CURRICULUM VITAE

Sangtae Kim, PhD
Distinguished Professor
School of Chemical Engineering
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Current Research Program

Research on rational, computer-aided drug design, enhancing success rates in the lead optimization preclinical stage of drug discovery & development. The research program spans "discovery to delivery" with a collaborative, campus-based network drawing expertise from the schools of medicine and pharmacy – to go from computer-design of novel drug candidates to Phase 1 human clinical trials. The approach shows great promise for a broad class of targets and therapeutic areas, but so as to reach the proof-of-concept endpoint (research alliance and licensing of the lead compound with a large pharmaceutical company) in a timely manner, the first efforts focused on the design of novel kinase inhibitors of validated cancer targets. Outreach discussions with pharmaceutical companies center on the superior therapeutic profile (fewer side effects) of our anti-cancer compounds.

Purdue University

- **Distinguished Professor of Chemical Engineering (**and **Donald W. Feddersen Distinguished Professor of Mechanical Engineering, 11/2003 – 10/2008), 2003-present**.
  - Research and teaching activities on the enabling role of cyberinfrastructure (CI) at the intersection of the biological, computational and mathematical sciences. Purdue CI interests focused on (1) the link between informatics and data-intensive processes in pharmaceutical discovery research and (2) self-assembly in microfluidic/nanofluidic environments to accelerate low-cost Radio Frequency Identification (RFID) technologies and the enablement of efficient supply chains.

Morgridge Institute for Research (MIR), Madison, Wisconsin

- **Executive Director (Founding), 10/2008 – 6/2012**

Inaugural Executive Director of the not-for-profit medical research institute based at the University of Wisconsin-Madison campus. CEO leadership role; created the organizational blueprint – a founding scientific leadership team to champion multi-disciplinary collaborations between the biomedical sciences with the computational & physical sciences. The strategy achieved high national profile for MIR and UW-Madison by winning two highly competitive and large awards at the biomedical interface with the physical sciences ($20M DOE award for accelerator-based technologies for medical isotopes) and computational sciences ($23.6M DHS award for software assurance technologies, renewable indefinitely after 2017 @ $5M/yr.).

National Science Foundation (on loan from Purdue University), Arlington, VA

- **Division Director, Division of Shared Cyberinfrastructure, 2/2004 – 9/2005**
  - Lead the transformation of the national R&D cyberinfrastructure from extant elements (comprised of supercomputer centers and high-speed network deployments) to the greater and emerging vision of an integrated system dynamically linking distributed resources, distributed data and distributed users.

Lilly Research Laboratories, Eli Lilly and Company, Indianapolis, IN

- **Vice President and Information Officer, 10/2000 – 10/2003**
  - Senior management position in the Lilly Research Laboratories (LRL, the R&D division of Eli Lilly and Company) with responsibilities for the many facets of informatics and information technology (over 500 staff) in support of one of the largest pharmaceutical research organizations in the world (annual R&D budget of over $2B in 2003). Guided the IT transition to web services and middleware architecture despite extreme budgetary constraints resulting from premature loss of patents on company's flagship product.

CURRICULUM VITAE

Sangtae Kim

Parke-Davis Pharmaceutical Research, Warner-Lambert Company, Ann Arbor, MI
- **Vice President, Scientific Information Resources, 12/97- 6/2000**
  - Responsible for seven departments (over 300 staff) whose missions encompass the many facets of scientific information technology (IT) and knowledge management (KM) in support of the fastest growing R&D organization among the large pharmaceutical companies. At the time of the merger with Pfizer, Warner-Lambert's annual pharmaceutical R&D budget was in excess of $1B.
  - Member, Information Management Functional Integration Team, with the charter to create a new informatics organization to support the largest R&D organization in the pharmaceutical world upon the merger of Pfizer and Warner Lambert.

University of Wisconsin-Madison, Madison, WI
- Emeritus Professor, 2014-present.
- Chair, Department of Chemical Engineering, 7/95-12/97.
- Wisconsin Distinguished Professor, 9/91-12/97.
- Professor of Computer Sciences (by courtesy), 9/90-12/97.
- Professor of Chemical Engineering, 6/90-12/97.
- Associate Professor, 6/87-6/90.
- Assistant Professor, 1/83-6/87.

Other Professional Experience
- Team Leader, 4/96-9/98, Computational Biology Applications Technology Team, NSF-PACI Alliance, **National Center for Supercomputing Applications**, Urbana, IL.
- NSF GOALI project on novel microfluidic self-assembly, summer 1995, with **Beckmen Display**, Berkeley, CA (now known as **Alien Technology Corporation**, Morgan Hill, CA).
- Visiting Professor, 7/91-12/91, **Pohang Institute of Science and Technology**, Pohang, Korea
- Distinguished Visiting Scholar, 8/89-12/89, **University of Massachusetts**, Amherst, MA.
- Process Engineer, summer 1984, **Intel Corporation**, Santa Clara, CA.
- Process Consultant, summer 1983, **Amoco Oil Company**, Naperville, IL,

EDUCATIONAL BACKGROUND

- **Princeton University**, 9/79-1/83, Ph.D. June 1983
  Ph.D. Thesis: *Modeling of Porous Media via Renormalization of the Stokes Equation.*
  Advisor: William B. Russel
- **California Institute of Technology**, M.S.Ch.E. (concurrent with B.Sc. degree) June 1979
  M.Sc. Thesis: *Periodic Capillary Models of Diffusion in Porous Solids.*
  Advisor: George R. Gavalas

