BIOGRAPHICAL SKETCH

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NAME: **PATRICK J. SINKO**

eRA COMMONS USER NAME (credential, e.g., agency login): **psinko**

POSITION TITLE: Distinguished Professor of Pharmaceutics, Parke-Davis Endowed Chair in Pharmaceutics and Drug Delivery

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Rutgers University, Piscataway, New Jersey	BS	05/1982	Pharmacy
University of Michigan, Ann Arbor, Michigan	PhD	01/1988	Pharmaceutics

A. Personal Statement

I am a pharmacist and pharmaceutical scientist who has been working in pharmaceutics and drug delivery for over 30 years. I have a broad background in pharmaceutical sciences, with specific expertise in biopharmaceutics, membrane transport, drug metabolism and pharmacokinetics, and drug delivery, including nanotechnology, drug targeting, formulation, and pharmaceutical polymers which are key research areas for this application. My doctoral work at the University of Michigan College of Pharmacy centered on oral drug delivery and intestinal absorption, concentrating on biopharmaceutics, pharmacokinetics, and predictive pharmacokinetic modeling. Since arriving at Rutgers University in 1992, I have been continuously funded by the NIH on projects related to drug delivery, formulation, biopharmaceutics, and pharmacokinetics. We have over 20 patents on drug delivery, targeting, and formulation technologies. I have also received NIH FIRST and MERIT awards during my career. The therapeutic focus of my lab is on developing drug delivery systems for treating non-small cell lung cancer, early stage breast cancer, and chemical counter-terrorism countermeasures.

Ongoing and recently completed projects:

Ongoing Research Support

U54AR055073 Laskin (PI), Sinko (contact PI, MCP Scientific Core) 09/15/06-08/31/25
Rutgers University CounterACT Research Center of Excellence
The major goals of this project are to provide formulations and drug delivery systems for the treatment of sulfur mustard wounds.
Role: Contact PI, Medicinal Chemistry and Pharmaceutics (MCP) Scientific Core

Galera Therapeutics, Inc. Sinko (PI) 07/01/19 – 12/31/22
The goal of this project is to perform mechanistic studies and develop orally administered delivery systems for novel mechanism-based cancer and COVID-19 therapeutics.

Recently Completed Projects

R01 AI117776-01 02/01/15-01/31/21
NIAID/NIH Sinko (PI)
Anti-HIV Colorectal Nanocarrier-Based Foams for Mucosal Pre-Exposure Prophylaxis
The goal of the research program is to formulate rectally administered foams that spread drug-containing nanoparticles throughout the rectum and colon, and to develop nanoparticles that are taken up and remain locally

in rectal and colonic tissues.
Role: PI

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2007- Distinguished Professor of Pharmaceutics, School of Pharmacy, Rutgers University, Piscataway, NJ.
2003- Parke-Davis Endowed Chair in Pharmaceutics and Drug Delivery, School of Pharmacy, Rutgers University, Piscataway, NJ.
2007-18 Associate Vice President, Office of Research & Economic Development, Rutgers University, New Brunswick, NJ.
1998-08 Chair, Department of Pharmaceutics, School of Pharmacy, Rutgers University, Piscataway, NJ.
1991-07 Assistant/Associate/Full Professor, School of Pharmacy, Rutgers University, Piscataway, NJ.
1988-91 Research Scientist (joint appointment): Therapeutics Systems Research Laboratories, Inc. & The University of Michigan, College of Pharmacy, Ann Arbor, Michigan.

NIH Advisory Panels (Since 2017)

2020 March: National Cancer Institute, 2020/05 ZCA1 TCRB-J (M1) Innovative Molecular and Cellular Analysis Technologies
March: National Institute of Drug Abuse, 2020/05 ZDA1 HXO-H (14) R. Avenir Award Program for Research on Substance Abuse and HIV/AIDS (DP2).
2019 February: (Chair) National Institute of Allergy and Infectious Diseases, SEP ZAI1 CD-A (C1). HHS-NIH-CDC-SBIR PHS 2019-1 Topic 64: Particle-Based Delivery of HIV Env Immunogens.
March: NIGMS ESI MIRA. National Institute of General Medical Sciences, ZGM1 TRN-2 (M1). June: CTSA Collaborative Innovation Awards, 2019/10 ZTR1 CI-4 (01) 1.
2018 March: Innovative Research in Cancer Nanotechnology**,** 2018/05 ZRG1 IMST-L (55) R.
April: National Institute of Child Health and Human Development Special Emphasis Panel 2018/05 ZHD1 DSR-L (52) 1.
July: Fellowships: Cell Biology, Developmental Biology, and Bioengineering Special Emphasis Panel ZRG1 F05-D (21).
August: NCATS Pharmacology Studies and Model Development, ZTR1 TRND-01 B.
October: NANO.
2017 March: Fellowships: Cell Biology, Developmental Biology, and Bioengineering, ZRG1 F05-D (21)/March.
July: Fellowships: Cell Biology, Developmental Biology, and Bioengineering, ZRG1 F05-D (21)/July.

