Alexander Wei: Curriculum Vitae (November 2016)

I. General Information

I.A. Education

B.S. 1989 in Chemistry (with honors), California Institute of Technology
Ph.D. 1995 in Chemistry, Harvard University

I.B-C. Previous and Current Positions

1990-1995: Graduate Research Fellow, Harvard University (Advisor: Yoshito Kishi)
1995-1997: Postdoctoral Research Fellow, Université Strasbourg (Advisor: Jean-Marie Lehn)
1997-2003: Assistant Professor, Department of Chemistry, Purdue University
2003-2008: Associate Professor, Department of Chemistry, Purdue University
2008- : Professor, Department of Chemistry, Purdue University
2009- : Program Leader, Drug Delivery & Molecular Sensing, Purdue Center for Cancer Research
2011-2012: Head, Organic Division, Department of Chemistry, Purdue Univ.

I.D. Selected Awards and Honors

Discovery Park Research Fellow (Purdue University)	2013-2014
University Faculty Scholar (Purdue University)	2007-2012
Best Paper Award, 3rd IEEE-NIH Life Sci. Systems Appl. Workshop	2009
Birck Nanotechnology Center Research Citation Award (Purdue University)	2008
JSPS Visiting Fellow (NIMS, Tsukuba, Japan)	2005
Seeds for Success (Purdue University)	2004-2014 (7×)
Research Innovation Award (Research Corporation, Purdue University)	1998
Chateaubriand Research Fellowship (Univ. Louis Pasteur, Strasbourg, France)	1996-1997
Fulbright Grant (Université Louis Pasteur, Strasbourg, France)	1995-1996

I.E. Professional and Scholarly Associations

Am. Chem. Soc., Am. Assoc. Adv. Science, Materials Res. Soc.

II. Teaching Duties

II.A. Teaching Assignments at Purdue (last 9 years, in chronological order)

semester	course	title	students	year
Spring 2006	CHM 462	Intermediate Organic Chemistry (3 cr.)	4 (2 aud.)	JR, SR
Spring 2006	CHM 116-S	Gen. Chem. Lab. (CASPiE) (1 cr.)	24	FR
Spring 2007	CHM 462	Intermediate Organic Chemistry (3 cr.)	2 (3 aud.)	JR, SR
Fall 2007	CHM 560	Organic Spectroscopic Analysis (3 cr.)	23	SR, Grad.
Spring 2008	CHM 462	Intermediate Organic Chemistry (3 cr.)	3 (1 aud.)	JR, SR
Fall 2008	CHM 560	Organic Spectroscopic Analysis (3 cr.)	21	SR, Grad.
Spring 2009	CHM 462	Intermediate Organic Chemistry (3 cr.)	9	JR, SR
Fall 2009	CHM 560	Organic Spectroscopic Analysis (3 cr.)	18	SR, Grad.
Spring 2010	CHM 255	Organic Chemistry, Part I (3 cr.)	175	SO-SR
Fall 2010-2014	CHM 560	Organic Spectroscopic Analysis (3 cr.)	22-26 (w/aud.)	JR, SR, Grad.
Spring 2011	CHM 696	Supramolecular Nanomaterials (3 cr.)	5	Grad.
Spring 2012	CHM 26605	Introductory Organic Chemistry (3 cr.)	90	SO, JR
Spring 2015	CHM 696	Topics in Green Chem./Sustainability (3 cr.)		Grad.

II.B. Selected Discussion of Courses

CHM 116-S: General Chemistry Laboratory with Authentic Research Practice. This introductory lab (operating under the auspices of the CASPiE program, see p.4) aims to develop basic research skills with application toward chemically based hypotheses. Students are engaged in two 6-week modules developed around authentic research questions proposed by participating faculty. Students gain several practical research skills: (i) to plan experiments involving chemical measurement and analysis, (ii) to create original scientific hypotheses, and (iii) to design experiments which generate real data with direct relevance to a research project of a faculty member. The course also includes a peer-led team learning (PLTL) component, and emphasizes scientific communication skills through poster presentations and preparation of research articles in a professional format.

CHM 255: Organic Chemistry (non-majors). This first-semester organic chemistry course involves both traditional examination (midterms and final) and online assessments and in-class responders (i-Clicker), with bonus points offered as a positive incentive for participation. Lecture materials are provided as electronic handouts (course-paks) via Blackboard and presented in class as Powerpoint lectures, with customized animations and interactive questions to address key points or challenging concepts. Vignettes on organic compounds featured in recent news topics are provided on a regular basis to strengthen the connection between class concepts and everyday issues. Examples include comestibles (caffeine, aspartame), materials (diamond, polypropylene), chiral pharmaceuticals (Thalomide, ibuprofen), and neurotransmitters (serotonin).

CHM 257: Introductory Organic Chemistry. This organic chemistry course for nonmajors is based on weekly quizzes in recitation, two midterms, and a final. Bonus quizzes are offered as a positive incentive for completing homework assignments. Lectures include a strong focus on nomenclature and three-dimension orientation of chemical structures, particularly with respect to stereochemistry. Several model demonstrations are provided, including in-class demonstrations with mass participation (e.g., taste tests, aromas, etc.) and vignettes on select organic compounds to strengthen the connection between class concepts and everyday life (see above).

CHM 26605: Organic Chemistry (majors). This second-semester organic chemistry course involves both traditional examineation (midterms and final) and online homework (SaplingOnline), with bonus points offered as a positive incentive for participation. Lecture materials are provided as electronic handouts (course-paks) via Blackboard and presented in class as Powerpoint lectures, with customized animations and interactive questions to address key points or challenging concepts. With respect to learning outcomes, a significant emphasis was place on mechanistic understanding and the strategic application of chemical reactions to organic synthesis. In addition, associations between lecture topics and everyday materials were provided on a regular basis, to maintain a high level of relevance.

CHM 462: Intermediate Organic Chemistry. This course (created by me, in 2006) is intended for upperclassmen who are considering pursing an advanced degree in a chemistry-related field. The course builds on principles from introductory organic chemistry, with an emphasis on basic strategies in multistep organic synthesis, reactivity in terms of conformational analysis and molecular orbital theory, new classes of organic reactions and their mechanisms (e.g., thermal and photochemical cycloadditions and organic reactions based on radicals, carbenes, and nitrenes), and some contemporary research topics in organic chemistry (organic materials, supramolecular chemistry, and chemical biology).

CHM 560: Spectroscopic Organic Analysis. This course is designed for upperclassmen and first-year graduate students, with a pedagogical emphasis on spectroscopy for organic structural determination. Problem-solving strategies are introduced at the beginning of the course, with a focus on functional group-based approaches toward structural elucidation. Individual techniques (mass spectrometry, NMR, etc.) are taught in a systematic fashion after introduction of structural elucidation strategies using a fragment-assembly approach. Students download handouts that are updated yearly.

Lecture materials are continuously upgraded in several areas:

MS: ion fragmentation analysis (including several examples of bio-organic molecules);

NMR: chemical shift analysis and scalar coupling interactions (including higher-order effects); detailed descriptions of pulse sequence experiments including double resonance (decoupling), polarization transfer (APT, DEPT), nuclear Overhauser effects; two-dimensional correlation experiments including COSY and modern variants, relayed correlation spectroscopy (TOCSY), 2D NOE spectroscopy (NOESY, ROESY), and ^{13}C-^{1}H correlation spectroscopy (HMQC/HETCOR, HMBC/COLOC);

Authentic data analysis: Practical training with MestreNova, for processing and analyzing 1D and 2D NMR spectra.

CHM 696 (Supramolecular Materials Chemistry): This graduate-level course is taught as a weekly, 2.5-hr. seminar with an intermission. Grades are based on literature reports, in-class exams, and an independent research proposal. The breadth of topics covered includes: four weeks on the principles and applications of supramolecular assemblies, including ion-dipole, hydrogen bonding, and other donor-acceptor interactions; three weeks on the science and technology of solid-state supramolecular materials and self-assembled monolayers; four weeks on nanoparticle-based materials, including metal particles (plasmonic nanomaterials), semiconductor nanostructures (quantum dots and nanowires), and magnetic nanomaterials. The remaining time is devoted to oral and written proposals, and a one-day mock review panel (NIH style) to introduce the importance of the peer review process (and the clear communication of ideas).

CHM 696 (Topics in Green Chemistry & Sustainability): This new course (the first of its kind at Purdue) surveys various topics of chemistry in accordance with the 12 Principles of Green Chemistry, as well as quantitative metrics associated with safety, efficiency, reaction economy, and life cycle analysis (LCA). Both academic and industrial processes are evaluated, with application toward the scalable production of fine chemicals and pharmaceuticals. The multivariate nature of accepted metrics are illustrated with homework and in-class problems, accompanied by in-depth discussions on scope and limitation for producing useful assessments and comparisons. The LCA section is being supplemented by the critical application of online software (currently under evaluation). As a capstone project, students are requested to write a proposal that can improve "greenness" of an important industrial synthesis by innovative changes of one or more process steps, using LCA metrics to support their arguments. Students will also evaluate classmates' proposals in a mock peer review (evaluations will be factored with that of the instructor's).

Educational activities and outcomes for this class include: (1) extensive research of the scientific and patent literature; (2) integrating concepts from general, organic, and physical chemistry; (3) developing systematic approaches toward quantitative estimates from incomplete data; (4) effective use of online tools and information for populating models of reaction efficiency and risk impact; (5) critical, data-driven analysis of published works claiming improved greenness and sustainability.

