

# Margaret E. Kosal, Ph.D.

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## Education:

Ph.D. University of Illinois at Urbana-Champaign  
Chemistry, July 2001  
Dissertation: "Porphyrin Network Materials: Chemical Exploration in the  
Supramolecular Solid-State"  
Research advisor: Professor Kenneth S. Suslick

B.S. University of Southern California, Los Angeles CA  
Chemistry, May 1995  
Research advisor: Professor Christopher A. Reed

**Honors:** American Chemical Society's *Chemical and Engineering News* Top 2002  
Supramolecular Chemistry research paper.  
Society of Porphyrins and Phthalocyanines Dissertation Research Award, 2001.  
Outstanding Chemistry Senior Award, USC Department of Chemistry, 1995.  
Dean's Scholar, USC School of Liberal Arts and Sciences, 1991-1995.  
Thematic Option Honors, USC, 1991.

**Experience:** September 2004 - **Center for International Security and Cooperation** Stanford CA  
**Institute for International Studies**  
**Stanford University**  
Science Fellow

Chemical and biological weapons (CBW) detectors and sensors

- Evaluating current and emerging technologies for CBW sensors.
- Analysis of policies driving CBW detector development and use.
- Role of detectors for attribution, inspection and verification.

Improvised chemical terrorism – trends in exploitation of commercial and research chemicals.

Nuclear, biological, chemical and radiological weapons ("WMD") terrorism risk and threat assessment.

August 2003 - 2004

**Center for Nonproliferation Studies** Monterey CA  
**Monterey Institute of International Studies**  
Post-doctoral Fellow  
Adjunct Professor

Technical security studies and analysis, with specific experience in

- Nanotechnology research and application. Implications for domestic and international security.

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- Analysis of terrorist intent at targeting critical infrastructure, with emphasis on domestic and international industrial chemical facilities.
- Chemical weapons destruction and public response, in U.S., Russia, Japan, and China.
- Agricultural terrorism and feed security.
- Analysis of 3<sup>rd</sup> generation nerve agents - "Novichoks."

Classes taught

Biological and Chemical Weapons Control and Verification (International Policy School graduate level course, IPS 588)  
Chemical/Biological Weapons Technical Workshop (IPS 589)  
WMD in Homeland Security (Naval Postgraduate School, executive-level Masters Program, team instruction)

Lead technical contributor and reviewer for country profiles of historical and contemporary evaluation of BW and CW programs in Iraq, Syria, Egypt, Iran, Libya, Israel, Kazakhstan, North Korea and the former Yugoslavia for the Nuclear Threat Initiative (NTI), available at [http://nti.org/e\\_research/profiles/index.html](http://nti.org/e_research/profiles/index.html).

June - August 2003

**School of Chemical Sciences**  
**University of Illinois at Urbana-Champaign**  
Visiting Scientist

December 2000 - May 2003

**ChemSensing, Inc.**  
Co-founder and Senior Scientist

Urbana IL

Development and analysis of colorimetric sensors for vapor and liquid detection.

- Collaborated on development of sensor for chemical warfare agents, simulants and toxic industrial chemicals (TICs). Specific CW agents tested: sarin (GB), sulfur mustard (HD), hydrogen cyanide (AC), cyanogen chloride (CK), chlorine (CL), phosgene (CG), (in cooperation with Battelle Memorial Institute).
- Initiated, supervised and successfully directed research and development of a novel sensor system for nitroaromatic explosives vapor detection, e.g., TNT in landmines and concealed improvised explosive devices (IEDs).
- Initiated program to employ sensor technology for detection of bacteriological biological warfare agents via detection of fingerprint enzymatic metabolites. Specific BW agents and simulants in program: *Yersinia pestis*, *Y. pseudotuberculosis*, *Y. enterocolitica* and *Bacillus anthracis*, *B. cereus*, *B. mycooides*, (in cooperation with U.S. Army Soldier and Biological Chemical Command).
- Led exploratory development, laboratory work and final evaluation on the initial phase of a project for detection of dissolved neuroactive compounds in liquids (potential contaminants to food, beverages and water supplies). Project entailed transforming system from vapor-compatible to liquid-compatible regime (immersion) – the first successful application of ChemSensing technology in a solution.

Synthesis of basic scientific concepts into technology and generated diverse practical applications for sensor system, including proposal writing, budgeting, reporting and project execution.

