

Mohammad Nadeem Khan, Ph.D.

EPR Center for the study of Viable Systems
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Research Summary

- **Ph.D. Chemistry with four years of extensive biomedical research experience in animal models and in pre-clinical studies.**
- **Extensive research experience in kinetics, metabolism and toxicity of nitroxides, spin traps, and other metabolites in animal and cell models.**
- **Data acquisition under physiological conditions, independent research under strict deadlines, experience in writing grants and experimental protocols.**
- **Excellent organization and communication skills.**
- **Good interpersonal skills and supervisory experience.**
- **19 research publications and 21 presentations in scientific meetings.**
- **2003 Melvin H. Knisely award for outstanding research in oxygen transport to tissue.**

US Status: Green card

Work History

Sep. 1999-present: Research Assistant Professor, Dartmouth Medical School, Hanover, NH, USA

Research skills and techniques

Four years of animal handling experience

Administration of nitroxides and other metabolites in rodents via intraperitoneal, intravenous and intramuscular routes

Implantation of paramagnetic oxygen probes in brain, liver, kidney, skeletal muscle and subcutaneous tissue of rodents

Kinetic analysis of nitroxides and radical adducts metabolism in animal models and in cell suspensions

In vivo and *in vitro* oxygen measurements, blood gas analysis, and *in vitro* tissue preparation

Cell culture and tumor cell implantation in rodents

Spin trapping of free radicals in rodents and in cell suspensions

EPR (Electron Paramagnetic Resonance) spectroscopy, MRI, Eppendorf, Oxylite, Pulse oximeter, Laser Doppler, and blood gas analysis using Rapidlab 845

Research accomplishments

- Developed India ink as a probe for oxygen measurement in animal models and for pre-clinical trials.
- Investigated the effects of
 - RSR13 (allosteric hemoglobin effector) on the oxygenation of subcutaneous and intracranial tumors for radiation therapy in animal models.
 - Metabolism, toxicity and kinetics of nitroxides, spin traps and other metabolites in cell suspensions and in rodents.
 - Hepato-toxin and quinoid radio-toxins on oxygenation and physiology of liver, brain and other organs in rodents.
 - Cell plasma membrane cholesterol concentration and mitochondrial mutation on oxygen concentration and oxygen metabolism in cells.
- Developed a new approach for
 - Simultaneous measurement of extra- and intra -cellular oxygen concentration in cells.
 - Spin trapping to allow laboratories to study free radicals in biological systems using spin trapping even without an EPR facility.
- Taught, trained and supervised graduate students in various research projects.
- Presented research data in scientific meetings and worked with several collaborators.

Sep. 1998 - Aug. 1999: Postdoctoral Fellow, University of Basel, Switzerland

Research skills and techniques

High vacuum oxidation and reduction, EPR, ENDOR, UV-Vis, IR, HPLC, and NMR spectroscopy

Research accomplishments

- Synthesized and characterized radical ions of organic molecules.
- Established ion pairing effect in radical cations, which play an important role in processes involving aggregation reactions, redox-coupled molecular magnets and electron transfer.

1993 – 1998: Ph.D., North Eastern Hill University, Shillong, India

Research techniques: EPR, NMR, IR and UV-Visible spectroscopy, HPLC and GC

- Investigated electron transfer and the ring opening reactions of succinimides.
- Investigated the self-association of nucleic acid bases (Guanine and Guanosine) in non-aqueous media.

Honors and Awards

- 2003 **Melvin H. Knisely award presented by International Society on Oxygen Transport to Tissue (ISOTT), Rochester, New York (<http://www.isott.org/>)**
- 1999 Best Poster Award, 32nd Annual International ESR Conference, University of York, United Kingdom
- 1996 Senior Research Fellow, Council of Scientific and Industrial Research, New Delhi, India

Education

- 1993-1998 Ph.D. North-Eastern Hill University, Shillong, India
- 1990-1992 M.Sc. AMU, Aligarh, India
- 1990 Diploma in Industrial & Computer Electronics, IGET Center, Patna, India
- 1985-1989 B.Sc. Magadh University, Patna, India

RESEARCH PUBLICATIONS: 19

PRESENTATIONS (ORAL/POSTER): 21

Other

Member of the International Society on Oxygen Transport to Tissue and International EPR Society. Participated in organization and co-chaired scientific session in the 9th International Meeting and workshop on EPR studies of Viable Systems, Sept. 8th-14th, 2001.