II.C. Course Evaluation

II.C.1. Student Evaluations (recent)

Course taught	average rating, out of 5.0 (received/enrolled)
CHM 255: Spr 2010	3.5 (86/179)
CHM 257: Spr 2004; Fall 2004	4.8 (32/115); 4.0 (61/200)
CHM 26605: Spr 2012	3.8 (39/89)
CHM 462: Spr 2006, 2007, 2008	4.8 (4/4), 4.0 (2/2), 4.8 (5/5)
CHM 560: Fall 2008−2014	4.6 (13/20), 4.2 (14/16), 4.7 (14/19), 4.2 (8/19), 4.8 (14/19), 4.7 (13/22)
CHM 696: Spr 2005, 2011, 2015	4.8 (3/5), 4.2 (2/3), 3.0 (6/7)

III. Other Contributions to Undergraduate Education

Undergraduate research: Since 1997, I have supported 44 undergraduate students in my laboratory: Ron Magliola (1997-98), Angela Thomas (1997-98), Siong-Tern Liew (1997-99), Tim Hanser (1998-2000); Andrew Potter (1998-2000); Bryce Sadtler (1998-2002), Laura Killingbeck (1998-2001); Paul Chestovich (1999, 2002); Paul Ridenour (1999); Jack Calvert (2000); Jason Kyle (2001); Jeff Ramey (2001); Elizabeth Kruse (2001-05); David Chen (2001-03), Todd McCready (2002-2003), Ben Wong (2003), Michael Goodwin (2003), Andrew Lautz (2003-04), Carol Johnson (2003-05), Spencer Hahn (2003-07), Marc Willerth (2004-05), Elise Novorovsky (2006), James Newton (2006-09), Brad Gibson (2006-07), Alex Schneider (2007), James Ryan (2008-09), Bridget Haley (2008), Sean McCartney (2009), Aaron Wagoner (2009-10), Rachel Weller (2010), Alec Green (2010), Daniel Lee (2010), Jeehun Kim (2010), Mary Zeller (2010-11), Zhao Tang (2010-12), Andrew Green (2011-12), Asher Demerot (2011), Kaleb Mathieu (2011-14), Jordan Bruce (2012-13), Yanyi Chen (2012-13), Siyuan Sun (2012-13), Chenyi Mao (2013-15), John Sides (2012-16), Maria Khlebnikova (2013-16), Rong Duan (2014-15), Sam Eleff (2014-16), Brendan Law (2014-16), Sydney KcKown (2015-16), David Wu (2015-), Sunna Wangnoi (2016-), Yan Yu (2016-), Shijie Yuan (2016-).

Chemistry Honors Coordinator (2000- present): Responsibilities of this position include (i) coordinating CHM 197, a 1-unit course introducing freshman honors Chemistry majors to undergraduate research (in collaboration with undergraduate advisor, Dr. Beatriz Cisneros), and (ii) coordinating senior Honors activities (oral or poster presentations and senior theses).

MARC/AIM Program (1998-2000): This program provides research experience to underrepresented minority undergraduate students. Three undergraduates have been mentored as summer MARC/AIM research fellows: Gerardo Moreno, Jesús Hernandez, Javier Rivera.

REU in Chemical Biology (Summer 2004): This NSF-sponsored program provides summer research experience in chemical biology to undergraduate students from four-year colleges. One student (Michael McClintock) became a coauthor on a *ChemBioChem* paper.

IV. Creative Endeavor, Research, Scholarship (last updated in 2013)

IV.A. Discussion of research and creative endeavor (personal statement)

We use a multidisciplinary approach to address contemporary problems at the interface of chemistry, biology, and materials science. Organic and nanomaterials synthesis, surface chemistry, and the principles of colloid science are applied toward research interests in plasmonics and nanomagnetics, biological sensing and imaging, and nanomedicine. As individual projects are developed into fruitful research products, they collectively provide the tools for exploring complex issues with biomedical or societal impact. Our projects are thus developed with two questions in mind:

- *How do molecular interfaces direct the organization of matter at multiple length scales?*
- *How can such materials enhance our understanding and control over processes in living systems?*

Our research activities typically fall into one of two categories. The first involves the development of functional nanomaterials, and the novel opportunities they create for novel applications in biosensing and medicine. These projects include:

(i) self-assembly and collective properties of metal nanoparticles
(ii) tunable plasmonic nanomaterials for chemical sensing and optical modulation
(iii) robust methods for the surface functionalization of metal substrates and nanoparticles
(iv) NIR-absorbing gold nanorods (GNRs) for biomedical imaging and photothermal therapies
(v) Pilot studies and preclinical evaluation of GNRs as photothermal agents for cancer treatment
(vi) dynamic contrast mechanisms based on hybrid magneto-plasmonic nanoparticles

The second research area is driven by a long-standing interest in carbohydrates, particularly those that present challenges in correlating molecular structure with biological recognition and function. Organic synthesis and surface chemistry are used to develop well-defined models that can mimic the function of complex glycans such as heparan sulfate. These projects include:

(vii) diversity-oriented synthesis and screening of heparan-like oligosaccharides
(viii) synthetic methodologies based on the chemistry of glycals and 4-deoxypentenosides (4-DPs)
(ix) chemical biology of unnatural carbohydrates (glycomimetics)
(x) technologies for detecting of bacterial pathogens using patterned glycoconjugates

Most recently, we have initiated a program to develop "designer soft materials" for technologies that can benefit from improvements in sustainability and lifecycle management. The current project involves the engineering of modified starch films into compostable substrates, for the development and scalable production of "smart wrappers" using web (roll-to-roll) manufacturing methods.

Research highlights from projects (i)–(x) are presented on the next few pages.

IV.A.i. *Collective properties of nanoparticle assemblies*. Self-assembly, considered by many to be a key methodology in materials synthesis, has been widely used to create superlattices of inorganic or metallic nanoparticles (NPs). Our interest is to develop novel materials from NPs with size-dependent optical or magnetic properties, many of which are most pronounced when the constituent particles are on the order of 20–200 nm. Such materials experience strong self-attractive forces, which can promote kinetic aggregation and result in poorly organized structures.

To address this issue, we have developed macrocyclic surfactants known as resorcinarenes to enhance the dispersion and self-assembly of NPs in the mid-nanometer size range.[1] These compounds possess at least two salient features which contribute to their superior dispersant properties: (i) large, multivalent headgroups for robust adsorption to the NP surface, and (ii) several hydrocarbon tails per molecule spaced several angstroms apart (see Figure 1). The latter ensures a high degree of configurational freedom per chain in the surfactant layer, which translates into effective steric repulsion associated with loss of conformational entropy. By comparison, typical single-chain surfactants desorb more readily and also tend to form densely packed domains on the NP surface (see Figure 1, *lower right*), which reduces entropic steric repulsion and promotes the flocculation of nanoparticles.

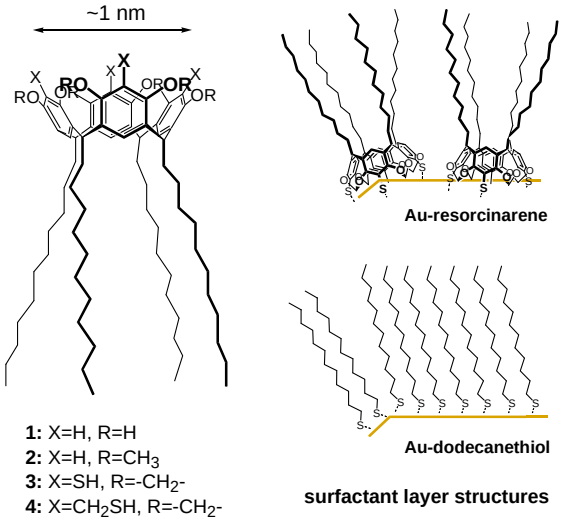

Figure 1. Resorcinarenes as nanoparticle dispersants.

Initial studies were performed using Au nanocrystals stabilized by resorcinarenes with polyhydroxyl or polyether headgroups (**1**,**2**)[2] and further developed using resorcinarenes with tetrathiol headgroups (**3**,**4**), which could extract colloidal Au NPs as large as 100 nm from aqueous suspensions and disperse them into organic solvents.[3,4] Resorcinarene-stabilized Au NPs as large as 170 nm could also be dispersed at the air-water interface, where they spontaneously organized into monolayer films. These were deposited onto substrates and analyzed by transmission electron microscopy (TEM), which confirmed the formation of hexagonally close-packed 2D arrays with good local order (see Figure 2).[5] The colloidal Au NP arrays exhibit tunable optical properties including surface-enhanced Raman scattering (SERS), a highly sensitive form of spectroscopy with exciting potential for chemical and biomolecular sensing (see section IV.A.ii). Because order is likely to be an important variable in the optical response of the NP arrays, we have developed a method of cluster size analysis which provides a figure of merit for the quantitative evaluation of local 2D order.[6,7]

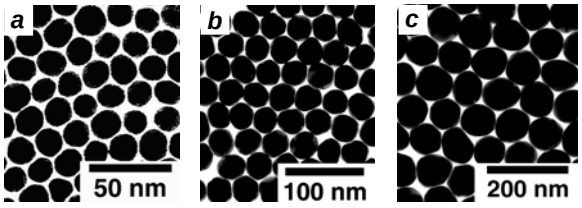

Figure 2. TEM images of Au nanoparticle films transferred onto Formvar-coated Cu grids (Philips EM-400, 80-100 keV). Unit particle sizes: (a) 16 ± 3 nm; (b) 34 ± 2 nm; (c) 87 ± 7 nm.