Select Awards, Honors, Recognitions

2017 Fellow, Controlled Release Society.
2011 Fellow, American Association for the Advancement of Science.
2010 Rutgers University Board of Trustees Award for Excellence in Research
2006 NIH MERIT Award, National Institutes of Health, for grant: Enhancing Intestinal & Brain Uptake of Anti-AIDS Drugs (R37 AI/DK-51214).
2003 Parke-Davis Endowed Chair in Pharmaceutics and Drug Delivery.
2003 Fellow, American Association of Pharmaceutical Scientists.
1997,99 Gallo Award for Outstanding Cancer Research.
1995 Hoechst Celanese Innovative Research Award.
1994 Outstanding Teacher of the Year, Rutgers College Parents Association, Rutgers University.
1992 NIH FIRST Award, National Institutes of Health, for grant: Oral Absorption and Biopharmaceutics of Anti-HIV Drugs (R29 AI-033789).

Professional Activities (since 2017)

2023 President, American Association of Pharmaceutical Scientists.
2022 Editor/Principal Author, Martin's Physical Pharmacy and Pharmaceutical Sciences, Eighth Edition, Lippincott Williams and Wilkins.
2020- Editor-in-Chief, Biopharmaceutics Section, *Pharmaceutics*.

2005-2022 Pharmaceutical Research and Manufacturers of America Foundation, Pharmaceutics and Drug Delivery Advisory Committees.

2017 Testifying Witness, "State of Nanotechnology R&D in China: Implications for Future US Competitiveness," US-China Economic and Security Review Commission hearing on China's Pursuit of Next Frontier Tech: Computing, Robotics and Biotechnology.

2017 Editor/Principal Author, Martin's Physical Pharmacy and Pharmaceutical Sciences, Seventh Edition, Lippincott Williams and Wilkins ISBN: 978-1451191455.

Current Editorial Advisory Boards

Applied Nano, Current Drug Discovery Technologies, Delivery Reviews, Drug Delivery and Translational Research, Journal of Drug Delivery, Journal of Drug Delivery Science and Technology, Molecular Pharmaceutics, Pharmaceutics, Recent Patents in Drug Delivery and Formulation, Scientia Pharmaceutica.

C. Contributions to Science

1. Advanced Drug Delivery Systems as Countermeasures for Treating Mustard-based Wounds of the Eyes, Lungs and Skin. We have been involved with developing mustard countermeasures for close to 15 years with a focus on treating at the site of exposure. Numerous issued patents and publications have resulted from our efforts in developing delivery systems for topical application to the skin and eyes. We also developed an injectable particulate-based drug delivery system that selectively accumulates in the lungs allowing for the treatment of the lung mucosa from the inside out, which is particularly important after inhalation mustard wounds that compromise a patient's lung function. We have developed nanosuspensions, nanoparticles and fast-forming polyethylene-glycol based hydrogels for these purposes.

