BIOGRAPHICAL SKETCH

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NAME: Prud'homme, Robert Krafft

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

POSITION TITLE: Professor of Chemical and Biological Engineering

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
Stanford University, Stanford CA	B.S.	06/1969	Chemical Engineering
Harvard University, Cambridge MA	Grad Special Studies	06/1973	Environmental Science and Public Policy
University of Wisconsin-Madison, Madison WI	Ph.D.	01/1978	Chemical Engineering

1. Personal Statement

My research program focuses on the use of engineering fundamentals, and specifically my background in polymer science, to develop novel delivery systems for therapeutic delivery. The work has a strong translational component where we take new therapeutic compounds and concepts and develop nanoparticle and microgel constructs to enable delivery and treatment. Our unique block-copolymer-directed, rapid-precipitation process enables efficient, scalable production of multifunctional nanoparticles in a single step. The process enables incorporation of imaging agents (PET, SPEC, MRI, and fluorescence), targeting agents (mannose, folate, VEGF, scFV, and antibodies) into nanoparticles for difficult to deliver therapeutics (hydrophobic drugs, siRNA, and biologics). The work is highly collaborative with linkages to major pharmaceutical companies (Merck, GSK, Novartis, J&J), innovative startup companies, and medical research centers (NIH, Harvard, Univ. Penn, Rutgers, Columbia).

I have trained 57 graduate students, 10 MSE students, and 13 post-doctoral students, who have advanced to academic and industrial careers. An important part of the training and culture in my group is to provide each student with a research experience outside of our laboratory. This involves training periods from 3 months to a year in industrial labs (Novartis Switzerland, Novartis USA, Merck, J&J), or in startup companies (ProChem Solutions, Bend Research), or academic laboratories (Univ. Sydney Pharmacy, Univ. Queensland, AU). Another component of training is that each student serves as a mentor and advisor for more junior researchers. For the post-doctoral researcher this means mentoring graduate students, and for graduate students this means mentoring Princeton seniors who do a Senior Thesis Research Project. The training of my students, thus, involves learning skills in working with peers in external collaborations, and learning leadership skills working as research supervisors.

Citations:

1. Prud'homme, R. K.; Ristroph, K. D.; Pinkerton, N. M.; Lu, H. D.; Rummaneethorn, P., Hydrophobic ion pairing and flash nanoprecipitation for formation of controlled-release nanocarrier formulations. Google Patents: 2020.

2. Ristroph, K.; Salim, M.; Wilson, B. K.; Clulow, A. J.; Boyd, B. J.; Prud'homme, R. K., Internal liquid crystal structures in nanocarriers containing drug hydrophobic ion pairs dictate drug release. *Journal of Colloid and Interface Science* **2020,** *582*, 815-824.
3. Sato, H.; Kaneko, Y.; Yamada, K.; Ristroph, K. D.; Lu, H. D.; Seto, Y.; Chan, H.-K.; Prud'homme, R. K.; Onoue, S., Polymeric Nanocarriers With Mucus-Diffusive and Mucus-Adhesive Properties to Control Pharmacokinetic Behavior of Orally Dosed Cyclosporine A. *Journal of Pharmaceutical Sciences* **2020,** *109* (2), 1079-1085.
4. .Wang, L. Z.; Lim, T. L.; Padakanti, P. K.; Carlin, S. D.; Alavi, A.; Mach, R. H.; Prud'homme, R. K., Kinetics of Nanoparticle Radiolabeling of Metalloporphyrin with 64Cu for Positron Emission Tomography (PET) Imaging. *Industrial & Engineering Chemistry Research* **2020**.