[1] Wei, A. *Chem. Commun.* **2006**, 1581-91.
[2] Stavens, K. B.; Pusztay, S. V.; Zou, S.; Andres, R. P.; Wei, A. *Langmuir*, **1999**, *15*, 8337-39.
[3] Balasubramanian, R.; Xu, J.; Kim, B.; Sadtler, B.; Wei, A. *J. Dispersion Sci. Tech*., **2001**, *22*, 485-89.
[4] Balasubramanian, R.; Kim, B.; Tripp, S. L.; Wang, X.; Lieberman, M.; Wei, A. *Langmuir* **2002**, *18*, 3676-81.
[5] Kim, B.; Tripp, S. L.; Wei, A. *J. Am. Chem. Soc.,* **2001**, *123*, 7955-56.
[6] Kim, B.; Carignano, M. A.; Tripp, S. L.; Wei, A. *Langmuir* **2004**, *20*, 9360-65.
[7] Kim, B.; Balasubramanian, R.; Pérez-Segarra, W.; Wei, A.; Decker, B.; Mattay, J. *Supramol. Chem.* **2005**, *17*, 173-80.

We have also investigated the dispersion and self-assembly of Co NPs which display nonzero remanence at room temperature. Dispersions of magnetic particles (ferrofluids) commonly produce chain-like assemblies as a result of magnetic dipolar interactions. We have determined that Co NPs stabilized by **1** are capable of assembling into novel bracelet-like rings (see Figure 3, *left*).[8] These kinetically stable assemblies are regulated by an equilibrium between enthalpic gain (dipole-dipole and long-range van der Waals interactions) and entropic loss, analogous to the thermodynamic balance of forces governing supramolecular self-assembly. Systematic investigations by TEM demonstrate that hole nucleation and other deposition effects, which are known to create larger, micron-sized rings upon solvent evaporation, are not responsible for nano-bracelet formation.

Figure 3. *Left*, ferromagnetic Co nanoparticles self-assemble into "bracelets" when dispersed in toluene with resorcinarene **1**. *Right*, chiral FC states in Co nanorings with CCW and CW polarizations, as visualized by electron holography.

The cobalt NP rings have been studied by electron holography in collaboration with Rafal Dunin-Borkowski (Cambridge Univ.), and shown to form chiral flux closure (FC) domains (see Figure 3, *right*).[9] These binary magnetic states are stable at room temperature, and comprise a "racemic" mixture of CW and CCW polarizations. Further studies have revealed that the FC polarizations can be reversed by an out-of-plane magnetic pulse (H_z), then switched again by applying H_z in the opposite direction. This physical behavior has no known analogy at the macroscopic level, but the effect can be reproduced by micromagnetic simulations.[10] The magnetodynamic basis for this FC reversal may involve a temporal correlation with residual out-of-plane magnetization (M_z).

IV.A.ii. *Plasmonic nanomaterials and their applications.* Our efforts in NP self-assembly kindled an interest in nanomaterials with tunable plasmon modes, and their applications as chemical sensors and as optical contrast agents for biological systems. With respect to the latter, gold nanostructures are appealing in three respects: (1) they are chemically inert under physiological conditions and compatible with living systems; (2) their plasmon resonances can generate intense optical responses at visible and near-infrared frequencies; (3) the physical size range of colloidal gold offers intriguing prospects for the study of biological processes within single cells, as much of life's machinery also operates on the nanoscale.

We first investigated gold NP arrays as SERS sensing platforms, with the prospects of studying chemical efflux across cell membranes in a direct and label-free manner. The 2D arrays above (see section IV.A.i) generated strong plasmon resonances at visible and near-infrared (NIR) wavelengths, and could excite SERS signals from the adsorbed resorcinarene layers with surface-averaged signal enhancement factors (G) of 10^5 to over 10^7 (see Figure 4).[11] These enhancements are tunable and generally increase with periodicity and excitation wavelength. We have also observed an aperture effect on the signal collection efficiency (see Figure 4d), indicating an angular dependency of the collective plasmon response and that propagating surface plasmon polaritons also contribute to the SERS effect produced by the Au NP films.

The enhanced Raman scattering is generated by localized field effects in the crevices and cavities of the NP arrays, whose intensities and volumes can be tuned by adjusting the ratio between particle size and interparticle spacing (see Figure 5a).[12] Theoretical studies and simulations on 2D arrays of metal NPs and

[8] Tripp, S. L.; Pusztay, S. V.; Ribbe, A. E.; Wei, A. *J. Am. Chem. Soc.,* **2002**, *124*, 7914-15.
[9] Tripp, S. L.; Dunin-Borkowski, R. E.; Wei, A. *Angew. Chem. Int. Ed.,* **2003**, *42*, 5591-93.
[10] Kasama, T.; Dunin-Borkowski, R. E.; Scheinfein, M. R.; Tripp, S. L.; Liu, J.; Wei, A. *Adv. Mater*. **2008**, *20*, 4248-52.
[11] Wei, A.; Kim, B.; Sadtler, B.; Tripp, S. L. *ChemPhysChem,* **2001**, *2*, 743-45.
[12] Genov, D. A.; Sarychev, A. K.; Shalaev, V. M.; Wei, A. *Nano Lett.* **2004**, *4*, 153-58.

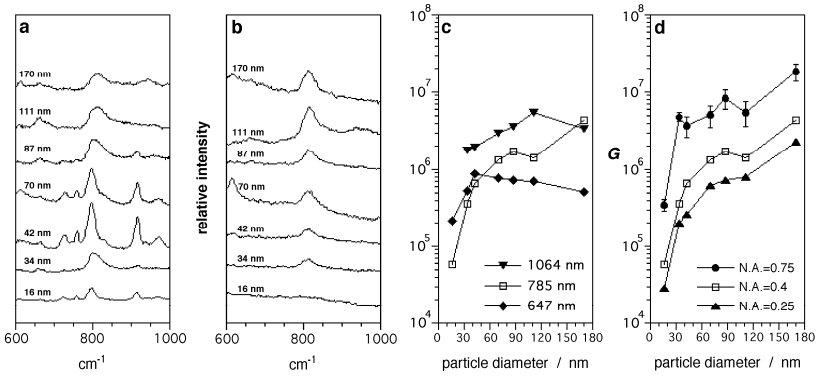

Figure 4. Tunable SERS activity from gold nanoparticle arrays. (*a, b*) Raman spectra obtained by excitation at 647 nm and 1064 nm; (*c*) signal enhancement factors (*G*) as a function of periodic structure and excitation wavelength; (*d*) *G* as a function of numerical aperture (N.A.) at a fixed excitation wavelength (785 nm).

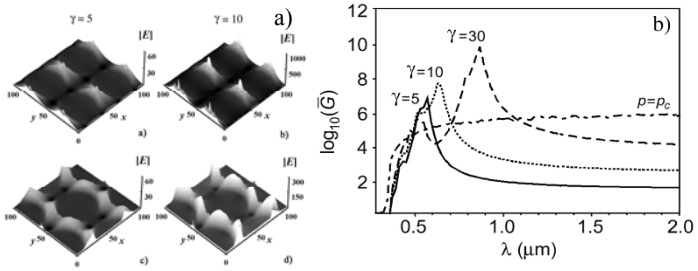

Figure 5. (a) Spatial distribution map of plasmon-generated fields from two metal nanoparticles at different interparticle spacings.[Error! Bookmark not defined.] (b) Average signal enhancements (*G*) from 2D arrays of Au nanodisks as a function of λ_{ex} at fixed particle diameter–spacing ratios (γ= 5, 10, and 30). Enhancements from random metal–dielectric films at the percolation threshold ($p=p_c$) are included for comparison.

nanowires were performed in collaboration with the Shalaev group (ECE, Purdue) to reveal quantitative relationships between periodic structure and the electromagnetic field factors responsible for SERS. Numerical and analytical calculations both suggest that the surface-averaged SERS enhancements can approach 2×10^{11} for 2D arrays of metal (Ag) nanowires, and 2×10^{9} for 2D arrays of metal nanospheres. These studies further indicate that the arrays' diameter–spacing ratios may be tuned for maximum SERS response at a given excitation wavelength (see Figure 5b).

The calculations above stimulated our interest in 2D arrays of cylindrical metal nanorods, whose field enhancements was predicted to be greater than that of nanosphere 2D arrays by up to 2 orders of magnitude. To this end, we fabricated highly uniform Au nanorod arrays by templated electrochemical deposition, using nanoporous alumina templates coated with polyethylenimine (PEI). In addition to their hexagonal 2D order the nanorod arrays have extremely narrow height distributions, with local relative standard deviations of 0.5% and overall standard deviations well below 2% (see Figure 6).[13] The uniform growth rate is determined by the adsorbed PEI matrix. The tips of these metal nanowires can be exposed by careful etching of the alumina matrix under basic conditions; alternatively, complete removal of the alumina template followed by supercritical drying can produce free-standing nanorod arrays.

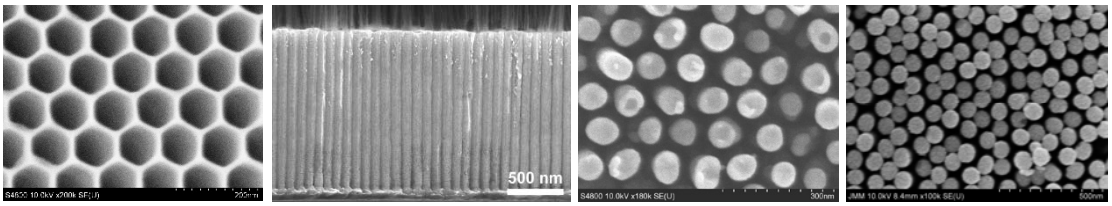

Figure 6. FE-SEM images of 2D Au nanorod arrays. (*a*) nanoporous Al_2O_3 template; (*b*) cross-section of 2D nanorod array (h = 1.396 ± 0.007 μm); (c) 2D array of nanorod tips; (*d*) free-standing 2D nanorod array.