Responsible for initiating technical contacts and interfacing with collaborators, potential customers and non-technical users.

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Monitoring and analysis of competing sensing technologies.

Supervising recruitment and hiring of laboratory technicians and post-doctoral researchers.

July 2002 - June 2003

**Feinberg School of Medicine  
Northwestern University**

Chicago IL

Visiting Scholar

Lead scientist on project assessing non-culturing methods for infection diagnosis (in conjunction with ChemSensing).

August 1995 - May 2001

**School of Chemical Sciences  
University of Illinois at Urbana-Champaign**

Research Assistant

- Synthetic analogs of oxygenase proteins – models to understand enzyme function.
- Nanoporous porphyrin coordination networks for use as solid-state molecular recognition materials – building molecule-sized “tinker toys” from scratch.
- Heterogeneous catalysis and molecular sieve behavior of novel organic zeolites – exploring and characterizing the functionality of a newly invented class of materials, analogous to three-dimensional, molecular-scale sieves.

1991 - 1995

**University of Southern California**

Los Angeles CA

Research Assistant

Synthesis and characterization of asymmetric porphyrin systems for modeling heme proteins and competitive ligand binding, e.g., O<sub>2</sub> versus CN; chromatographic separations – model compounds to understand how blood proteins bind and transport oxygen.

**Peer-reviewed  
Publications:**

“Moving Beyond Detection to Attribution: Applying Technology to Domestic and International Security,” *manuscript in preparation*.

“Analyzing Bioterror Response: the Case of Anthrax Biodetectors,” *manuscript in preparation*.

“Nanotechnology: Assessing the Proliferation and Terrorism Risks,” *manuscript in preparation for submission to Science and Global Security*.

“Terrorism Targeting Industrial Chemical Facilities: Strategic Motivations and International Repercussions,” *manuscript in preparation for submission to International Security*.

Kosal, M.E.; Nakagaki, S.; Wilson, S.R.; Suslick, K.S. “A Porous Manganese(III) Porphyrin Framework Solid: Structure and Catalytic Activity,” *manuscript submitted to Inorganic Chemistry*.

Suslick, K.S.; Kosal, M.E.; et al. “Microporous Porphyrin Solids,” *manuscript in press at Accounts of Chemical Research*.

Cassagrande, R.; Kosal, M.E. “Detection of Bioterrorist Agents,” Encyclopedia of Bioterrorism Defense, Zilinskas, R.A.; Pilch, R., eds., Wiley: New York, *forthcoming February 2005*.

Kosal, M.E. “Biological Simulants,” Encyclopedia of Bioterrorism Defense, Zilinskas, R.A.; Pilch, R., eds., Wiley: New York, *forthcoming February 2005*.

**Margaret E. Kosal, Ph.D.**

Kosal, M.E. "Anti-material Agents," Encyclopedia of Bioterrorism Defense, Zilinskas, R.A.; Pilch, R., eds., Wiley: New York, *forthcoming February 2005*.

Kosal, M.E.; Anderson, D.A. "An Unaddressed Issue of Agricultural Terrorism – A Case Study on Feed Security," *Journal of Animal Science*, **2004**, *82*, 3394.

Suslick, K.S.; Kosal, M.E.; McNamara, W.B.; Sen, A.; Rakow, N.A. "ChemSensing: A Colorimetric Array Detector," 9<sup>th</sup> International Symposium on Olfaction and Electronic Nose (ISOEN '02) Proceedings, D'Amico A.; DiNatale, C, eds., IEEE: Baltimore, **2003**, 46-52.

Kosal, M.E.; Chou, J-H.; Suslick, K.S. "A Calcium-Bridged Porphyrin Network," *J. Porphyrins and Phthalocyanines*, **2002**, *6*, 377.

Kosal, M.E.; Chou, J-H.; Wilson, S.R.; Suslick, K.S. "A Functional Zeolite Analogue Assembled From Metalloporphyrins," *Nature Materials*, **2002**, *1*, 118.

Kosal; M.E.; Suslick, K.S. "Microporous Porphyrin and Metalloporphyrin Materials," *J. Solid State Chemistry*, **2000**, *152*, 87.

Brunner, R.S.; Kosal, M.E.; Suslick, K.S.; Lamche, R.; Marti, O.; White, J.O. "Near-Field Scanning Optical Microscopy (NSOM) of Zinc-Porphyrin Crystals," *Ultramicroscopy*, **2000**, *84*, 149.