AWARDS and HONORS

- **2015 Induction,** Fellow, American Institute of Chemical Engineers.
- **2013 Ho-Am Prize in Engineering,** Samsung Foundation.
- **2008** Listed in the **"One Hundred Engineers of the Modern Era"**, by the American Institute of Chemical Engineers, Centennial celebrations of the Institute.
- **2008 George Lappin Award**, American Institute of Chemical Engineers (for distinguished service to meetings and technical programming).
- **2007 Profiled on TV Documentary** (30-minute episode), "*Cross World People*", Arirang TV Network, Korea.
- **2005** *Microhydrodynamics: Principles and Selected Applications* selected for the reprint series by the Dover Editorial Board and cited for "enduring value".
- **2001 Induction**, National Academy of Engineering.
- **2001 Induction**, Fellow, American Institute of Medical and Biological Engineers.
- **1993 Allan P. Colburn Award**, American Institute of Chemical Engineers.
- **1992 William O. Baker Award for Initiatives in Research**, National Academy of Sciences U.S.A.
- **1991-92 Outstanding Instructor in Chemical Engineering**, Polygon Engineering Student Council.

- **Wisconsin Distinguished Professorship**, University of Wisconsin (awarded 1991).
- **Romnes Faculty Fellowship**, University of Wisconsin (awarded 1990).
- **Presidential Young Investigator Award**, National Science Foundation (awarded 1985).
- **George Van Ness Lothrop Fellowship**, Princeton University (awarded 1981).
- **Jack E. Froelich Award for Professional Promise**, (1978) California Institute of Technology.

Distinguished/Endowed/Named Lectureships

- ***2007 Robert L. Pigford Lecture***, Department of Chemical Engineering, University of Delaware.
- ***2007 Distinguished Lecture***, (inaugural) Department of Chemical Engineering, University of Massachusetts.
- ***2006 Arnie G. Fredrickson Lecture***, Department of Chemical Engineering, University of Minnesota.
- ***2005 Barnett F. Dodge Lecture***, Department of Chemical Engineering, Yale University.
- ***2005 Benton Lecture*** College of Engineering, University of Florida.
- ***2002 William N. Lacey Lecture***, Dept. of Chemical Engineering, California Institute of Technology.
- ***2002 Julian C. Smith Lecture***, School of Chemical Engineering, Cornell University.
- ***2002 Britton Chance Distinguished Lecture In Engineering and Medicine***, University of Pennsylvania.
- ***2001 Janice Lumpkin Memorial Lecture,*** University of Maryland Baltimore County.
- ***2001 Reilly Lecture***, Department of Chemical Engineering, University of Notre Dame.
- ***2001 Jack A. Gerster Lecture***, Department of Chemical Engineering, University of Delaware.
- ***1996 Stanley Corrsin Lecture in Fluid Mechanics,*** Johns Hopkins University.
- ***1995 Warren McCabe Lecture***, North Carolina State University.
- ***1991 Robert W. Vaughan Lecture***, Department of Chemical Engineering, California Institute of Technology.
- ***1989 Allan P. Colburn Memorial Lecture***, Department of Chemical Engineering, University of Delaware.

RESEARCH GROUP (past and present)

Current PhD Students
Curtis P. Martin
Akancha Pandey

Former PhD Students (22) and Current Assignments
Nathan J. Patterson (Ph.D. 2009) (*intelligent supply chains*) Radiant Fabrication (founder), Madison, WI.
Hari Nair (Ph.D. 2009) (*microfluidics for high throughput analysis*) ExxonMobil, Florham Park, NJ.
Kevin N. Witte (Ph.D. 2008) (*self-assembly*) Intel Corp., Portland, OR.
Sridhar Maddipati (Ph.D. 2007) (*machine learning algorithms*) Microsoft, Redmond, WA.
Ravi Nandigam (Ph.D. 2007) (*supply chain informatics*) Aspen Technology, Cambridge, MA.
Brian M. Prather (Ph.D. 1999) (*data visualization – pharma/biotech*) Spotfire Inc., Cambridge, MA.
Atipat Rojnuckarin (Ph.D. 1998) (*information architecture*) ArQule Pharmaceuticals, Woburn, MA.
Iasson Mustakis (Ph.D. 1998) (*new manufacturing technologies*) Pfizer Global R&D, Groton, CT.
Saroja Ramanujan (Ph.D. 1998) (*systems biology*) Entelos, Foster City, CA.
Heewon Yang (Ph.D. 1998) Research Associate (food science) U. of Wisconsin, Madison, WI.
Brian E. Saunders (Ph.D. 1997) (*bioinformatics*) San Diego Supercomputer Center, LaJolla, CA.
Gene Xu (Ph.D. 1996) Intel Corp., Portland, OR.
Gary A. Huber (Ph.D. 1995) UC San Diego, LaJolla, CA.
Christine Maul (Ph.D. 1994) Bayer Research Laboratory, Leverkusen, Germany.
Peyman Pakdel (Ph.D. 1993) Co-Founder, Novex Products Inc., Lorain, OH.
Douglas A. Brune (Ph.D. 1993) Dow Chemical, Midland, MI.
Yuris O. Fuentes (Ph.D. 1990) Dupont Corp. Wilmington, DE.
Steven R. Strand (Ph.D. 1989) Dow Chemical, Midland, MI.
Byung J. Yoon (Ph.D. 1989) Professor (chemical engineering), POSTECH, Pohang, Korea.
Seppo J. Karrila (Ph.D. 1988) Research Scientist, Lilly Systems Biology, Singapore.
Shih-Yuan Lu (Ph.D. 1988) Professor (chemical engineering), NTHU, Hsinchu, Taiwan.
Hanh X. Vo (Ph.D. 1988) Dow Corning, Midland, MI.