[13] Moon, J.-M.; Wei, A. *J. Phys. Chem. B* **2005**, *109*, 23336-41.

In the course of this work, we discovered that the Au nanorod arrays exhibit several resonant attenuations at visible and NIR frequencies using reflectance spectroscopy (see Figure 7).[14] These are due to standing-wave plasmonic cavity modes excited at normal incidence (k_z), as opposed to photonic band gaps associated with in-plane light ($k_{x,y}$). Finite-element modeling of the 2D nanorod arrays verified these to be higher-order harmonics whose resonances are sensitive to several factors, including nanorod height, diameter−spacing ratio, and the dielectric medium. The simulations also reveal strong near-field effects localized between the nanorods, especially at the tips.

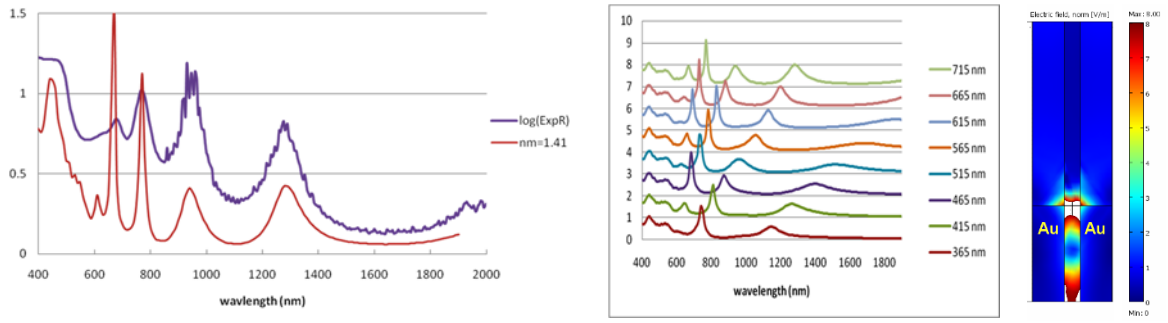

Figure 7. (a) Experimental and simulated absorbance−reflectance spectra from Au nanorod arrays on a 50-nm Au baseplate. (b) Collective plasmon resonances as a function of nanorod height (d=75 nm; 105 nm spacing). (c) Local field factors (E/E_0) between gold nanorods near tips (white region is offscale).

We also developed a method for assembling colloidal Au NPs into spherical "superparticle" ensembles, and applied these as SERS-active nanoprobes in cells.[15] Core–shell ensembles of citrate-stabilized gold nanoparticles (20–80 nm) on PEI-functionalized silica particles (330–650 nm) were prepared by electrostatic self-assembly with shell packing densities as high as 55% (see Figure 8, *left*).[16] Shell densities were optimized by increasing the surface charge of both core and shell particles; the latter was accomplished by increasing the amount of adsorbed citrate prior to assembly. The superparticles exhibit significant levels of extinction at NIR wavelengths due to the strong electromagnetic coupling between nanoparticles, and also exhibit strong SERS activity in several cases.[15] Superparticle nanoprobes have been implanted into live mammalian cells using cationic transfection systems with minimal cell trauma (see Figure 8, *right*),[17] and have transduced intracellular SERS signals from adsorbed DNA molecules.[15]

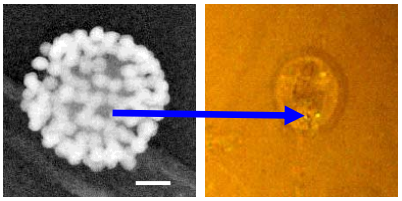

Figure 8. *Left*, 40/350-nm Au/SiO_2 superparticle ensemble (scale bar = 100 nm). *Right,* tSA201 cell subjected to nanoprobe implantation.

IV.A.iii. *Nanoparticles with nondesorptive coatings.* There has been tremendous interest in using functionalized NPs as site-directed delivery systems for imaging and therapeutic applications. Surface modification is typically achieved by electrostatic adsorption (e.g., proteins or polyelectrolytes) or by chemisorption (e.g., thiolated ligands), but these methods may not provide long-term stability against ligand desorption or aggregation, particularly in nonaqueous solvents. Therefore, we have sought to develop NPs encapsulated in functional, nondesorptive coatings to resist chemical erosion in various environments, or to react selectively for further surface conjugation. The latter could also enable the preparation of libraries of ligand-coated NPs, by applying methods and techniques similar to those used in solid-phase synthesis on functionalized microspheres.

[14] Lyvers, D. P.; Moon, J.-M.; Kildishev, A. V.; Shalaev, V. M.; Wei, A. *ACS Nano* **2008**, *2*, 2569-75.
[15] Wei, A. *e-J. Surf. Sci. Nanotechnol.* **2006**, *4*, 9-18.
[16] Sadtler, B.; Wei, A. *Chem. Commun.* **2002**, 1604-05.
[17] Zhao, Y.; Sadtler, B.; Lin, M.; Hockerman, G. H.; Wei, A. *Chem. Commun.* **2004**, 784-85.

Our initial investigations into robust NP coatings involved the crosslinking of resorcinarene surfactants with chemically reactive tailgroups. Initial studies were conducted using tetraalkene **5**, whose chains could be crosslinked by olefin metathesis (see Figure 9).[18] Gold nanocrystals encaged in crosslinked shells were found to be resistant to precipitation-induced fusion, and could survive passage through a polystyrene size-exclusion column. Second-generation systems based on tetrathiol resorcinarenes such as **6** were capable of encaging colloidal gold NPs upon treatment with Grubbs' original metathesis catalyst, despite its potential incompatibility with thiols.[19] The resulting crosslinked shells were found to be resistant to surface desorption while retaining excellent dispersibility in organic solvents, and were also amenable to synthetic modifications involving epoxidation and dihydroxylation.

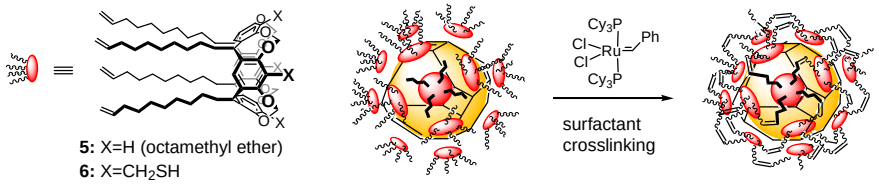

Figure 9. Gold nanoparticles encaged in a crosslinked resorcinarene shell.

We then identified a more general alternative based on the chemisorptive properties of dithiocarbamates (DTCs), which form by the spontaneous condensation of amines with CS_2 under mildly basic conditions but form robust attachments onto metal surfaces (Figure 10).[20] DTC-based chemisorption enables us to address several limitations imposed by thiols: they are better able to withstand degradation under oxidative conditions and can resist displacement by competing thiols and electrolytes, and are thus suitable for applications involving blood circulation and exposure to biological fluids.

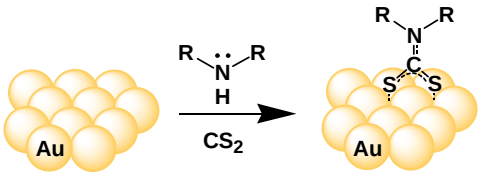

Figure 10. Assembly of dithiocarbamates on Au.

Surface modification by *in situ* DTC formation combines robustness with the simplicity of self-assembly, with considerable expansion to the scope of organic and biomolecular ligands that can be anchored onto metal and other inorganic substrates. The chemistry is highly practical and has been adopted by us and others to functionalize surfaces and nanoparticles with oligopeptides, DNA, glycoconjugates, and various targeting ligands and receptors.[21,22] For example, *in situ* DTC formation to coat Au nanorods with amine-terminated mPEG and folic acid conjugates, by direct functionalization in aqueous solutions.

IV.A.iv. *Functionalized gold nanorods (GNRs) and agents for integrated therapeutics and diagnostics (theranostics).* GNRs with controlled aspect ratios exhibit intense plasmon resonances at NIR wavelengths, a spectral region of relatively high transmittivity in biological tissues. GNRs can be prepared by templated synthesis; for example, we have prepared Au nanorods between 300–1400 nm by electrochemical reduction in nanoporous alumina, followed by dissolution of the templates and redispersion in solution (see Figure 11).[23] Such GNRs may find some use in nanophotonic or *ex vivo* bioanalytical applications, however they are too large to be used as agents for biological imaging, and their synthesis is currently not scalable.

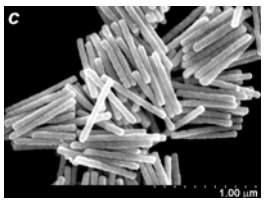

Figure 11. Au nanorods (750 nm) prepared by templated electrodeposition in nanoporous Al_2O_3.

[18] Pusztay, S. V.; Wei, A.; Stavens, K. B.; Andres, R. P. *Supramol. Chem.* **2002**, *14*, 291-94.
[19] Balasubramanian, R.; Kwon, Y.-G.; Wei, A. *J. Mater. Chem.* **2007**, *17*, 105-12.
[20] Zhao, Y.; Pérez-Segarra, W.; Shi, Q.; Wei, A. *J. Am. Chem. Soc*. **2005**, *127*, 7328-29.
[21] Zhu, H. et al. *Langmuir* **2008**, *24*, 8660-66.
[22] Zhao, Y.; Newton, J. N.; Liu, J.; Wei, A. *Langmuir* **2009**, *25*, 13833-39.
[23] Moon, J.-M.; Wei, A. *Mater. Res. Soc. Symp. Proc. Ser.* **2006**, *900E,* O.12.32, 1-7.