Chou, J-H.; Kosal, M.E.; Nalwa, H.S.; Rakow, N.A; Suslick, K.S. "Applications of Porphyrins and Metalloporphyrins to Materials Chemistry," The Porphyrin Handbook, Kadish, K.; Smith, K.; Guilard, R., eds.; Academic Press: New York, **2000**, *6*, 41.

**Other Publications:** "How Bad is That Bug in the Freezer? Proliferation Risks of Biotech and Biodefense Research," *manuscript in preparation for submission to Issues in Science and Technology*.

Kosal, M.E. "Chemical Weapons Destruction and the Public Response," Towards the Elimination of the Chemical Weapons, Haru, E.; Thakur, R. eds., OPCW/UNU, The Hague, Netherlands, *forthcoming April 2005*.

Kosal, M.E. "Art or Bioterrorism? Implications of the Kurtz Case for Research Science and for Limiting Terrorist Threats," *INESAP Bulletin*, December **2004**, *24*, 85.

Kosal, M.E. "Is Small Scary? Nanotechnology Research in an Age of Terrorism," *Bulletin of Atomic Scientists*, September/October **2004**, *60*, 38, (*cited as an Army War College Article for Current Awareness*).

Baker, M.; Kosal, M.E. "Osmium Tetroxide – A New Chemical Terrorism Weapon?" *CNS Research Story*, 13 April 2004, <http://cns.miis.edu/pubs/week/040413.htm>.

Kosal, M.E. "The Basics of Chemical and Biological Weapons Detectors," *CNS Research Story*, 24 November 2003, <http://cns.miis.edu/pubs/week/031124.htm>. (*Being used by New York City Fire Dept in terrorism response training*)

Suslick, K.S.; Kosal, M.E.; Rakow, N.A.; Sen, A. "Smell-Seeing: A New Approach to Artificial Olfaction," *Eurodeur-Airodeur 2001 Proceedings*, Paris 2002.

Suslick, K.S.; Rakow, N.A.; Kosal, M.E.; Chou, J-H. "The Materials Chemistry of Porphyrins and Metalloporphyrins," *J. Porphyrins and Phthalocyanines*, **2000**, *4*, 407.

Kosal, M.E.; Brunner, R.S.; Suslick, K.S.; White, J.O. Frederick Seitz Materials Research Laboratory Department of Energy (DOE) Program Review (cover), Urbana IL, June 1998. "Unusual Fluorescence Behavior of Zinc Porphyrin Crystals as Characterized by NSOM."

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**Op-Eds and Letters To the Editor:** Kosal, M.E. Letter to the Editor on “Billions for Biodefense,” *Bulletin of Atomic Scientists*, forthcoming March/April 2005.

Kosal, M.E. Letter to the Editor on “Women, Science and Harvard,” *New York Times*, 21 January 2005, p. A28.

Kosal, M.E. “The U.S. Response to WMD (other than in Iraq): the First CWC Review Conference and the NPT Preparatory Conference,” *The Public I*, June 2003, p. 9.

Bremer Mærli, M.; Kosal, M.E. “A More Troubling Nuclear Threat: Unsecured Fissile Material,” *The Public I*, January 2003, pp. 1, 16.

**Patent:** Suslick, K.S.; Kosal, M.E.; Rakow, N.A.; Sen, A. “Colorimetric Artificial Nose Having an Array of Dyes and Method of Artificial Olfaction,” U.S. Pat. Appl. Publ. (2002), 32 pp., Cont.-in-part of U.S. Ser. No. 6,368,558.

**Presentations:** “Feed Security: an Unaddressed Agricultural Terrorism Risk,” invited talk to be given at the DCI Center for Weapons Intelligence, Nonproliferation and Arms Control (WINPAC), March 2005, Langley VA.

“Moving Beyond Detection to Attribution: a New Role for Technology in Biological and Chemical Nonproliferation” invited talk to be given at Sandia National Laboratory, 21 February 2005, Albuquerque NM.

“Shifting Trends in Chemical Terrorism – from Radical Islamists to Homegrown Terrorists,” Chemical and Biological Terrorism Defense Gordon Research Conference poster, 31 January - 3 February 2005, Buellton CA.

“The Changing Face of Chemical Terrorism,” American Chemical Society (ACS) Western Regional Meeting, 28 October 2004, Sacramento CA.