B. Positions and Honors

Positions and Employment

1969-1972 Officer (Captain), U.S. Army, Republic of Vietnam, l970-l971
1971-1972 Environmental Engineer, U.S. Army Armaments Command, Joliet Ill. Awards: Bronze Star, Army Commendation Medal
1978 Professor, Department of Chemical Engineering, Princeton University
1982-2014 Director and founder, Princeton Program in Engineering Biology

Professional Memberships and Experience

1979-1981 Task Force on Exxon Research and Engineering, University Cooperative Research
1982-1992 Board of Directors, AIChE Materials Science and Engineering Division
1982-2000 Board of Directors, Rheometrics Inc., Piscataway, NJ
1983- Editorial Board, Butterworths Publishers Series in Chemical Engineering
1985 Lecturer, University of Minnesota short course, "Rheological Measurements"
1985 Lecturer, University of Connecticut short course, "Laser Doppler Velocimetry"
1986, 1987, 1992, 1993 Lecturer, A.C.S. short course "Water Soluble and Water Swellable Polymers"
1984 Steering Committee, National Bureau of Standards Chemical Engineering Center Mixing Study
1985 Advisory Committee, Water Soluble Polymer Research, American Cyanamid Central Research
1988 Lecturer, Polymer Processing Institute short course, "Polymers in Electronics Packaging"
1989-1991 Executive Committee, U.S. Society of Rheology
1992-1998 Editorial Board, "Polymer Gels and Networks", Elsevier Science Publishers
2003- Editorial Board, "Soft Materials", Elsevier Science Publishers
2004 Editorial Board, "Journal of Applied Polymer Science, Wiley Publishers
1990 Director, Program in Engineering Biology, Princeton University
2001-2005 Dow Chemical Company, Material Science Technical Advisory Board
2005 Chair Dow Chemical Company, Material Science Technical Advisory Board
1997- Operations Advisory Group, New Jersey Center for Biomaterials & Devices
2005 Wayne State University Visiting Committee
2005-2009 BASF Advisory Council for Nanotechnology
2005-2007 Vice President of the Society of Rheology
2007-2009 President of the Society of Rheology
2009- Editorial Board, "Therapeutic Delivery", Future Science Group
2012 Scientific Advisory Board, Lubrizol Chemical Company
2013 Scientific Advisory Board for Formulation Science, Dow Chemical Company.

Honors and Awards

1984 National Science Foundation Presidential Young Investigator Award
1998 Outstanding Teacher Award, SEAS Princeton University
1992 McCabe Lecturer, Dept. Chem. Engr., North Carolina State Univ.
2005 Turner Alfrey Professor, Midland Molecular Institute
2005 Bird, Stewart and Lightfoot Lecturer, University of Wisconsin
2006 University of Sydney Visiting Professor Fellowship

2007 Merck Lectureship, University of Puerto Rico – Mayaguez
2009 Denis Shah Lectureship, University of Florida
2013 University of Sydney Visiting Professor Fellowship
2018 Edison Award for outstanding foundational patent, Research and Development Council NJ
2020 Reuel Shinnar Lecturship, City College of New York
2020 Princeton University Award for Distinguished Innovation

C. Contribution to Science

1. Our major contribution to the field of nanomedicine comes from our development of the block-copolymer directed rapid precipitation process Flash NanoPrecipitation (FNP). The importance of the technology is that it enables the formation of nanocarriers that can incorporate multiple hydrophobic actives in the cores of 50-500 nm particles in a single step. The process is scaleable from 1mg of new drug compound samples to 1000 kg/da. Under our funding from the Bill and Melinda Gates Foundation the FNP process has been implemented at WuXi Aptec to produce antimalarial drugs for global health. The process ensures the translation of new laboratory science to clinical production. The block copolymer corona stabilizing the nanocarriers enables the synthesis of targeted nanocarriers where the difficult polymer synthesis, purification, and validation can be done prior to nanocarrier formation. With the process we have demonstrated:

a. Prodrug synthesis and encapsulation to enable controlled release of single and multiple actives to achieve drug “cocktail” delivery of multiple drugs from a nanocarrier platform.
b. Simultaneous encapsulation of actives and imaging agents to enable MRI, PET, SPECT, photo-acoustic, upconverting crystal, and long wavelength optical imaging to track nanoparticle delivery and fate.
c. Encapsulation of siRNA using ion pairing to enable scaleable siRNA therapeutics in collaboration with Merck.
d. Single step assembly of targeted nanocarriers with targeting using: mannose, folate, LHRH peptides, VEGF, centyrins, BSA, and antibodies. The process provides quantitative assembly of small molecule ligands up to 14K.