List of Publications:

2002-present:

19. Organic Radicals and Radical Ions
Nadeem Khan and Georg Gescheidt, RSC Specialist Periodic Reports EPR series, 2004.
18. Clinical applications of EPR: overview & perspectives
Harold M. Swartz, **Nadeem Khan**, Jay Buckey, Richard Comi, Lisa Gould, Oleg Grinberg, Alan Hartford, Harriet Hopf, Huagang Hou, Eugen Hug, Akinori Iwasaki, Piotr Lesniewski, Ildar Salikhov and Tadeusz Walczak, NMR in Biomed. 17; 1-17, 2004
17. Black Magic and EPR oximetry: from lab to initial clinical trials
Nadeem Khan, Huagang Hou, Patrick Hein, Richard J. Comi, Jay C. Buckey, Oleg Grinberg, Ildar Salikhov, Shi Y. Lu, Hermine Wallach, Harold M. Swartz, Oxygen Transport to Tissue (Okunieff, P. ed). Plenum Publishers, New York, in press, 2004.
16. Modeling of the Response of ptO_2 in Rat Brain to Changes in Physiological Parameters
O. Grinberg, H. Hou, M.A. Roche, J. Merlis, S.A. Grinberg, **Nadeem Khan**, H.M. Swartz and J.F. Dunn, Oxygen Transport to Tissue (Okunieff, P. ed). Plenum Publishers, New York in press, 2004.
15. Cerebral PtO_2 , Acute Hypoxic Hypoxia, and Volatile Anesthetics in the Rat Brain
H. Hou, O.Y. Grinberg, S.A. Grinberg, **Nadeem Khan**, Jeff F. Dunn and H.M. Swartz, Oxygen Transport to Tissue (Okunieff, P. ed). Plenum Publishers, New York, in press, 2004.
14. Comparison of EPR Oximetry and Eppendorf Polarographic Electrode Assessments of Rat Brain PtO_2
J.A. O'Hara, **Nadeem Khan**, H. Hou, C.M. Wilmot, E. Demidenko, J.F. Dunn and H. M. Swartz, Physiological Measurement, in press, 2004
13. Effect of the allosteric hemoglobin modifier RSR 13 on oxygenation in murine tumors: An *in vivo* EPR oximetry and Bold MRI study
Huagang Hou, **Nadeem Khan**, Julia A O'Hara, Oleg Y Grinberg, Jeff F Dunn, Michelle A Abajian, Carmen M Wilmot, Malek Makki, Eugene Demidenko, Shi Y Lu, Robert P Steffen, and Harold M Swartz, International Journal of Radiation Oncology, Biology, Physics, 59(3): 834-843, 2004
12. Spin traps: in vitro toxicity and stability of radical adducts
Nadeem Khan, Wilmot C M, Rosen G M, Demidenko E, Sun J, Joseph J, O'Hara J, Kalyanaraman B, Swartz H M., Free Radic Biol Med. 34(11): 1473-1481, 2003
11. Plasma membrane cholesterol: a possible barrier to intracellular oxygen in normal and mutant CHO cells defective in cholesterol metabolism
Nadeem Khan, Jiangang Shen, Ta Yuan Chang, Catherine C. Chang, Peter C.W. Fung, Oleg Grinberg, Eugene Demidenko, Harold Swartz, Biochemistry 42(1): 23-29, 2003