*Keynote speaker*, “From Sarin to Ice Cream: Chemical Terrorism in the 21<sup>st</sup> Century,” Norwegian Defence Research Establishment (NDRE) and Norwegian Institute of International Affairs (NUPI) Consortia Seminar on Terrorism and Chemical and Nuclear Weapons, 14 June 2004, Oslo Norway.

*Panel chair*, “Preventing a Bioterrorist Attack,” Student Pugwash Biology and Security National Symposium, 11-14 July 2004, George Washington University, Washington, DC.

“The Technical Challenges of Biological and Chemical Weapons Verification (NBC),” University of California Institute on Global Conflict and Cooperation’s (IGCC) Conference on Public Policy and Biological Threats, 22 July 2004, University of California at San Diego (UCSD).

“An Insider’s View of Biological and Chemical Weapons Detector Research and Development,” Center for Nonproliferation Studies Seminar, Monterey Institute of International Studies, 20 November 2003, Monterey CA.

“Whither More Biosafety Level Four Labs? U.S. Civilian Biodefense Initiatives,” 15<sup>th</sup> Annual International Summer Symposium of Science and World Affairs, July-August 2003, Moscow Russia.

“Vapor Sensing Using Nanotechnology,” Nanotechnology Industry Workshop, Center for Nanoscale Science and Technology, May 2003, Urbana IL.

“Colorimetric Sensor Arrays as End-of-Service-Life Indicators,” Army Research Office and U.S. Army Soldier Biological Chemical Command, End-of-Service-Life Indicators for Mask Filters Workshop, October 2002, Panama City FL.

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"SmellSeeing: a New Tool for Detection of Volatile Chemicals," 17<sup>th</sup> International Forum on Process Analytical Chemistry & 11<sup>th</sup> International On-Site Analysis Conference, January 2003, Scottsdale AZ.

"Rapid Colorimetric Evaluation of Bacterial Metabolites," 9<sup>th</sup> International Symposium on Olfaction and Electronic Nose (ISOEN '02), October 2002, Rome Italy.

"Colorimetric Sensors for Rapid Detection of Chemical and Biological Warfare Agents," 14<sup>th</sup> Annual International Summer Symposium of Science and World Affairs, July 2002, Urbana IL.

*Society of Porphyrins and Phthalocyanines Dissertation Award Lecture*, "PIZA-1: A Functional Zeolite Analogue Assembled From Metalloporphyrins," 2<sup>nd</sup> International Conference on Porphyrins and Phthalocyanines, June 2002, Kyoto Japan.

"SmellSeeing: A Colorimetric Electronic Nose," 2<sup>nd</sup> International Conference on Porphyrins and Phthalocyanines, June 2002, Kyoto Japan.

"A Colorimetric Electronic Nose: 'SmellSeeing'," NIH National Institute of Biomedical Imaging and Bioengineering BECON Symposium on Sensors for Biological Research and Medicine, June 2002, Bethesda MD.

"Smell-Seeing: a New Tool for Identification of Volatile Organic Compounds," Pitt-Con, March 2002, New Orleans LA.

*Invited Plenary Lecture*, "Smell-Seeing: A New Approach to Artificial Olfaction," Eurodeur-Airodeur, June 2001, Paris France.

"Bis-Pocket Porphyrin Liquid Crystals: Entries in Molecular Switches & Non-Fullerene Nanotubes," Frederick Seitz Materials Research Laboratory DOE Program Review, June 2000, Urbana IL.

"Characterization of Porphyrin Materials by NSOM and AFM," 217<sup>th</sup> American Chemical Society National Meeting, March 1999, Anaheim CA.

"Novel Calcium Porphyrin Carboxylate Materials," Tetrapyrrole Gordon Conference *poster*, October 1998, Santa Barbara CA.

"Porphyrin Carboxylate Network Solids," IXth Midwest Organic Solid State Chemistry Symposium, June 1998, Manhattan KS.

"Porphyrin Polyanion Salts as Building Blocks for Network Solids," 214<sup>th</sup> American Chemical Society National Meeting, September 1997, Las Vegas NV.

**Skills:**

**Development** and **applications** of **detector** and sensor systems, with emphasis on **chemical weapon** detection, **biological weapon detection** and **diagnosis**, **explosives vapor detection**, and identification of potential terrorist contaminants in foodstuffs, as well as medical **diagnostic device design** and the current market, particularly point-of-care (POC) devices.