CURRICULUM VITAE

Sangtae Kim

CURRENT SPONSORED RESEARCH

Unrestricted startup funds to support the design of anti-cancer kinase inhibitors, UW-Madison Chancellor's Innovation Fund.

PRIOR SPONSORED RESEARCH University of Wisconsin (1983-97)

National Science Foundation (Continuous support from NSF 1984-97)
Bridging Microstructural and Continuum Theories of Dispersed Systems: New Insights from Advanced Computational Architectures, Fluid, Particulate & Hydraulics Systems Program;
University-Industry Collaborative Research on Fluidic Self Assembly, GOALI Program;
Partnership for Advanced Computational Infrastructure (Computational Biology), Division of Advanced Scientific Computing;

Office of Naval Research (Continuous support from ONR 1989-97)
Microstructural Models of Interactions that Govern Protein Conformations, Biological Sciences and Technology Program.
Optimal Configurational Space Pathways for Protein Dynamics, Biological Sciences and Technology Program.

SERVICE, OUTREACH and TECHNOLOGY TRANSFER

Board Service (Private Sector)

- Scientific Advisory Board, Venture Investors, Madison, WI. 2005 to present.
- Scientific Advisory Board, IO Informatics, Berkeley, CA. 2005 to 2012.
- Board of Directors, Indigo Biosystems (Eli Lilly spin-off), Carmel, IN. 2005 to 2011.
- Technical Advisory Board, Alien Technology Corp., Morgan Hill, CA. 2003 to 2006.
- Scientific Advisory Board, MDL Inc. (subsidiary of Reed-Elsevier), San Leandro, CA. 2002 to 2003.

Current and Past (Selections) Public and Professional Service

- International Advisory Panel, NGS of the National University of Singapore, 2008 to present.
- Science Board, Food and Drug Administration, 2009 to 2012.
- Panel on Simulation Based Engineering and Science (Vice Chair), World Technology Evaluation Center on behalf of several federal agencies, 7/2007 to 2009.
- Advisory Boards (Korea Advanced Inst. Science & Technology: ChE Dept, UC Santa Barbara: ChE Dept, Illinois Inst. Technology: College of Engineering.
- Consulting Editor (Information Technology), AIChE Journal, 2003 to present.
- Centennial Science and Technology Review Group (Chair, IT Infrastructure Subgroup), Science Board, Food and Drug Administration, Rockville, MD, 2006 to 2007.
- Fernbach Award Committee, Supercomputing 2006 and 2007.
- Awards Committee, American Institute of Chemical Engineers, 2004 to 2007.
- Executive Review Board, Pharmaceutical Achievement Awards, 2004 to 2006.
- Committee of Visitors, NSF Chemical Transport and Systems Division, 2006.
- Division Director Search Committee, NSF Chemical Transport and Systems Division, 2004.
- U.S. Papers Co-Chair, International Conference on Theoretical and Applied Mechanics, 2004.
- Trustee, Computer Aids for Chemical Engineering (CACHE), 11/1990 to 12/2003.
- Advisory Board, Dept. of Chemical Engineering, Princeton University (1998 to 12/2003).
- National Advisory Council, College of Engineering, University of Michigan (1998 to 12/2003).
- Advisory Board, Department of Chemical Engineering, University of Illinois (1998 to 12/2003).
- Advisory Board, Bioinformatics Program, Boston University (1999 to 12/2003).
- Advisory Board, Dept. of Chemical Engineering, Northwestern University (2000 to 12/2003).

CURRICULUM VITAE

Sangtae Kim

- Advisory Board, Dept. of Chemical Engineering, University of Texas (2000 to 12/2003).
- Engineering Directorate Advisory Committee, National Science Foundation (10/2002 to 12/2003).
- Chair, Executive Board of the National Programming Committee, American Institute of Chemical Engineers (2002), Past Chair (2003).
- Board on Chemical Sciences and Technology, National Research Council (6/2000 to 6/2003).
- U.S. Co-Chair, German-American Frontiers of Engineering, National Academy of Engineering (2002-03).
- Peer Review Committee (Special Section 13 - Bioinformatics), National Academy of Engineering (2002-03).
- Meeting Program Chair, American Institute of Chemical Engineers Annual Meeting, Chicago (1996).
- Area 1j (Fluid Mechanics) Programming Coordinator, AIChE Annual Meeting, San Francisco (1989).

PUBLICATIONS (Pharmaceutical Informatics denoted by (**) and highly decorated publications in blue)

1. Gavalas, G.R. and Kim, S. (1981) *Periodic Capillary Models of Diffusion in Porous Solids*, Chem. Engrg. Sci. **36**, 1111-1122.

2. Kim, S. and Fan, X. (1984) *A Perturbation Solution for Rigid Dumbbell Suspensions in Steady Shear Flow*, J. Rheology **28**, 117-122.