10. Respiration rates and oxygen concentration in Molt-4 cells and their mtDNA depleted (ρ^0) mutants
Jiangang Shen, **Nadeem Khan**, Lionel D. Lewis, Ray Armand, Oleg Grinberg, Eugene Demidenko and Harold Swartz, *Biophysical Journal*, *Biophys J.* 4(2): 1291-1298, 2003
9. EPR spectroscopy of function *in vivo*: Origins, Achievements, And Future Possibilities
Nadeem Khan and H.M. Swartz, in *Biomedical ESR a volume in the Biological Magnetic Resonance Series* (S.S. Eaton, G.R. Eaton, L.J. Berliner, eds.), Kluwer Publisher (The Netherlands, New York, Boston), 2003.
8. Measurements *in vivo* of parameters pertinent to ROS/RNS using EPR spectroscopy
Nadeem Khan and Harold Swartz, *Mol. Cell. Biochem.* 234-235(1-2): 341-357, 2002
7. *In vivo* assessment of Nodularin-induced hepatotoxicity in the rat using magnetic resonance techniques (MRI, MRS and EPR oximetry)
Rheal A. Towner, Sharelle A. Sturgeon, **Nadeem Khan**, H. Hou, and Harold M. Swartz, *Chem. Biol. Interact.* 139(3): 231-250, 2002
6. Development of isoindoline nitroxides for EPR oximetry in viable systems
J. Shen, S. Bottle, **Nadeem Khan**, O. Grinberg, D. Reid, A. Micallef and H. Swartz, *Appl. Magn. Reson.* 22: 357-368, 2002

Manuscripts in preparation or submitted:

5. EPR investigation of metabolic changes in living animals under quinoid radiotoxin (QRT)
Ibragimova M.I., Petukhov V. Yu., Zheglov E. P., **Nadeem Khan**, Hou H., Swartz H., Konjukhov G.V., Nizamov R. N., submitted to *Nitric oxide*.
4. Distant Spin Trapping: A good alternative for non-EPR labs
Nadeem Khan, Oleg Grinberg, Carmen Wilmot, Heather Kiefer and Harold M Swartz, submitted to *Free Radical Biology and Medicine*, 2004.
3. Changes in Oxygenation of Intracranial Tumors with an Allosteric Hemoglobin Modifier RSR13: An In Vivo EPR Oximetry Study
H. Hou, **Nadeem Khan**, J.A. O'Hara, O.Y. Grinberg, J.F. Dunn, M.A. Abajian, C.M. Wilmot, E. Demidenko, S.Y. Lu, R.P. Steffen and H.M. Swartz, submitted.
2. Simultaneous measurement of rat brain cortex PtO₂ using oxylite and EPR assessments under normoxia and during hyperoxia
Julia A. O'Hara, Huagang Hou, Carmen M. Wilmot, Eugene Demidenko, Roger J. Springett, **Nadeem Khan**, Harold M. Swartz, in preparation.
1. *In vivo* EPR spectrometer for clinical applications
I. Salikhov, T. Walczak, P. Lesniewski, N. Khan, A. Iwasaki, J. Buckey, R. Comi, and H. M. Swartz, submitted.

1996-2001:

5. Ion Pairing in radical cations: the example of 9,9'-bianthryl
Nadeem Khan, Cornelia Palivan, Frederique Barbosa, Jerome Amaudrut and Georg Gescheidt, J. Chem. Soc., Perkin Trans. 2, p1522, 2001.
4. Electron Transfer Reactions of Aromatic Compounds
 G. Gescheidt and **Nadeem Khan**, "Electron Transfer in Chemistry" ed. Vincenzo Balzani, Wiley-VCH, Vol.2, 2001.
3. Single Electron Transfer (SET) reaction studies. A possible new role for nitron spin trap
Nadeem Khan, Suchandra Bhattacharjee, Harish Chandra and Martyn C. R. Symons, Spectrochimica Acta Part A, 54, p779, 1998.
2. Electronic spectroscopic study of self-association of guanine and guanosine in non-aqueous media
 Suchandra Bhattacharjee, **Nadeem Khan**, Harish Chandra and Martyn C. R. Symons; Spectrochimica Acta Part A, 54, p759, 1998.
1. Radical cations from nitron spin traps: reaction with water to give OH adducts
 S. Bhattacharjee, **Nadeem Khan**, Harish Chandra and Martyn C R Symons; J. Chem. Soc., Perkin Trans. 2, 12, p2631, 1996.