Smaller (45–60 nm) GNRs can be prepared by the seeded reduction of $AuCl_4$ in aqueous cetyltrimethylammonium bromide (CTAB) solutions in the presence of $AgNO_3$.[24] However, GNRs prepared by this route are often plagued by a gradual blueshift in longitudinal plasmon resonance, rendering them unsuitable for applications requiring optical stability in the NIR region. We were able to arrest this "optical drift" by adding small amounts of Na_2S to quench GNR growth (see Figure 12).[25] A time-resolved TEM analysis revealed two distinct growth periods: an initial burst (t<15 min) generating dumbbell-shaped nanorods with flared ends, and a slower phase (t>30 min) favoring growth around the midsection, leading to nanorods with an oblate geometry. The blueshift in plasmon resonance correlates with changes in the length-to-midsection (L/D_1) aspect ratio. Most importantly, the sulfide-treated GNRs are sufficiently stable for their use as contrast agents for biomedical imaging and theranostics.

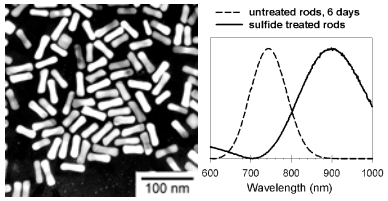

Figure 12. Au nanorods (l<50 nm) prepared by a seeded growth process and stabilized by sulfide quenching.

The GNRs have been evaluated as NIR contrast agents for optical coherence tomography (OCT) in collaboration with Stephen Boppart (Beckman Institute, Univ. of Illinois),[26,27] and also as nonlinear optical imaging agents based on two-photon luminescence (TPL) in collaboration with Ji-Xin Cheng (BME and Chemistry, Purdue). In the latter case, we have determined that GNRs excited at NIR frequencies produce strong TPL intensities, with a $\cos^4$ dependence on the incident polarization.[28] The TPL is due to a plasmon-enhanced two-photon absorption cross section, and the signal from a single GNR is many times brighter than the two-photon fluorescence signal from a single rhodamine molecule. The low background afforded by TPL permits GNRs to be detected *in vivo* with single-particle sensitivity, as demonstrated by the intravital imaging of GNRs passing through a blood vessel in a mouse ear at subpicomolar concentrations (Figure 13).

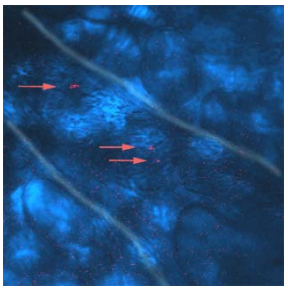

Figure 13. TPL image of individual unlabeled GNRs (indicated by red arrows) flowing through a mouse ear blood vessel.

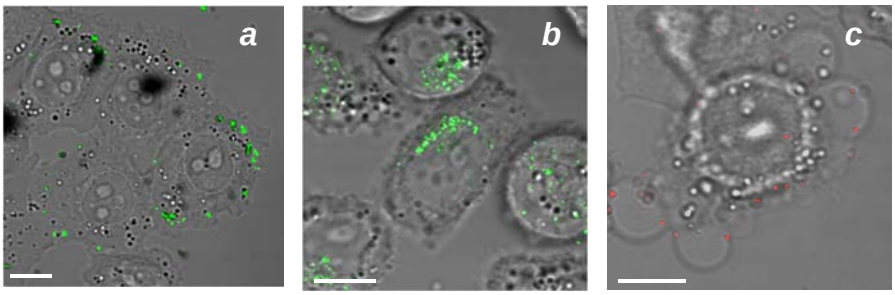

Figure 14. (a) Confocal TPL image (λ_{ex}=795 nm) of folate-conjugated GNRs (green) accumulated on the surfaces of KB cells, after 6 hours incubation. (b) Confocal TPL image of GNRs internalized in KB cells after 17 hours incubation. (c) KB cells experiencing membrane blebbing after 60 sec pulsed irradiation at 5 mW (20 J/cm^2). The nanorods (red) remain intact at this fluence level. Bar = 10 μm.

We have found TPL imaging to be useful for addressing questions of GNR targeting and cell uptake. For example, TPL can be used to monitor the permeation of GNRs through the membranes of KB cells when coated with the cationic surfactant CTAB.[29] This nonspecific uptake could be minimized by displacing CTAB with mPEG chains anchored by *in situ* DTC formation (see **IV.A.iii**). If the GNRs are conjugated

[24] Sau, T. K.; Murphy, C. J. *Langmuir* **2004**, *20*, 6414-20.
[25] Zweifel, D. A.; Wei, A. *Chem. Mater*. **2005**, *17*, 4256-61.
[26] Oldenburg, A. L.; Zweifel, D. A.; Hansen, M. N.; Wei, A.; Boppart, S. A. *Opt. Express* **2006**, *14*, 6724-38.
[27] Oldenburg, A. L.; Hansen, M. N.; Ralston, T. S.; Wei, A.; Boppart, S. A. *J. Mater. Chem.* **2009**, *19*, 6407-11.
[28] Wang, H.; Huff, T. B.; Zweifel, D. A.; He, W.; Low, P. S.; Wei, A.; Cheng, J.-X. *Proc. Natl. Acad. Sci.* **2005**, *102*, 15752-56.
[29] Huff, T. B.; Hansen, M. N.; Zhao, Y.; Cheng, J.-X.; Wei, A. *Langmuir* **2007**, *23*, 1596-99.

instead with PEG-linked folate,[30] TPL imaging revealed these to accumulate on the outer membrane surface during the first few hours, followed by their gradual uptake (Figures 14a,b).

With respect to therapeutic capabilities, we have shown cells labeled with GNRs to be highly susceptible to photothermally induced membrane damage, even when irradiated at low intensity (Figure 14c). The power threshold for the killing of tumor cells with membrane-bound GNRs is lower by at least an order of magnitude versus cells with internalized GNRs.[31] We also determined that GNR-mediated membrane damage permits the rapid influx of intracellular Ca^{2+}, which promotes actin depolymerization to produce a dramatic membrane blebbing response. The photothermally induced disruption in cellular homeostasis is a significant departure from earlier assumptions regarding nanoparticle-mediated hyperthermia, and suggests membrane "optoporation" as a novel form of targeted cell therapy.

IV.A.v. *Preclincal evaluation and pilot studies of GNRs for nanomedicine.* A materials transfer agreement is in place with the NCL (a characterization lab supported by the NCI and FDA) to profile the toxicity and biodistribution of functionalized GNRs, in order to establish investigational new drug (IND) status. In the course of this work, we encountered an important toxicological issue concerning the presence of residual CTAB in GNR formulations, which can contribute to nonspecific uptake.[29] A protocol to detoxify GNRs was developed by introducing polystyrenesulfonate (PSS) as an adsorbent and detergent, which permits the removal of CTAB without GNR flocculation.[32] CTAB-laden PSS could then be exchanged with fresh polyelectrolyte to produce "CTAB-free" GNRs with no significant cytotoxicity at the highest level evaluated (Figure 15). This protocol enables functionalized GNRs to be prepared on a batch (multigram) scale without undue concern for contamination by cationic surfactants, and permits complete a surface exchange with traditional electrolytes such as citrate.[33] (the use of citrate-stabilized NPs in bioconjugation protocols is well established).

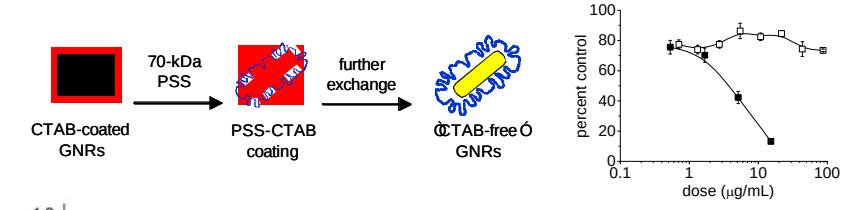

Figure 15. *Left*, Removal of CTAB from GNRs using 70-kDa PSS. *Right*, cytotoxicity profile (against KB cells) of PSS-coated GNRs contaminated with CTAB (■), and after further exchange with unadulterated PSS (□).

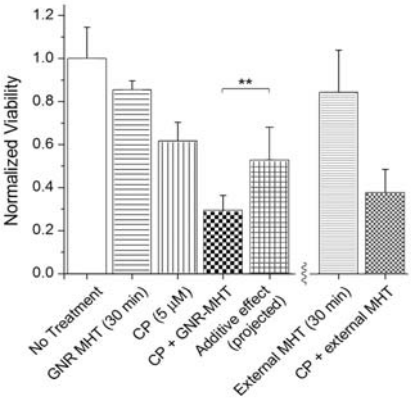

Figure 16. Synergistic effects of CP and GNR-mediated MHT on SKOV3 cells (**, $p = 0.05$). MHT by external heating shown for comparison. (**, $p = 0.05$).