3. Kim, S. and Russel, W.B. (1985) *The Hydrodynamic Interaction between Two Spheres in a Brinkman Medium*, J. Fluid Mech. **154**, 253-268.

4. Kim, S. and Russel, W.B. (1985) *Modeling of Porous Media by Renormalization of the Stokes Equations*, J. Fluid Mech. **154**, 269-286.

5. Kim, S. and Mifflin, R.T. (1985) *The Resistance and Mobility Functions of Two Equal Spheres in Low Reynolds Number Flow*, Phys. Fluids **28**, 2033-2045.

6. Kim, S. (1985) *Sedimentation of Two Arbitrarily Oriented Spheroids in a Viscous Fluid*, Intl. J. Multiphase Flow **11**, 699-712.

7. Kim, S. (1985) *Note on Faxen Laws for Nonspherical Particles*, Intl. J. Multiphase Flow **11**, 713-719.

8. Kim, S. (1986) *Singularity Solutions for Ellipsoids in Low-Reynolds-Number Flows: with Applications to the Calculation of Hydrodynamic Interactions in Suspensions of Ellipsoids*, Intl. J. Multiphase Flow **12**, 469-491.

9. Kim, S. (1986) *The Motion of Ellipsoids in a Second Order Fluid*, J. Non-Newtonian Fluid Mech. **21**, 255-269.

10. Kim, S. and Arunachalam, P.V. (1987) *The General Solution for an Ellipsoid in Low-Reynolds-Number Flow*, J. Fluid Mech. **178**, 535-547.

11. Kim, S. and Lawrence, C.J. (1987) *Similarity Solutions for the Orientation Distribution Function and Rheological Properties of Suspensions of Axisymmetric Particles with External Couples*, J. Non-Newtonian Fluid Mech. **24**, 297-310.

12. Strand, S.R., Kim, S. and Karrila, S.J. (1987) *Computation of Rheological Properties of Suspensions of Rigid Rods: Stress Growth after Inception of Steady Shear Flow*, J. Non-Newtonian Fluid Mech. **24**, 311-329.

13. Kim, S. (1987) *Stokes Flow past Three Spheres: An Analytic Solution*, Phys. Fluids **30**, 2309-2314.

14. Kim, S. and Lu, S.Y. (1987) *On the Functional Similarity between Faxen Relations and Singularity Solutions for Fluid/Fluid, Fluid/Solid and Solid/Solid Dispersions*, Intl. J. Multiphase Flow **13**, 837-844.

15. Yoon, B.J. and Kim, S. (1987) *A Note on the Direct Calculation of Mobility Functions of Two Equal-sized Spheres in Stokes Flow*, J. Fluid Mech. **185**, 437-446.

16. Lu, S.Y. and Kim, S. (1987) *The General Solution and Faxªn Laws for the Temperature Field in and Outside an Isolated Ellipsoid*, J. Engng. Math. **21**, 179-200.

17. Kim, S. and Lawrence, C.J. (1988) *Review Article 28. Suspension Mechanics for Particle Contamination Control*, Chem. Engrg. Sci. **43**, 991-1016.

18. Fuentes, Y.O., Kim, S. and Jeffrey, D.J. (1988) *Mobility Functions for Two Unequal Viscous Drops in Stokes Flow. Part 1. Axisymmetric Motions*, Phys. Fluids **31**, 2445-2455.

19. Kim, S. (1988) *A New Approach to Hydrodynamic Interactions in Polydisperse Suspensions*, Particulate Science and Technology **6**, 69-80.

20. Fuentes, Y.O., Kim, S. and Jeffrey, D.J. (1989) *Mobility Functions for Two Unequal Viscous Drops in Stokes Flow. Part 2. Asymmetric Motions*, Phys. Fluids **A1**, 61-76. (Special Inaugural Issue on A. Acrivos' 60th Birthday).

21. Yoon, B.J. and Kim, S. (1989) *Electrophoresis of Spheroidal Particles, J. Colloid and Interface Science* **128**, 275-288.

22. Karrila, S.J. and Kim, S. (1989) *Integral Equations of the Second Kind for Stokes Flow: Direct Solution for Physical Variables and Removal of Inherent Accuracy Limitations*, (Festschrift on low-Reynolds-number flow in honor of John Happel's 80th Birthday) Chem. Engng. Commun. **82**, 123-161.

23. Karrila, S.J., Fuentes, Y.O. and Kim, S. (1989) *Parallel Computational Strategies for Hydro-dynamic Interactions between Rigid Particles of Arbitrary Shape in a Viscous Fluid*, (Special Issue on R.B. Bird's 65th Birthday) J. Rheology **33**, 913-947.

24. Yoon, B.J. and Kim, S. (1990) *A Boundary Collocation Method for the Motion of Two Spheroids in Stokes Flow: Hydrodynamic and Colloidal Interactions*, (Special Memorial Issue honoring S.G.‹Mason) Intl. J. Multiphase Flow **16**, 639-650.

25. Lu, S.Y. and Kim, S. (1990) *Effective Thermal Conductivity of Composites Containing Spheroidal Inclusions*, A.I.Ch.E. J. **36**, 927-938.

