Healthc. Mater.* 7(16):e1800052, 2018.
28. Bressler, E.M.*, **Kim, J.***, Shmueli, R.B.*, Mirando, A.C., Bazzazi, H., Lee, E., Popel, A.S., Pandey, N.B., Green, J.J. Biomimetic peptide display from a polymeric nanoparticle surface for targeting and antitumor activity to human triple-negative breast cancer cells. *J. Biomed. Mater. Res. A.* 106(6):1753-64, 2018.
29. Zamboni, C.G., Kozielski, K.L., Vaughan, H.J., Nakata, M.M., **Kim, J.**, Higgins, L.J., Pomper, M.G., Green, J.J. Polymeric nanoparticles as cancer-specific DNA delivery vectors to human hepatocellular carcinoma. *J. Control Release* 263:18-28, 2017.
30. Lima e Silva, R., Kanan Y., Mirando, A.C., **Kim, J.**, Shmueli, R.B., Lorenc, V.E., Fortmann, S.D., Sciamanna, J., Pandey, N.B., Green, J.J., Popel, A.S., Campochiaro, P.A. Tyrosine kinase blocking collagen IV-derived peptide suppresses ocular neovascularization and vascular leakage. *Sci. Transl. Med.* 9(373):eaai8030, 2017.
31. **Kim, J.**, Kang, Y., Tzeng, S.Y., Green, J.J. Synthesis and application of poly(ethylene glycol)-co-poly(beta-amino ester) copolymers for small cell lung cancer gene therapy. *Acta Biomater.* 41:293-301, 2016.
32. **Kim, J.**, Wilson, D.R., Zamboni, C.G., Green, J.J. Targeted polymeric nanoparticles for cancer gene therapy. *J. Drug Target.* 23(7-8):627-41, 2015.
33. Bishop, C.J., **Kim, J.**, Kozielski, K.L., Meyer, R., Green, J.J. Highlights from the latest articles in nanomedicine. *Nanomedicine (Lond)* 9(7):945-7, 2014.
34. **Kim, J.**, Sunshine, J.C., Green, J.J. Differential polymer structure tunes mechanism of cellular uptake and transfection routes of poly(beta-amino ester) polyplexes in human breast cancer cells. *Bioconjug. Chem.* 25(1):43-51, 2014.
35. Bishop, C.J., **Kim, J.**, Green, J.J. Biomolecule delivery to engineer the cellular microenvironment for regenerative medicine. *Ann. Biomed. Eng.* 42(7):1557-72, 2014.
36. Shmueli, R.B., Ohnaka, M., Miki, A., Pandey, N.B., Lima e Silva, R., Koskimaki, J.E., **Kim, J.**, Popel, A.S., Campochiaro, P.A., Green, J.J. Long-term suppression of ocular neovascularization by intraocular injection of biodegradable polymeric particles containing a serpin-derived peptide. *Biomaterials* 34(30):7544-51, 2013.

Manuscript Submitted

Curreri, A.M.*, **Kim, J.***, Dunne, M., Angsantikul, P., Mitragotri, S. Deep eutectic formulations for subcutaneous biologics delivery.

PATENTS

1. Mitragotri, S., Curreri, A.M., **Kim, J.**, Ionic liquids for drug delivery. *US Provisional Patent 63/253,623*, 2022.
2. Mitragotri, S., **Kim, J.** Self-emulsifying apomorphine-releasing therapeutic (SEAPORT). *US Provisional Patent 63/214,979*, 2021, 2021.
3. Campochiaro, P.A., Green, J.J., **Kim, J.**, Shen, J. Non-viral gene transfer to the suprachoroidal space. *US20200330396A1*, 2020.
4. Green, J.J., Pandey, N.B., Popel, A.S., Campochiaro, P.A., **Kim, J.**, Lima e Silva, R., Shmueli, R., Mirando, A. Biodegradable microparticles for sustained delivery of anti-angiogenic peptide. *US20200179285A1*, 2020.
5. Green, J.J., **Kim, J.**, Tzeng S. Poly(beta-amino ester)-co-polyethylene glycol (PEG-PBAE-PEG) polymers for gene and drug delivery. *US20180112038A1*, 2018.