Presentations (Oral/Poster):

2002-present:

23. Arteriogenesis is not dependant on tissue Hypoxia
 Armin Helisch, **Nadeem Khan**, Ulrike Brandt, Huagang Hou, Shawn Wagner, Wolfgang Schaper, Bad Nauheim, and Harold M Swartz, American Heart Association Conference, New Orleans, Louisiana, Nov. 7-10, 2004.
22. *In vivo* EPR measurements of pO₂ in liver and brain of mice treated with radiotoxin
 M. I. Ibragimova, **N. Khan**, V. Yu. Petukhov, H. M. Swartz, H. Hou, G. V. Konjukhov, Modern Development of Magnetic Resonance, Kazan, August 15–20, 2004.
21. Black Magic and EPR oximetry: from lab to initial clinical trials
Nadeem Khan, Huagang Hou, Patrick Hein, Richard J. Comi, Jay C. Buckey, Oleg Grinberg, Ildar Salikhov, Shi Y. Lu, Hermine Wallach, Harold M. Swartz
 International Society on Oxygen Transport to Tissue, Rochester, NY, 2003.
20. Comparison of Eppendorf and EPR assessments of rat brain PtO₂
 Julia A. O'Hara, **Nadeem Khan**, Huagang Hou, Carmen M. Wilmot, Eugene Demidenko, Jeff F. Dunn, Harold M. Swartz
 International Society on Oxygen Transport to Tissue, Rochester, NY, 2003.

19. Measurements by EPR and BOLD of the effectiveness of an allosteric hemoglobin effector, RSR13, to repetitively enhance tumor oxygenation.
H. Hou, **Nadeem Khan**, J.A. O'Hara, O. Y. Grinberg, J. F. Dunn, M. A. Abajian, E. Demidenko, R.P. Steffen, H. M. Swartz
International Society on Oxygen Transport to Tissue, Rochester, NY, 2003.
18. Cerebral pO₂, acute hypoxic and volatile anesthetics in the rat brain
H. Hou, O. Y. Grinberg, S.A., Grinberg, **Nadeem Khan**, J. F. Dunn, H. M. Swartz,
International Society on Oxygen Transport to Tissue, Rochester, NY, 2003.
17. Simultaneous measurement of rat brain cortex PtO₂ using oxylite and EPR assessments under normoxia and during hyperoxia
Julia A. O'Hara, Huagang Hou, Carmen M. Wilmot, Eugene Demidenko, Roger J. Springett, **Nadeem Khan**, Harold M. Swartz
International Society on Oxygen Transport to Tissue, Rochester, NY, 2003.
16. Modeling of the pO₂ reactivity in rat brain
Oleg Y. Grinberg, Huagang Hou, Jennifer Merlis, Marcie A. Roche, Stalina A. Grinberg, **Nadeem Khan**, Harold M. Swartz, and Jeff F. Dunn
International Society on Oxygen Transport to Tissue, Rochester, NY, 2003
15. Histopathological examination of inflammatory response to implantation of EPR probes (wood chars, India inks) into rat skeletal muscles
Shi-Yi Lu, Oleg Y. Grinberg, Stalina A. Grinberg, Huagang Hou, **Nadeem Khan**, and Harold M. Swartz, International Society on Oxygen Transport to Tissue, Rochester, NY, 2003.
14. Clinical oximetry using EPR – The start of systematic measurements in human subjects
Harold M. Swartz, Jay Buckey, Richard Comi, Oleg Grinberg, Patrick Hein, Eugen Hug, **Nadeem Khan**, Piotr Lesniewski, Ildar Salikhov, Tadeusz Walczak, Hermine Wallach,
International Society on Oxygen Transport to Tissue, Rochester, NY, 2003.
13. Measurements by EPR and BOLD of the effectiveness of an allosteric hemoglobin effector, RSR13, to repetitively enhance tumor oxygenation
H. Hou, **Nadeem Khan**, J.A. O'Hara, O. Y. Grinberg, J. F. Dunn, M. A. Abajian, E. Demidenko, R.P. Steffen, H. M. Swartz, International Society for Magnetic Resonance in Medicine, 11th Scientific meeting and exhibition, Toronto, 10-16th July, 2003.
12. Cytotoxicity and stability of new spin traps
Nadeem Khan, Carmen M Wilmot and Harold Swartz; 7th International Symposium on Spin Trapping, NC, USA, July 7th, 2002.
11. *In Vivo* spin trapping: opportunities and challenges as viewed in 2002
Harold M Swartz, **Nadeem Khan**; 7th International Symposium on Spin Trapping, NC, USA, July 7th, 2002