Familiarity with major **international agreements** and **U.S. legislation** regarding **terrorist** and **WMD threat reduction**, along with the **Cooperative Threat Reduction (CTR) program**.

Knowledge of **private sector research**, with special emphasis on the biotech and nanotech industry.

**Inorganic and organic synthetic chemistry**, with expertise in the solid-state synthesis of microporous network materials (organic zeolites), clathrates and intercalation compounds. **Synthesis, properties and applications** of diverse **molecular recognition materials**.

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Nanotechnology and microfluidics, particularly for biotechnological applications.

Knowledge of heme-based **proteins** and fundamental **bioinorganic chemistry**, including function and inhibition of metalloenzymes.

Synergistically involved in wide range of scientific activities from

- design of oligo-peptide **de novo proteins** (building peptides from 'scratch')
- synthesis and properties of proteinacious **microspheres** with biomedical uses, e.g., drug delivery, image contrast agents and artificial blood
- artificial photosynthetic systems
- single-bubble sonoluminescence (changing sound into light)
- synthesis of porphyrin-based **nanotubes**

Experience with chemometrics (algorithms for processing multi-variable data sets), including principal component analysis (PCA) and Linear Discriminant Analysis (LDA).

Languages –

Beginning Spanish (spoken and written), French (spoken and written), Norwegian (spoken, written and read) and ancient Sumerian (read). Intermediate Spanish (read) and French (read).

**Activities:**

Teaching faculty selected for the 2004 Summer Faculty Development Seminars in Iraq, University of Sulaymania, to teach **Renewable Energy through Nanotechnology** to professors from Iraqi universities, technical institutes and colleges. (*Program indefinitely postponed due to security concerns.*)

Invited Participant – Gordon Research Conferences on Chemical and Biological Terrorism Defense, Santa Barbara CA, 18-23 January 2004 and 29 January - 4 February 2004.

Invited Participant – 14<sup>th</sup> Summer Symposium on Science and World Affairs, Urbana IL, July 2002 and 15<sup>th</sup> Summer Symposium, Moscow, Russia, July 2003.

American Chemical Society's *Chemical and Engineering News* Top 2002 Supramolecular Chemistry research paper (Chemistry Highlights 2002, 16 December 2002, Vol. 80, No. 50, p. 44.)

Champaign City Public Planning Commission Member, 2002-03.

Champaign-Urbana GirlZone: developed, coordinated and led programs in hands-on science program for 8-13 year olds, 1995-99.

Editorial Board Member: Urbana-Champaign *Public I* newspaper, 2002-03, San Francisco *Fault Lines* newspaper, 2004-05.

Founding member: U of I Materials Research Society student affiliate, 1996-2000.

Founder: USC Society of Women in Science and Mathematics, undergraduate student organization for women in science; initiated and coordinated an ongoing program with the Angeles Girl Scout Council's Science Center (located in South Central LA), 1993-95.

Load Organizer & Coach: Archway Skydiving Centre, Vandalia IL, 1998-2003.

Load Organizer: World Freefall Convention, 1999-2000, 2002.

Organizer: Missouri State Women's Freefall Record Attempt, SEMO Skydiving Club, Charleston MO, 1999.

Professional Memberships:

International Society for Infectious Diseases (ISID)

Women in International Security (WIIS)

Bay Area Terrorism Working Group (BATWinG)

Interstate Chemical Terrorism Working Group

Society of Porphyrins and Phthalocyanines (SPP)

American Association for the Advancement of Science (AAAS)

International Union of Pure and Applied Chemistry (IUPAC)

American Chemical Society (ACS)

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Technical Consultations (unpaid):

Associated Press (AP), CNN, ABC News, NBC News, *60 Minutes* (CBS), *Los Angeles Times*, BBC TV4, *National Defence Magazine*, New York City Fire Department Terrorism Response Training, *Maxim Magazine*, Markland Group (Canada), U.S. Airline Pilots Association's Security Committee, KCBS (San Francisco radio), KUTV (Oakland TV), Fox News (Philadelphia), SDA (Madison, WI).

**Funded Grants:** *Total \$838,464*  
*Specific information available upon request.*

**Personal Information:**

Birth date: July 1973  
Birthplace: Detroit, Michigan  
Citizenship: USA  
Marital status: unmarried, no children

**References Available Upon Request**