a. Anumolu, S.S., A.S. DeSantis, A.R. Menjoge, R. A. Hahn, J.A. Beloni, M.K. Gordon, **P.J. Sinko**. *Doxycycline loaded poly(ethylene glycol) hydrogels for healing vesicant-induced ocular wounds.* Biomaterials, 2010. **31**(5): 964-974. doi: 10.1016/j.biomaterials.2009.10.010. (PMID 19853296).
b. Gordon, M.K., A. DeSantis, M. Deshmukh, C.J. Lacey, R.A. Hahn, J. Beloni, S.S. Anumolu, J.J. Schlager, M.A. Gallo, N. Hiendel, D.R. Gerecke, K.K.H. Svoboda, M. Babin, and **P.J. Sinko**. *Doxycycline hydrogels as a potential therapy for ocular vesicant injury.* Journal of Ocular Pharmacology and Therapeutics, 2010. **26**(5): 407-419. doi: 10.1089/jop.2010.0099. (PMCID: PMC2956382).
c. Anumolu, S.S., A.R. Menjoge, M. Deshmukh, D. Gerecke, S. Stein, J. Laskin, and **P.J. Sinko**. D*oxycycline hydrogels with reversible disulfide crosslinks for dermal wound healing of mustard injuries*. Biomaterials, 2011. **32**(4): 1204-1217. doi: 10.1016/j.biomaterials.2010.08.117. (PMCID: PMC 2995374).
d. Laskin, J.D., G. Wahler, C.R. Croutch, **P.J. Sinko**, D.L. Laskin, D.E. Heck and L.B. Joseph. *Skin remodeling and wound healing in the Gottingen minipig following exposure to sulfur mustard*. Cellular and Molecular Pathology, 115: August 2020. https://doi.org/10.1016/j.yexmp.2020.104470

2. Non-surgical Methods and Delivery Systems for Treating Early Stage Breast Cancers. I have been involved in the development of non-surgical alternative treatments for early stage breast cancers including DCIS for over 10 years. The general approach includes injection of a liquid vehicle containing a drug delivery system such as a nanocarrier through the nipple into a milk duct using superfine microcatheters that were developed for this purpose. The affected/cancerous milk duct can be identified in clinical practice without biopsies. The liquid vehicle gels after distributing throughout the duct by chemical- or temperature-dependent processes thus increasing its residence time. Our team has clearly demonstrated that breast milk ducts are highly permeable and that mammary tissue retention and drug efficacy can be significantly increased using nanotechnology. Representative papers and patents are listed below:

a. Al-Zubaydi, F., D. Gao, D. Kakkar, S. Li, D. Alder, J. Holloway, Z. Szekely, Z. Gu, N. Chan, S. Kumar, S. Love, and **P.J. Sinko** (2020). Transpapillary Nanoformulations For Treating Ductal Carcinoma In Situ I: Exploring Metal-Ion Complexation To Slow Ciclopirox Release, Enhance Mammary Persistence And Efficacy. Journal of Controlled Release, 323: 71-82 (2020). https://doi.org/10.1016/j.jconrel.2020.04.016.
b. Gu, Z, F. Al-Zubaydi, D. Adler, S. Li, S. Johnson, P. Prasad, J. Holloway, Z. Szekely, S. Love, D. Gao and **P.J. Sinko** (2018). Evaluation of Intraductal Administration of Polyethylene Glycol-Doxorubicin

Conjugate Nanocarriers for the Treatment of Ductal Carcinoma In Situ (DCIS) -Like Lesions in Rats. Journal of Interdisciplinary Nanomedicine, 2018. **3**(3): 146-159. doi:10.1002/jin2.51.

c. Gu, Z, D. Gao, F. Al-Zubaydi, S. Li, Y. Sing, K. Rivera, J. Holloway, Z. Szekely, S. Love and **P. J. Sinko** (2018). The Effect of Size and Polymer Architecture of Doxorubicin-Poly(ethylene) Glycol Conjugate Nanocarriers on Breast Duct Retention, Potency and Toxicity. European Journal of Pharmaceutical Sciences. **121**(30): 118-125. doi.org/10.1016/j.ejps.2018.04.033. (PMID: 29698706).

d. Singh, Y., D. Gao, Z. Gu, S. Li, K. A. Rivera, S. Stein, S. Love, **P. J. Sinko** (2012). Influence of Molecular Size on the Retention of Polymeric Nanocarrier Diagnostic Agents in Breast Ducts. Pharmaceutical Research, **29** (9): 2377-2388. doi:10.1007/s11095-012-0763-z. (PMCID: PMC3442773).