26. Kim, S. and Zukoski, C.F. (1990) *A Model of Growth by Hetero-Coagulation in Seeded Colloidal Dispersions, J. Colloid and Interface Sci.* **139**, 198-212.

27. Kim, S., Fuentes, Y.O. and Karrila, S.J. (1991) *Towards Ab Initio Simulations of Concentrated Suspensions*, J. Stat. Physics **62**, 1197-1223.

28. Pakdel, P. and Kim, S. (1991) *Mobility and Stresslet Functions of Particles with Rough Surfaces: A Numerical Study*, J. Rheology **35**, 797-823.

29. Phan-Thien, N., Tullock, D. and Kim, S. (1992) *Completed Double Layer in Half-Space: a Boundary Element Method*, Computational Mechanics **9**, 121-135.

30. Fuentes Y.O. and Kim, S. (1992) *Numerical Simulation of Suspension Flow on High-Performance Parallel Computers*, Chap. 27, Particulate Two-Phase Flow, M.C. Roco, Ed., Butterworth-Heinemann, Boston.

31. Strand, S.R. and Kim, S. (1992) *Dynamics and Rheology of a Dilute Suspension of Dipolar Nonspherical Particles in an External Field*, Rheologica Acta **31**, 94-117.

32. Fuentes, Y.O. and Kim, S. (1992) *Parallel Computational Microhydrodynamics: Communication Scheduling Strategies*, American Inst. Chemical Engineers J. **38**, 1059-1078.

33. Phan-Thien, N., Tullock, D., Ilic, V. and Kim, S. (1992) *Completed Double Layer Boundary Element Method: A Numerical Implementation and Some Experimental Results*, Computational Mech. **10,** 381-396.

34. Kim, S. (1992) *A Course in Parallel Computing,* Chemical Engineering Educ. **26**, 172-174.

35. Amann, N. and Kim, S. (1992) *Parallel Computational Microhydrodynamics: Scalable Load Balancing Strategies*, Engineering Analysis with Boundary Elements **11**, 269-276.

36. Brune, D.A. and Kim, S. (1993) *Predicting Protein Diffusion Coefficients*, Proc. Natl. Acad. Sci. USA **90**, 3835-3839.

37. Keh, H.J., Chen, J.B. and Kim, S. (1994) *Axisymmetric Electrophoresis of Coaxial Spheroids*, Colloids and Surfaces A: Physicochemical and Engineering Aspects **75**, 147-162.

38. Kim, S. and Power, H. (1993) *A Note on Two Boundary Integral Formulations for Particle Mobilities in Stokes Flow*, J. Fluid Mech. **257**, 637-639.

39. Brune, D.A. and Kim, S. (1994) *Hydrodynamic Steering Effects in Protein Association*, Proc. Natl. Acad. Sci. USA **91**, 2930-2934.

40. Phan-Thien, N. and Kim, S. (1994) *The Load Transfer Problem Between Two Rigid Spherical Inclusions*, ZAMP **44**, 177-201.

41. Traenkle, F., Frank, M.I., Vernon, M.K. and Kim, S. (1994) *Solving Microstructure Electrostatics with MIMD Parallel Supercomputers and SPLIT-C*, J. Non-Newtonian Fluid Mech. **53**, 197-213.

42. Phan-Thien, N. and Kim, S. (1994) *On the Elastic Double Layer: Some Exact Solutions and the Spectrum on the Sphere*, J. Mechanics and Physics of Solids **42**, 1177-1197.

43. Xu, Z., dePablo, J. and Kim, S. (1994) *Anistropic Friction and Excluded Volume Effects in a Freely-Jointed Bead-Rod*, J. Chem. Phys. **101**, 5293-5304.

44. Maul, C., Kim, S., Ilic, V., Tullock, D. and Phan-Thien, N. (1994) *Sedimentation of Hexagonal Flakes in a Half-space: Numerical Predictions and Experiments in Stokes Flow*, J. of Imaging Science and Technology **38**, May/June.

45. Maul, C. and Kim, S. (1994) *Image Systems for a Stokeslet Inside a Rigid Spherical Container*, Physics of Fluids A **6**, 2221-2223.

46. Pakdel, P. and Kim, S. (1994) *On the Capabilities of the Double Layer Representation for Stokes Flows. Part I: Analytical Solutions*, Engineering Analysis with Boundary Elements **13**, 339-347.

47. Pakdel, P. and Kim, S. (1994)*On the Capabilities of the Double Layer Representation for Stokes Flows. Part II: A Convergence Proof for GCR*, Engineering Analysis with Boundary Elements **13**, 349-351.

48. Pakdel, P. and Kim, S. (1994) *On the Capabilities of the Double Layer Representation for Stokes Flows. Part III: Numerical Approximations*, Engineering Analysis with Boundary Elements **14**, 139-148.

49. Yang, H. and Kim, S. (1995) *Boundary Element Analysis of Particle Mobilities in a Cylindrical Channel: Network-Based Parallel Computing with Condor*, Computers and Chemical Engineering **19**, 683-692.

50. Traenkle, F., Hill, M.D. and Kim, S. (1995) *Solving Microstructure Electrostatics on a Proposed Parallel Computer*, Computers and Chemical Engineering **19**, 743-757.

51. Xu, Z., dePablo, J. and Kim, S. (1995) *Transport Properties of Polymer Melts from Nonequilibrium Molecular Dynamics*, J. Chem. Phys. **102**, 5836-5844.