1999-2001:

10. Relationship between cholesterol of plasma membrane and intracellular oxygen gradient in CHO cells and their mutants
Jiangang Shen, **Nadeem Khan**, T.Y. Chang, Catherine C.Y. Chang, Oleg Grinberg, Harold Swartz; 9th International Meeting on EPR Studies of Viable Systems, Dartmouth Medical School, NH, USA, September 8th, 2001
9. Respiration rates and oxygen concentration in lymphoblastic Molt-4 cells and their respiratory deficient mutant
Nadeem Khan, Jiangang Shen, Lionel D. Lewis, Armond Ray, Oleg Grinberg and Harold Swartz; 9th International Meeting on EPR Studies of Viable Systems, Dartmouth Medical School, NH, USA, September 8th, 2001.
8. Monitoring cerebral pO₂ and intracranial pressure during ischemia and intracranial hemorrhage
H G Hou, O Y Grinberg, S A Grinberg, **Nadeem Khan**, H M Swartz; 9th International Meeting on EPR Studies of Viable Systems, Dartmouth Medical School, NH, USA, September 8th, 2001.
7. “Distant Spin Trapping”: An alternative for non-EPR labs
Nadeem Khan, Heather Kiefer, Oleg Grinberg and Harold Swartz; 9th International Meeting on EPR Studies of Viable Systems, Dartmouth Medical School, NH, USA, September 8th, 2001.
6. “Distant Spin Trapping”: A good possibility for non-EPR labs
Nadeem Khan, Heather Kiefer and Harold Swartz; 43rd Rocky Mountain Conference on Analytical Chemistry, Colorado, USA, July 29th, 2001.
5. Using Spin traps *in vivo*: great opportunities & challenges
Harold M Swartz, **Nadeem Khan**, Ke Jian Liu, Graham Timmins; 43rd Rocky Mountain Conference on Analytical Chemistry, Colorado, USA, July 29th, 2001.
4. “Distant Spin Trapping”: developments of methodology to carry out spin trapping for laboratories without access to appropriate EPR facilities
H Kiefer, **Nadeem Khan**, H M. Swartz; Karen E. Wetterhahn Science Symposium, Dartmouth College, NH, USA, May 24th, 2001.
3. Development of New Nitroxides for EPR Oximetry in Viable Biological Systems
Jiangang Shen, **Nadeem Khan**, Steven Bottle, Damien Reid, Aaron Micallef and Harold Swartz; ISOTT 2000, Nijmegen, The Netherlands, August 20th, 2000.
2. Using spin traps *in vivo*: great opportunities & challenges!
Harold M. Swartz, **Nadeem Khan**, Ke Jian Liu, Graham Timmins; 6th International Symposium on Spin Trapping, Marseille, France, August 27th, 2000.
1. Ion pairing in radical cations- the example of 9, 9’-Bianthryl
Nadeem Khan, Georg Gescheidt; 32nd Annual International Meeting on “ESR Spectroscopy; Recent Advances and Applications”, The University of York, UK, April 11th, 1999.