3. <u>Active Targeting of Nanocarriers to Cellular Therapeutic Sites of Action</u>. Targeting immune cells such as macrophages is an important goal of drug therapy, in order to maximize drug concentrations at the required site of action while minimizing systemic exposure and side effects. A major effort in my lab has been the active targeting of cell types such as macrophages for preventing and eradicating HIV, treating non-small cell lung cancer and developing chemical terrorism countermeasures. In addition to delivering drug payloads, we have been able to actively target nanocarriers to macrophages without activating them, use nanocarriers without drugs to mimic the biology of HIV infection and thus prevent infection, target macrophages based on their phenotype, and other important advances. The NIH has funded us for many years in these areas and representative publications are listed below:

a. Gao, J., Chen, P., Singh, Y., Zhang, X., Szekely, Z., Stein, S., and **Sinko, P.J.** (2013). Novel monodisperse PEGtide dendrons: design, fabrication and evaluation of mannose receptor-mediated macrophage targeting. Bioconjugate Chemistry, 24(8), 1332-1344. PMCID: PMC3940669

b. Chen, P., Zhang, X., Jia, L., Prud'homme, R.K., Szekely, Z., and **Sinko, P.J.** (2014). Optimal structural design of mannosylated nanocarriers for macrophage targeting. Journal of Controlled Release, 194, 341-349. PMCID: PMC4254139

c. Samizadeh, M., Zhang, X., Gunaseelan, S., Nelson, A.G., Palombo, M.S., Myers, D.R., Singh, Y., Ganapathi, U., Szekely , Z., and **Sinko, P .J.** (2015). Colorectal delivery and retention of PEG-Amprenavir-Bac7 nanoconjugates-proof of concept for HIV mucosal pre-exposure prophylaxis. Drug Delivery and Translational Research, 6, 1-16. doi 10.1007/s13346-015-0269-4

d. Chen, P., X. Zhang, A. Venosa, I.H. Lee, D. Myers, J.A. Holloway, R.K. Prud'homme, D. Gao, Z. Szekely, J.D. Laskin, D.L. Laskin, and **Sinko, P.J.** (2020). *A Novel Bivalent Mannosylated Targeting Ligand Displayed On Nanoparticles Selectively Targets Anti-Inflammatory M2 Macrophages*. Pharmaceutics, 2020. 12, 243; doi:10.3390/pharmaceutics12030243.

4. <u>Passive Targeting to Improve Drug Therapy</u>. Passive targeting is a drug delivery method that exploits the anatomical properties of the human body to promote drug carrier and drug accumulation at or near sites of therapeutic action. For example, after intravenous injection, the first filter organs that are encountered are the lungs. The lungs have the largest pore size followed by the liver and then the spleen. Our lab is developing particle-based injectable delivery systems for the treatment of non-small cell lung cancer and chemical terrorism countermeasures that take advantage of these natural phenomena. For example, we have been able to prolong drug concentrations in the lung for up to a week while achieving negligible systemic drug concentrations.

a. Kutscher, H.L., Chao, P., Deshmukh, M., Singh, Y., Hu, P., Joseph, L.B., Reimer, D.C., Laskin, D.L., and **Sinko, P.J.** (2010). Threshold size for optimal passive pulmonary targeting and retention of rigid microparticles in rats. Journal of Controlled Release, 143(1), 31-37. PMCID: PMC2840186

b. Deshmukh, M., Kutscher, H., Gao, D., Sunil, V.R., Malaviya, R., Vayas, K., Stein, S., Laskin, J.D., Laskin, D.L., and **Sinko, P.J.** (2012). Biodistribution and renal clearance of biocompatible lung targeted poly(ethylene glycol) (PEG) nanogel aggregates. Journal of Controlled Release, 164(1), 65-73. PMCID: PMC3858961

c. Kutscher H., D. Gao, S. Li, C. B. Massa, J. Cervelli, M. Deshmukuh, L. B. Joseph, D. L. Laskin, and **Sinko, P. J.** (2013). Toxicodynamics of ridged polystyrene microparticles on pulmonary gas exchange

in mice: Implications for microemboli-based drug delivery systems. Toxicology and Applied Pharmacology, 2013. 266(2): 214-223. doi: 10.1016/j.taap.2012.10.021. (PMCID: PMC3586786).

d. **Sinko, P.J.**, Prud'homme, R.K., Stone, H.A., Pinkerton, N.M., Shi, L., Wan, J., Ibrahim, S., & Gao, D. "Lung Targeting Dual Drug Delivery System." United States Patent 9,421,194 (August 2016).

Complete List of Published Work in MyBibliography: https://www.ncbi.nlm.nih.gov/pubmed/?term=sinko+p

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Google Scholar:
https://scholar.google.com/citations?hl=en&user=EQIgiYcAAAAJ&view_op=list_works&sortby=pubdate

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