52. Klingenberg, D., Pakdel, P., Belongia, B. and Kim, S. (1995) *Protein Enhanced Electrorheological Fluids*, Ind. Eng. Chem. Res. **34**, 3303-3306.

53. Huber, G. and Kim, S. (1996) *Weighted-Ensemble Brownian Dynamics Simulations for Protein Association Reactions,* Biophysical J. **70**, 97-110.(**)

54. Pakdel, P. and Kim, S. (1996) *Traction Singularities on Sharp Corners and Edges in Stokes Flows,* Chemical Engineering Communications **148**, 257-269.

55. Maul, C. and Kim, S. (1996) *Image of a Point Force in a Spherical Container and Its Connection to the Lorentz Reflection Formula,* (Lorentz Centennial Issue) J. Engineering Math. **30**, 119-130.

56. Palaniappan, D. and Kim, S. (1997)) *Analytic Solutions for Stokes Flows past a Partially Encapsulated Droplet,* Physics of Fluids A **9**, 1218-1221.

57. Rojnuckarin, A., Kim, S. and Subramaniam, S. (1998) *Brownian Dynamics Simulations of Protein Folding: Access to Millisecond Time Scales and Beyond,* Proc. Natl. Acad. Sci. USA **95**, 4288-4292. (**)

58. Mustakis, I. and Kim, S. (1998) *Microhydrodynamics of Sharp Corners and Edges: Traction Singularities,* American Inst. Chemical Engineers J. **44**, 1469-1483.

59. Stone, H. and Kim, S. (2001) *Microfluidics (perspectives article),* American Inst. Chemical Engineers J. **47**, 1250-1254.

60. Kaznessis, Y., Kim, S. and Larson, R.G. (2002) *Specific Mode of Interaction between Components of Model Pulmonary Surfactants Using Molecular Dynamics Simulations and Structural Bioinformatics,* J. Molecular Biology **322**, 569-582.

61. Kaznessis, Y., Kim, S. and Larson, R.G. (2002) *Simulations of Zwitterionic and Anionic Phospholipid Monolayers,* Biophysical J. **82**, 1731-42.

62. Fisher, E.W., Rojnuckarin, A. and Kim, S. (2002) *Exhaustive Enumeration of the Effects of Point Charge Mutations on the Electrostatically Driven Association of Hemoglobin Subunits using Weighted-Ensemble Brownian Dynamics Simulations,* Siam Structural Chemistry **13**, 193-202. (**)

63. Yariv, E., Brenner, H. and Kim, S. (2004) *Curvature induced dispersion in electro-osmotic serpentine flows,* Siam Journal Appl. Math. **64**, 1099-1124.

64. Freeman, P.A., Crawford, D.L., Kim, S. and Munoz, J.L. (2005) *Cyberinfrastructure for science and engineering: promises and challenges,* Proc. of the IEEE **93**, 682-691.

65. Kim, S. and Heller, M. (2006) *Emerging Cyberinfrastructure: Challenges for the Chemical Process Community,* Computers and Chemical Engineering **30**, 1497-1501.

66. Nandigam, R.K., Evans, D.A., Erickson, J.A., Kim, S., and Sutherland, J.J. (2008) *Predicting the Accuracy of Ligand Overlay Methods with Random Forest Models,* J. Chem. Inf. Model. **48**, 2386-2394.(**)

67. Witte, K.N., Hur, J., Sun, W., Kim, S. and Won, Y. (2008) *Evidence of Lateral Nanoscale Heterogeneities in Weak Polyelectrolyte Brushes*, Macromolecules **41** (23) 8960-8963.

68. Nandigam, R.K., Kim, S., Singh, J. and Chuaqui, C. (2009) *Position Specific Interaction Dependent Scoring Technique for Virtual Screening Based on Weighted Protein-Ligand Interaction Fingerprint Profiles,* J. Chem. Inf. Model. **49**, 1185-1192.(**)

69. Witte, K.N., Kim, S. and Won, Y. (2009) *Self-Consistent Field Theory Study of the Effect of Grafting Density on the Height of a Weak Polyelectrolyte Brush*, J. Phys. Chem. B **113** (32) 11076-11084.

70. Maddipati, S., Nandigam, R.K., Kim, S. and Venkatasubramanian, C. (2011) *Learning Patterns in Combinatorial Protein Libraries by Support Vector Machines,* Computers and Chemical Engineering **35**, 1143-1151.(**)

71. Patterson, N.J., Rhoads, J.F. and Kim, S. (2012) *The Effects of RFID and EDI Technologies on Supply Chain Dynamics,* Intl. J. Modeling and Simulation **32**, 10-17.

72. Kim, S. and Palaniappan, D. (2014) *Hydrodynamic Interactions between Two Slender Tori in a Viscous Fluid*, AIChE J. **60**, 1517-1522.

73. Kim, S. (2015) *Ellipsoidal Microhydrodynamics without Elliptic Integrals and How to Get There with Linear Operator Theory*, Ind. Eng. Chem. Res. **54** (Ramkrishna Festschrift), 10497-10501.

74. Kim, S. (2015) *Ellipsoidal Microhydrodynamics without Elliptic Integrals and How to Get There with Linear Operator Theory: A Note on Weighted Inner Products*, Ind. Eng. Chem. Res. **54** (Ramkrishna Festschrift), 10549-10551 (ACS Editors' Choice award).