We are now conducting several *in vitro* and *in vivo* studies on photothermally-assisted chemotherapy using GNRs as active agents. One study has revealed synergistic effects between cisplatin (CP) and GNR-mediated mild hyperthermia (MHT) against metastatic ovarian cancer (OC). CP-resistant SKOV3 cells (IC_{50}: 10 μM) were treated with 5 μM CP and subjected to GNR-mediated MHT (42−43 °C) for 30 min, then incubated for 3 days; the combination was 80% more potent than the additive effects of individual treatments (Figure 16).[34] We are also developing GNR carriers for the delivery and photothermal release of siRNA. SKOV3 cells were treated with GNR–siRNA complexes and NIR laser irradiation for 15 min, which produced a bulk temperature increase of just 2 °C but a reduction in protein expression as high as 45%. Folate-mediated GNR–siRNA delivery and photothermal RNA interference was demonstrated for TG2, an enzyme associated with the metastatic

[30] Huff, T. B.; Tong, L.; Zhao, Y.; Hansen, M. N.; Cheng, J.-X.; Wei, A. *Nanomedicine* **2007**, *2*, 125-32.
[31] Tong, L.; Zhao, Y.; Huff, T. B.; Hansen, M. N.; Wei, A.; Cheng, J.-X. *Adv. Mater.* **2007**, *19*, 3136-41.
[32] Leonov, A. P.; Zheng, J.; Clogston, J. D.; Stern, S. T.; Patri, A. K.; Wei, A. *ACS Nano* **2008**, *2*, 2481-88.
[33] Mehtala, J. G.; Wei, A. Manuscript submitted (2013).
[34] Mehtala, J. G.; Torregrosa-Allen, S.; Elzey, B. D.; Jeon, M.; Kim, C.; Wei, A. *Nanomedicine* **2013**, mnuscript accepted.

progression of OC.[35] We are also conducting *in vivo* studies of folate-targeted delivery of GNRs in orthotopic tumor mouse SKOV3 models, with Prof. Daniela Matei at the IU School of Medicine. A biodistribution study of folate–GNRs in an orthotopic OC mouse model confirmed their targeted delivery to the OC tumor, as well as to metastatic lesions (Figure 17).

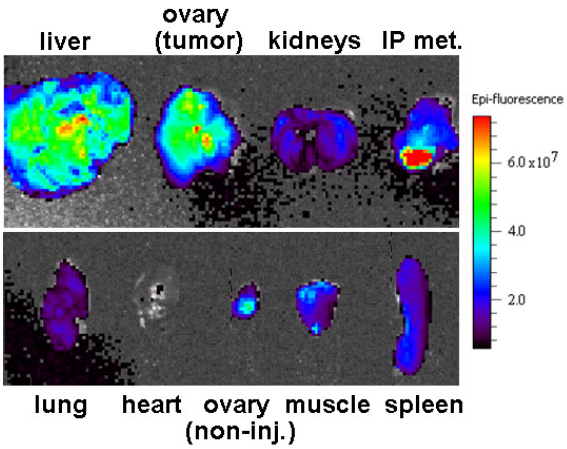

Figure 17. Biodistribution of folate-labeled GNR–siRNA complexes (labeled with Cy3) in orthotopic OC mouse model, 24-h post-injection. IP met. = intraperitoneal metastasis.

IV.A.vi. *Dynamic contrast agents using hybrid magneto-plasmonic nanoparticles.* GNRs and other NIR-active NPs have been under active scrutiny as contrast agents for the optical imaging of biological tissues. We have found that while such contrast is possible,[26,27] most tissue samples produce a high background and require high NP loadings to generate signals of sufficient quality. In order to overcome fundamental limits in signal-to-noise ratios (SNR), we have been developing dynamic contrast mechanisms that combine optical scattering with magnetic responsivity to generate periodic modulations in optical signal. This magnetomotive contrast mechanism has been validated for OCT using colloidal Fe_3O_4 NPs (in collaboration with Boppart), but limited to changes in morphology-dependent scattering.[36]

We have demonstrated an important example of dynamic contrast by combining magnetomotive activity with polarization-sensitive plasmon modes, using gold nanostars (NSTs) with magnetic cores (Figure 18a).[37] Like GNRs, these anisotropic nanoparticles have NIR-active, polarization-sensitive plasmon modes that extend radially along one or more spines. Modulations in NIR scattering is generated by gyromagnetic actuation driven by a rotating magnetic field gradient (ω up to 10 Hz), giving rise to a periodic but apparently stationary "twinkling." Real-time images of gyrating nanostars are converted by Fourier transform into images a the driving frequency for noise filtering, with dramatic enhancements in peak SNR (up to 25 dB). Gyromagnetic signals that are otherwise obscured by brighter, aperiodic scatterers may be resolved with considerable clarity (Figure 18b,c). We have also shown that dynamic contrast can be generated by magnetomotive modulation, with comparable enhancements in signal quality and contrast.[38] The enhanced quality of dynamic contrast is defined by strategies in image collection and processing, independent of the imaging platform.

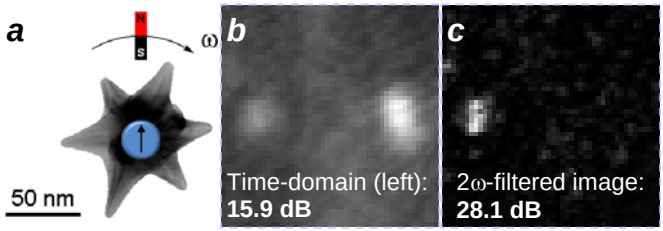

Figure 18. (a) Gyromagnetic Au nanostar with Fe_3O_4 core. (b) Time-averaged image of magnetically active NST (left) inside KB cell under low-lighting conditions, next to brighter but static scatterer. (c) Gyromagnetic 2ω-filtered image. Images are 8 x 8 μm.

IV.A.vii. *Synthetic oligosaccharides based on heparan sulfate.* Our experiences thus far have led us to consider ligand-functionalized NPs for modulating protein−protein interactions in cell biology. Protein-conjugated NPs are often used in immunostaining techniques and in biomedical applications involving delivery to cell-surface receptors; however, far fewer studies have demonstrated modulatory effects of NPs

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[35] Shao, M.; Cao, L.; Shen, C.; Satpathy, M.; Chelladurai, B.; R., B.; Matei, D. *Cancer Res.* **2009**, *69*, 9192-9201.
[36] Oldenburg, A. L.; Toublan, F. J.-J.; Suslick, K. S.; Wei, A.; Boppart, S. A. *Opt. Express* **2005**, *13*, 6597-14.
[37] Wei, Q.; Song, H.-M.; Leonov, A. P.; Hale, J.; Oh, D.; Ong, Q. K.; Ritchie, K.; Wei, A. *J. Am. Chem. Soc.* **2009**, *131*, 9728.
[38] Song, H.-M.; Wei, Q.; Ong, Q. K.; Wei, A. *ACS Nano* **2010,** *4*, 5163-73.

on receptor activity. We have a particular interest in heparin-binding proteins, which rely on highly sulfated cell-surface oligosaccharides for receptor binding and downstream signaling. Ideally, we wish to use structurally well-defined heparin sulfate (HS) oligosaccharides with high binding affinities for specific proteins; however, the structural complexity and low natural abundance of the active binding sequences in HS has prevented their elucidation in most cases. We aim to address this impasse by synthesizing HS-like compounds with unique sulfation patterns (sulfoforms) to identify high-affinity substructurs for heparin-binding proteins. The synthetic sulfoforms can serve two purposes: (i) they can be screened directly as microarrays in affinity binding assays, and (ii) they can provide a training set for correlation with authentic HS binding sequences by MS fragmentation analysis.

We have developed orthogonal protecting group systems for oligosaccharides derived from chitosan (D-GlcN(β1→4)-D-GlcN-(β1→4)) and heparan (D-GlcN(α1→4)-D-GlcA(β1→4)), whose sulfated congeners are known to have potent biological activities. Orthogonally protected oligomers of chitosan such as **8**[39] can generate up to 12 sulfoforms per unit (including $-NH_3^+$, NHAc, and $-NHSO_3^-$), whereas building blocks based on heparan disaccharide **9** can generate up to 48 sulfoforms per unit, only half of which have been identified from natural sources (Figure 19). Disaccharide **9** features 6 different protecting groups, and has been subjected to orthogonal deprotection and sulfonation conditions to produce mono-*O*- and *N*-sulfates (Figure 20).[40] α1,4-Disaccharide formation was prepared in good yields using bicyclic 3,6-lactone **10** as the glycosyl acceptor, which reverted to the $^4C_1$ conformation upon saponification (Scheme 1). In the course of this work, we also discovered a temperature-dependent regioselectivity in the reductive cleavage of *p*-anisylidene-protected pyranosides, which yields either 4-*O*- or 6-*O*-PMB ethers in high yields.[41]

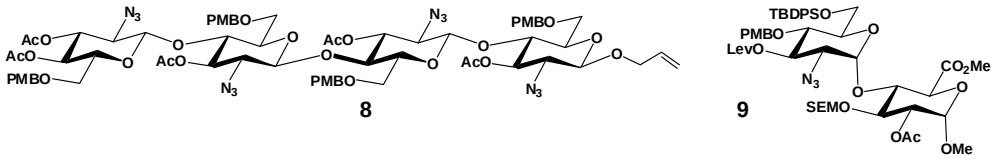


Figure 19. Orthogonally protected derivatives of chitosan tetrasaccharide **8** and heparan I disaccharide **9**.