FELLOWSHIPS & AWARDS

Fellowships

2013 – 18 Samsung Scholarship for Ph.D. program
2011 – 13 Samsung Scholarship for Master's program

Awards

2021 Baxter Young Investigator Awards

Non-academic Awards

2010 US Army Commendation Medal

PRESENTATIONS

Invited Talks

1. Engineering solutions to drug delivery challenges. Fort Worth, TX (*departmental seminar*) 2022.
2. Deep eutectic solvent-enabled intravenous formulation of cancer drugs. Round Lake, IL (*Baxter Young Investigator Award*) 2021.

Conference Talks

1. Deep eutectic solvent-based intravenous formulation of chemotherapeutic agent. Orlando, FL (*Biomedical Engineering Society*) 2021.
2. Deep eutectic solvent-enabled nano-complexation and solvation of chemotherapeutic drug. Virtual meeting (*Controlled Release Society*) 2021.

3. High-throughput i*n vivo* evaluation of nanobiomaterial-mediated tissue targeting of polymeric gene delivery vectors using DNA barcodes. Phoenix, AZ (*Biomedical Engineering Society)* 2017.
4. High-throughput combinatorial approach to formulating stable and efficient poly(ethylene glycol)-poly(beta-amino ester) nanoparticles for gene delivery. Montreal, QC (*10th World Biomaterials Congress)* 2016.
5. Subtle changes to polymer structure of poly(beta-amino ester) nanoparticles modulate cellular uptake pathway and transfection efficacy in human breast cancer cells. Washington DC (*American Society of Gene and Cell Therapy*) 2014.

Poster Presentation

1. Biodegradable polymeric microparticles allow sustained durability of a multimodal anti-angiogenic peptide to treat neovascular age-related macular degeneration. Baltimore, MD (*Association for Research in Vision and Ophthalmology)* 2017.
2. Biodegradable polymeric nanoparticles targeted by a novel biomimetic peptide to human breast cancer. Minneapolis, MN (*Society for Biomaterials)* 2017.
3. Biomimetic peptide-conjugated polymeric nanoparticles to target human breast cancer. Baltimore, MD (*Nano DDS)* 2016.
4. Engineering stable and efficient poly(ethylene glycol)-co-poly(beta-amino ester)polyplexes towards cancer gene therapy. Tampa, FL (*Biomedical Engineering Society)* 2015.
5. Engineering poly(beta-amino ester) end-group and PEGylation to improve nanoparticle stability and cellular uptake. Washington DC (*TERMIS Americas)* 2014.
6. Optimizing poly(beta-amino ester) polyplexes for enhanced cellular uptake and particle stability. San Antonio, TX (*Biomedical Engineering Society)* 2014.
7. Cellular uptake pathway of poly(beta-amino esters) nanoparticles affects gene transfection in breast cancer cells. Baltimore, MD (*Johns Hopkins INBT Symposium)* 2012.

PROFESSIONAL SERVICE

Committee Experience

2017 - 19 **Student Representative,** International Affairs Committee, Biomedical Engineering Society
Responsibilities: promote policies to encourage participation of international students

Editorial Experience

2021 - **Guest Editor,** *Bioengineering* (Publisher: MDPI)
Special Issue: Biomedical Applications of Ionic Liquids and Deep Eutectic Solvents

Journal Reviewer

Bioengineering and Translational Medicine, Molecules, Polymers, Pharmaceutics, Crystals, Journal of Drug Delivery Science and Technology

Professional Memberships

2021 - Controlled Release Society
2014 - Biomedical Engineering Society
2014 - Society for Biomaterials

2014 American Society of Gene & Cell Therapy

Non-academic Service

2007 - 10 **Military Officer (Retired 1st Lieutenant)**, Republic of Korea Air Force
interpreter to the Director of Intelligence (Major General) at the Combined Forces Command
Responsibilities: mediate and provide interpretation at meetings with US DIA, NSA, DoD