Other Important Publications

1. Mustakis, I., Clear, S., Nealey, P.F. and Kim, S. ***Fluidic Self-Assembly and Self-Assembled Monolayers***, ASME Fluids Engineering Division Summer Meeting, (Proceedings of FEDSM'97) June, 1997.

Books

Kim, S. and Karrila, S.J. (1991) ***Microhydrodynamics: Principles & Selected Applications*** , Butterworth-Heinemann, (original edition). Dover Publications Reprint Edition (2005), selected for reprinting by the Dover Editorial Board in recognition of "enduring value".

Phan-Thien, N. and Kim, S. (1994) ***Microstructures in Elastic Media***, Oxford University Press, New York.

Patents

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School of Chemical Engineering, Purdue University
Headship Vision Statement – Sangtae Kim

Universities play a special and unique role in our society and this is manifest in the complexity of the challenge in leading a major unit (department) therein. In contrast to a business unit in the private sector, there is no single "bottom line" to gauge the health and performance of the organization. Indeed there are multiple "bottom lines" and the responsible and responsive leader pays attention to all as a basis for meaningful engagement with the multiple stakeholders of the School of Chemical Engineering.

Today, the School of Chemical Engineering at Purdue finds itself in a favorable environment where major "macro" trends of state and university support are in excellent form. And thanks to decades of excellent stewardship, the School can count on loyal support from its many successful alumni. The challenge for the next head of the school is to translate these resource-based competitive advantages to an enhancement of the reputation of the School, not only for higher rankings per se, but to benefit from the new doors that open for highly regarded organizations.

The specific opportunities and the required decisions depend on many factors and the former will undoubtedly range over a wide landscape and the latter may adjust accordingly in the years to come. However, the leader's **core principles** and **leadership philosophy** should remain invariant, and thus these can form the basis for establishing a suitable match between the leader and the organization, to insure a productive relationship. It is thus appropriate to share these with the search committee.

First and foremost is a philosophy on **investing in people**. This starts with the recruitment of new faculty and the creation of a supportive environment to make Purdue the best place to start a career. The excellence of the faculty is the cornerstone on which all other achievements are made, and there must be belief that substantial investment (not just money, but time as well) in people at early points in their career will lead to a substantial return on that investment, especially if a culture is established for "giving back" once careers flourish. A "can do" spirit of the faculty is infectious and outstanding students soon appear on the scene at all levels.

Chemical Engineering as a discipline is poised to make meaningful contributions to the great challenges in **health**, **energy** and **sustainability**. **Collaborations** (research and education) between our faculty and students, both internally and with external stakeholders, are now the established norm for addressing such grand challenges to achieve societal impact. The Head of the School can be a **catalyst** to accelerate this transformation to help insure that the whole is greater than the sum-of-the-parts.

In the following pages, we go from these high level abstractions to concrete examples of these principles in action by an examination of the leadership experiences during the two decades, 1995-2014.

First Leadership Role in 1995

Prior to his own leadership roles, Kim benefited as a junior colleague at Wisconsin from the time and energetic investments of visionary leaders: the first twelve years as an academic covering the period 1983-1995 is well documented and includes several awards and citations for outstanding research (he achieved the rank of distinguished professor at the University of Wisconsin merely eight years after his PhD). In 1995, his Wisconsin colleagues elected him as chair of the chemical engineering department thus starting two decades of leadership roles. The interactions with 3 young ChE faculty members from that period (DePablo, Graham, Nealey) can be viewed in the context that these former colleagues are now very successful academic chemical engineers including a recent inductee (2016) to the NAE.

Trajectory from 1998 to 2013 and the Foundational Experiences for Translational Research

Kim left his distinguished professorship and chair of the chemical engineering department positions at UW-Madison in December, 1997, and embarked on a series of leadership/executive roles at Parke-Davis (1998-2000), Eli Lilly (2000-2003), NSF Cyberinfrastructure Division (2004-2005) and the UW-Madison Morgridge Institute for Research (2009-2013). Kim's views and *expertise in translational research* were largely shaped by these experiences as described below.

Parke-Davis/Warner Lambert: this company developed Lipitor, a superstatin with annual sales of $14B; with profits and R&D budgets all projected to grow at a phenomenal rate, recruited Kim in the summer of 1997 for the key role of V.P. of R&D IT with the remit to transform Parke-Davis' drug discovery platforms for the pending genomic and IT revolutions. Kim was selected in part because of his leadership role in NCSA's web and internet-based computational biology platforms (a direct consequence of the Mosaic Worldwide Web Project). *This ability to pick out emerging trends and foresee the future (before others see it), is a recurring pattern in Kim's trajectory as a leader*. The years at Parke-Davis with essentially an unlimited budget for new technologies in drug discovery laid the foundation for the experiences for the next decade, when in the year 2000, Parke-Davis' parent company, Warner Lambert, was acquired by Pfizer in the culmination of a year-long takeover effort.

Eli Lilly: by the year 2000 Kim had developed a reputation within the IT sector of the pharmaceutical industry, and (while *en route* from Parke-Davis back to the university) was recruited by the Lilly Research Laboratories as its first V.P. for its R&D IT organization, an organization formed by the consolidation of all IT departments. The challenge at Lilly was the polar opposite of the Parke-Davis experience and thus interesting enough to convince Kim to stay longer in the industry. Lilly was already a world-class R&D organization, but the unexpected loss of the patent on Prozac (its top selling product) required leaders who could *manage very lean budgets* until new product (Cymbalta) launches could restore profitability. Last but not least, Eli Lilly wished to avoid mergers. Kim successfully navigated these challenges and by 2003, it was clear that Lilly would survive.