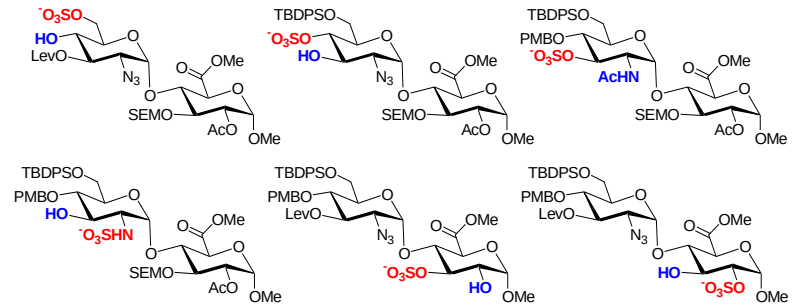
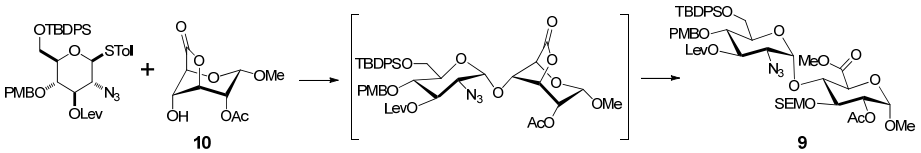


Figure 20. Subset of six heparan disaccharide *O*- and *N*-monosulfates in partially deprotected form. *O*-monosulfates were prepared by an initial deprotection and sulfation, followed by a second deprotection. The *N*-monosulfate (*lower left*) was prepared by chemoselective *N*-sulfation of the corresponding amino alcohol.

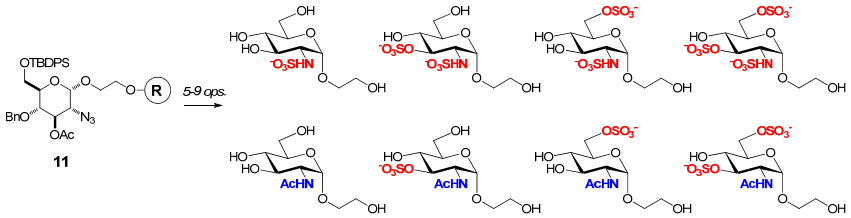


Scheme 1. Glycosidic coupling using inverted bicylic lactone **10** as an acceptor (see Ref. 40 for synthetic details).

To extend this methodology toward the synthesis of highly sulfated carbohydrates, orthogonal deprotection and sulfation conditions were performed on derivatives immobilized on solid-phase supports. A set of 8 monosaccharides with variable sulfation patterns was recently produced from immobilized α-glucosamine

[39] Liew, S.-T.; Wei, A. *Carbohydr. Res.* **2002**, *337,* 1319-24.
[40] Fan, R.-H.; Achkar, J.; Hernández, J. M.; Wei, A. *Org. Lett*. **2005**, *7*, 5095-98.
[41] Hernández, J. M.; Achkar, J.; Wei, A. *J. Org. Chem.* **2004**, 7205-11.

11 (Scheme 2).[42] Deprotection and resin cleavage conditions were optimized and determined to be compatible with *O*- and *N*-sulfates with Bu_4N counterions, which helped to maintain the resin in a swollen state (see below). The benzylated glucosamine sulfoforms were produced in 5−9 operations and purified by RP-HPLC, with a minimum conversion efficiency of 85% per step. MS/MS analyses of these derivatives suggest that the (rare) 3-*O*-sulfate is more labile than the (common) 6-*O*-sulfate, suggesting a potential method for distinguishing isomeric sulfoforms.



Scheme 2. Solid-phase synthesis of glucosamine sulfoforms (see Ref. 42 for synthetic details).

IV.A.viii. *Synthetic methodologies based on 4-deoxypentenosides.* In order to obtain synthetically useful amounts of L-iduronic acid, an important component in heparan sulfate (D-GlcN(α1→4)-L-IdoA(β1→4)), we have developed a general synthesis of L-hexoses via 4-deoxypentenosides (4-DPs).[43] These unsaturated sugars bear a strong resemblance to glycals, and can be obtained in gram quantities to produce L-pyranoside derivatives in good yields upon stereoselective epoxidation and ring opening. In particular, we have shown that the *syn* addition of organozinc species to 4α-epoxypyranosides can produce L-*ido* derivatives (Fig. 21a),[44] and have converted some of these into L-iduronic acid for the preparation of HS ligands. We have also found that D-glucosamine can be efficiently transformed into 2-amino-4-DP derivatives for conversion into L-aminoglycosides in similar fashion (Fig. 21b).[45] β-*C*-glycosides can likewise be transformed into L-glycals (Fig. 21c), enabling the synthesis of all possible L-hexopyranosides.[46]

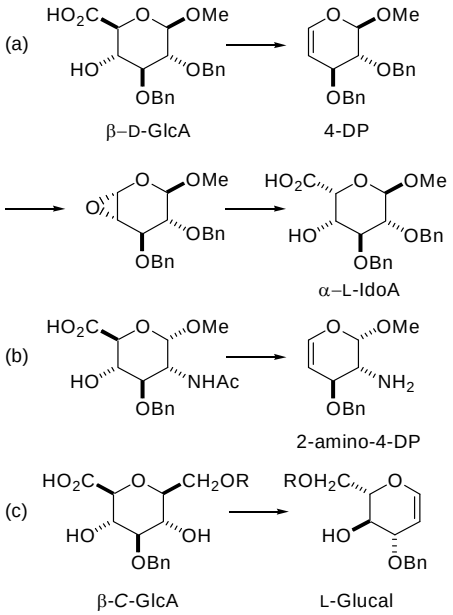


Figure 21. (*a*) 4-deoxypentenoside (4-DP), with conversion into L-iduronic acid; (*b*) 2-amino-4-DP; (*c*) L-glycals.

Remarkably, the epoxidation of 4-DPs by DMDO is highly facioselective, always occurring *anti* to two of the three exocyclic substituents. We attribute this stereoselectivity to the asymmetric polarization of the π-bond, an argument that is supported by DFT calculations based on polarized–π molecular orbital (PPFMO) theory.[45] We have also performed a comparative analysis of 4-DPs with glycals, including a number of deoxygenated derivatives, with evidence that such an effect may be general to this class of compounds.[47]

[42] Liu, R. et al. *J. Org. Chem*. **2008**, *73*, 6059-72.
[43] Boulineau, F. P.; Wei, A. *Org. Lett.* **2002**, *4*, 2281-83.
[44] Cheng, G.; Fan, R. H.; Hernández, J. M.; Boulineau, F. P.; Wei, A. *Org. Lett.* **2007**, *9*, 4849-52.
[45] Cheng, G.; Boulineau, F. P.; Liew, S.-T.; Shi, Q.; Wenthold, P. G.; Wei, A. *Org. Lett*. **2006**, *8*, 4545-48.
[46] Boulineau, F. P.; Wei, A. *Org. Lett.* **2004**, *6*, 119-21.
[47] Alberch, L.; Cheng, G.; Seo, S.-K.; Li, X.; Boulineau, F. P.; Wei, A. *J. Org. Chem.* **2011**, *76*, 2532-47.

IV.A.ix. *Glycomimetic chemistry.* The 4-DPs and L-glycals provide an expedient point of entry into entire classes of L-sugars and mirror-image glycoconjugates, as exemplified by **12**, the antipode of a blood group trisaccharide (D-Fuc(α1→2)-L-Gal(β1→4)-L-GlcNAc) prepared by the stepwise assembly of L-glycals,[48] and the nonreducing disaccharides L-trehalose **13** and L-sucrose **14,** synthesized by intramolecular aglycone delivery (Fig. 22).[49,50] Mirror-image carbohydrates enable us to test hypotheses concerning the biological functions of carbohydrates and glycosylated interfaces, in which physicochemical properties can be cleanly separated from issues of chiral recognition. For example, we have evaluated L-trehalose **13** as a cryoprotectant for yeast cells, and found it to have properties identical to its natural enantiomer D-trehalose; in contrast, the achiral *meso*-trehalose **15** (D-Glc(α1→1)-L-Glc) is a poor cryoprotectant (Fig. 23).[49] The discrepancy in biostabilization can be attributed to differences in conformational behavior and glass transition temperatures. Our study shows that relative stereochemistry, but not absolute stereochemistry, is a primary determinant of the cryoprotectant properties of α,α-trehalose.

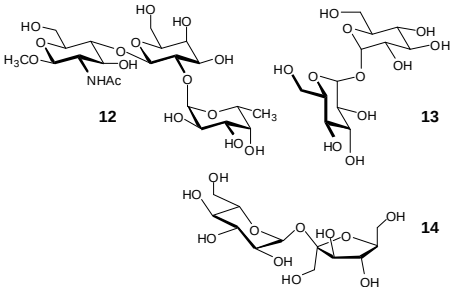


Figure 22. Mirror-image carbohydrates.

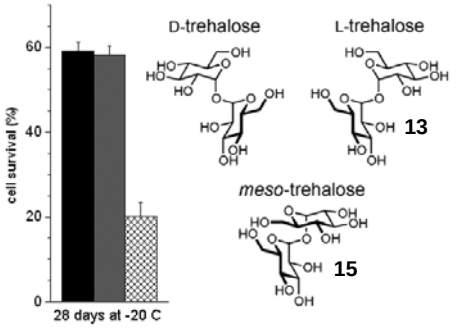


Figure 23. Cryoprotection of yeast cells by D-trehalose, L-trehalose **13**, and *meso*-trehalose **15**. Live cell populations were surveyed using an MTT assay after 28 days at −20° C.

Mirror-image carbohydrates can also be used to deconvolute nonspecific physicochemical effects from substrate recognition in enzyme kinetics. For example, we recently established that the invertase-catalyzed hydrolysis of D-sucrose is susceptible to osmotic pressure, which was independently adjusted by introducing biochemically inert L-sucrose **14** as a cosolute.[50] This enzymatic reaction is a well-known example of substrate inhibition, which assumes the simultaneous occupancy of two substrate molecules in the active site. However, sucrose is also considered to be preferentially excluded from the surfaces of macromolecules at high concentrations, which reinforces the hydration layer around proteins and reduces their conformational flexibility. In the case of invertase, we observed a significant deceleration in rate when using L-sucrose as the dominant solute. This shows that osmotic pressure can account for over 1/3 of the activity loss normally attributed to substrate inhibition (Fig. 24). We also observed that macromolecular crowding agents such as dextran also have a decelerating effect on catalytic activity (k_{cat}), but differ from osmolytes in their effects on catalytic efficiency (k_{cat}/K_M). Such effects may be of general importance to enzyme catalysis in physiological conditions or nonideal solutions.