NSF Cyberinfrastructure: the return to the university and the academic freedom to explore new ideas on translational research for IT-enabled drug discovery was enhanced by the formation in 2003 of the cyberinfrastructure division at NSF. By 2003, the potential of the emerging internet/worldwide web was universally recognized and NSF consolidated all cyberinfrastructure activities (including support for NCSA and activities like the Mosaic project) into one division. Kim was selected from over 50 candidates to become the inaugural division director, 2004-2005, as a distinguished professor at Purdue on loan to NSF. Major initiatives within NSF supported by Kim during this time included the support of distributed computing (grid middleware) and multi-agency plans for the formation of large software institutes for emerging priorities such as cyber-security.

Morgridge Institute for Research (MIR) at UW-Madison: upon return to Purdue in 2005, Kim launched his research program on informatics and computer-aided drug discovery. But within a few years and before significant achievements at Purdue, Kim was contacted by friends from UW-Madison (summer of 2008) to come back and help stabilized a Madison-based medical research institute, MIR, founded in 2006. The institute was launched with a $200M building designed to win architectural awards (great open vistas) but that same design lacked sufficient laboratory space to sustain its own medical research. MIR's "translational research" vision had difficulty gaining traction because of failed searches to fill the CEO/Executive Director position. Kim agreed to take on this nearly impossible challenge, in part to make amends for the sudden departure from Wisconsin to Parke-Davis in 1997-98 and also as an opportunity to demonstrate his productive and pragmatic approach to translational research.

In 2009, Kim articulated MIR's priorities as winning large, center-scale grants ($20M+) with significant IP outcomes and *minimal use of MIR's scarce laboratory space*. In essence the award-winning architecture would serve as a "collaboratory" magnet to position MIR as the hub for multi-institutional projects. Realistically, the statistical success rate could be only 2% based on the large number of competitors (~200) for the few awards (~4) but Kim promised to deliver a success rate of 1 in 3 (i.e., one award every three years) based on strategic use of the building and *know how about funding agencies*. Under Kim's direction, MIR would go after three such proposals: (1) DHS software center for cyber-security; (2) DOE medical isotope project; (3) FDA Center for Regulatory Science.

1. MIR's Dept. of Homeland Security proposal (codename "SWAMP") was successful [DHS], winning against formidable competitors (IBM, MITRE) in the final round in 2011. Key to the win was Kim's recruitment of computational science leader Miron Livny as the CTO of MIR, and providing him with two years of directed resources (and ring fencing $10M MIR endowment for cyber-infrastructure) to enable Livny to win the $23.6M DHS Award for the Software Assurance Market Place (SWAMP). After the initial five years, this award can continue in perpetuity at ~$5M/yr. This award is the biggest prize of the past decade in software cyberinfrastructure in an academic setting, and UW-Madison was not considered as a major or viable candidate prior to Kim's arrival at MIR.
2. MIR partnered with startup company SHINE to design a $2M prototype that went on to win a $25M DOE Cooperative Award [NNSA] for a novel process that eliminates the use of weapons-grade highly enriched uranium (HEU) in the manufacture of the medical isotope Mo-99. Within two years of working with MIR, the company was able to raise venture capital with valuation of $25M, secured a $125M term sheet from Deerfield Management and signed supply agreements with GE Healthcare and Lantheus. Recently (Feb. 25) the Nuclear Regulatory Commission approved the construction permit and thus a major milestone was achieved. OECD nations have agreed to switch to LEU (low enriched uranium) and the cost of making Mo-99 (for everyone else) will go up by a factor of 10. The global Mo-99 market will transform to $6B from the current $600M and this resets the IP royalty stream accordingly. *Kim saw this entire roadmap when he convinced the skeptical trustees to back the $2M commitment to build the prototype*.
3. The U.S. FDA budget was cut after the 2010 U.S. congressional elections and the FDA canceled the competition for the Centers of Excellence in Regulatory Science. So the final tally for Kim's success rate was 2 out of 3 (or 2 out of 2 if the canceled competition is not included in the statistics!).

By 2014, it was time to return to Purdue University in the spirit of fairness and equitable treatment of the two universities, i.e., to help Purdue achieve comparable successes in translational research.

Purdue 2014 to Present and the Launch of CiSTAR

A group of faculty in the School is proposing an ERC to harness the potential of light hydrocarbon feedstocks from shale oil and gas, CiSTAR (Center for Innovation and Strategic Transformation of Alkane Resources). Kim's track record in translational research will be helpful role in convincing NSF that the $40M ERC will deliver on "translational promise" / economic development. Given that the value-added is applied to a feedstock entering the U.S. economy at five million barrels per day (and growing), the IP implications for Purdue are even greater than that in SHINE/Wisconsin's medical isotope project.

Concluding remarks: while these 3 pages have been used mostly to describe examples from a period covering two decades, the belief is that a mutually shared understanding of the underlying principles and philosophy is the basis for a productive relationship – there should be no major surprises when an organization delegates so much power and responsibility to its head.