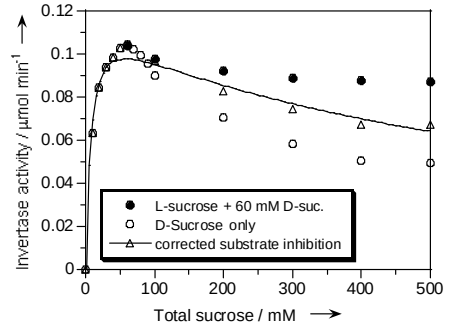


Figure 24. Probing osmotic effects on invertase activity with L-sucrose **14.** Over 30% of the apparent substrate inhibition by D-sucrose can be attributed to osmotic pressure; when accounted for, an improved fit for true substrate inhibition can be observed.

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IV.A.x. *Pathogen detection using patterned glycoconjugates.* We have developed a novel technology for the rapid identification and detection of bacterial pathogens, in collaboration with Phil Low (Chemistry) and Ron Reifenberger (Physics). The method is based on the "immutable" recognition of virulence factors such as cell-surface glycans, which avoids many of the potential pitfalls found in antibody-based detection schemes. In one instance, the bacterial detection platform is comprised of synthetic recognition elements presented as periodic arrays on glass or gold-coated slides (Figure 25). Select pathogens are captured on a patterned surface for optical detection and readout, using a 2D FFT-based image processing algorithm. The latter enables bacteral capture patterns to be encoded as a function of periodicity and orientation. The conversion of signals into Fourier space permits pathogens to be detected reliably at 10^3 cfu/mL within 30 min, and in a label-free fashion using simple darkfield imaging.[51] This modality can tolerate surface fouling and nonspecific binding events much better than other detection methods, yet is sufficiently sensitive to detect pathogens below their infective dose. We currently use piezoelectric inkjet printing to generate arrays of immutable ligands, which can now be presented using multiple periodicities to enable multiplex detection.[52]

A company was created (PathoChip, Inc.) to explore commercial opportunities for specific *in vitro* diagnostic applications.

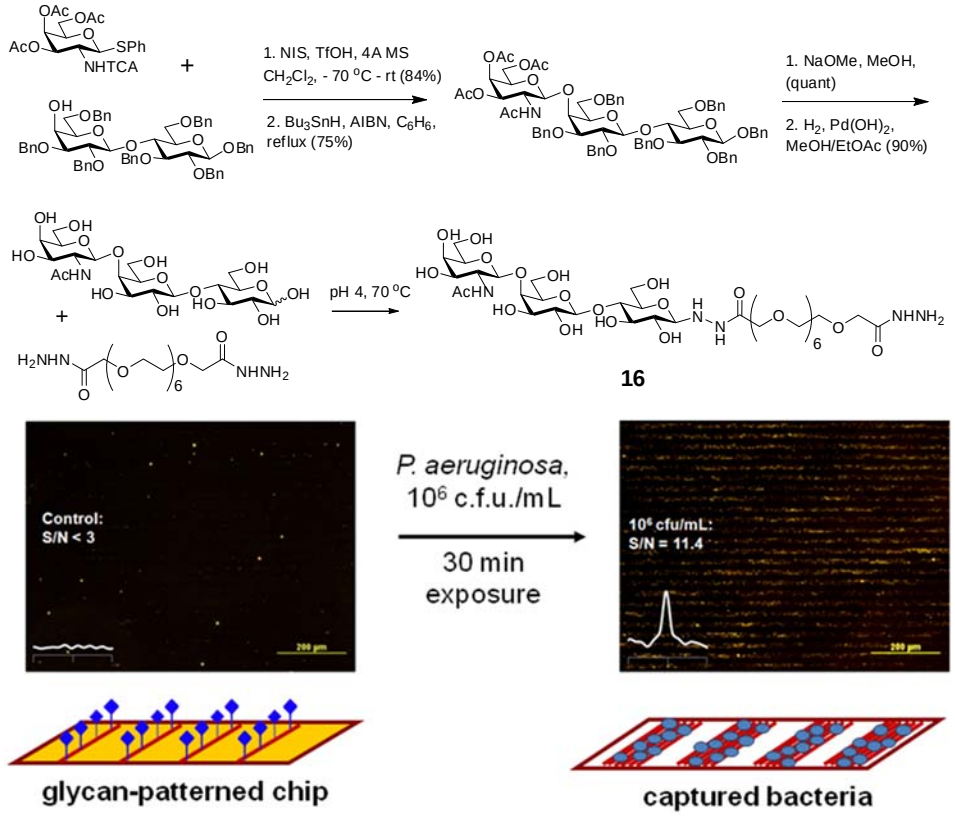

Figure 25. *Top*, synthesis of glycoconjugate **16**, a high-affinity ligand for bacteria that infect the respiratory tract. *Bottom*, patterned capture chip before and after exposure to Psuedomonas (10^6 cfu/mL). *Inset*: reciprocal lattice peak after 2D-FFT, for quantitative signal analysis. The limit of detection of this system is 10^3 cfu/mL.

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93. Park, J.; Kadasala, N. R.; Abouelmagd, S.; Castanares, M.; Collins, D.; Wei, A.*; Yeo, Y.* "Magnetophoretic delivery of polydopamine-coated polymer–iron oxide composite nanoparticles." *Biomaterials* **2016**, *101*, 285-95.

94. Maltais, T. R.; Adak, A. K.; Younis, W.; Seleem, M. N.; Wei, A.* "Label-Free Detection and Discrimination of Pathogens Based on Hemin Recognition." *Bioconjugate Chem.* **2016**, *27*, 1713-22.

95. Gao, J.; Mahapatra, C. T.; Mapes, C. D.; Khlebnikova, M.; Wei, A.; Sepúlveda, M. S.* "Vascular toxicity of silver nanoparticles to zebrafish (*Danio rerio*) embryos." *Nanotoxicology* **2016**, *10*, 1363-1372.

Refereed Publications (Tier II)[53]

96. Wei, A.*; Stavens, K. B.; Pusztay, S. V.; Andres, R. P. "Synthesis and Characterization of Resorcinarene-Encapsulated Nanoparticles." *Mater. Res. Soc. Symp. Proc.* **1999**, *581,* 59-63.

97. Kim, B.; Tripp, S. L.; Wei, A.* "Tuning the Optical Properties of Large Gold Nanoparticle Arrays." *Mater. Res. Soc. Symp. Proc.* **2001**, *676,* Y.6.1, 1-7.

98. Moon, J.-M.; Wei, A.* "Controlled Growth of Gold Nanorod Arrays from Polyethylenimine-coated Alumina Templates." *Mater. Res. Soc. Symp. Proc.* **2006***, 300E,* O.12.32, 1-7.

99. Wei, A.*; Cheng, J.-X. "Ligand-Functionalized Gold Nanorods as Theragnostic Agents." *Proc. 3rd IEEE-NIH Life Science Systems and Applications Workshop* **2009***,* 13-16.

100. Zemlyanov, D. Y.*; Fingland, B. R.; Wei, A.; Durbin, S. M.; Ribeiro, F. H. "Plasma Cleaning Applications for Surface Science and Model Catalyst Samples." *Microsc. Microanal.* **2009,** *15*, 816-817.

IV.B.2. Manuscripts accepted or in press (Tier I) [53]

IV.B.3. Manuscripts Submitted/In preparation

Submitted:

101. Kadasala, N.; Lin, L.; Wei, A.* "Eco-Friendly (Green) Synthesis of Magnetic Gold Nanoclusters." *Sci. Technol. Adv. Mater.,* **2016,** manuscript in revision.

102. Morales-de-Echegaray, A. V.; Maltais, T. R.; Younis, W.; Kadasala, N. R.; Dutta, S.; Seleem, M. N.; Wei, A.* "Rapid Uptake and Antimicrobial Activity of Ga(III)-Protoporphyrin IX." *ACS Omega* **2016**, manuscript in revision.

103. Chandrasekar, R.; Wang, Z. X.; Meng, X. G.; Shalaginov, M.; Lagutchev, A.; Kim, Y. L.; Wei, A.; Boltasseva, A.; Shalaev, V. M.* "Lasing Action with Gold Nanorod Hyperbolic Metamaterials." *ACS Photonics* **2016**, manuscript in revision.

In preparation:

104. Kadasala, N.; Saei, M.; Cheng, G. J.*; Wei, A.* **"**Dry Etching with Nanoparticles: Laser-Driven Optoporation in Nonwoven Substrates Using Magnetic Gold Nanoclusters." (*Adv. Mater.*)

105. Wang, J. X.; Thomas, M.; Wei, A.* “RNA Interference with Dithiocarbamate-Anchored Oligonucleotides on Gold Nanorods.” (*Bioconjugate Chem.* invited contribution)

106. Kistler, E. L.; Wei, A.* "Dithiocarbamate-Anchored Monolayers." (Feature Article for *Langmuir*)

107. Scholz, F.; Padungros, P.; Ford, W. E.; Wei, A.*; von Wrochem, F.* "X-ray Photoelectron Spectroscopy and Scanning Tunneling Microscopy of Aromatic Dithiocarbamate-Anchored Monolayers on Au(111)." (*Langmuir*)

108. Wang, J. X.; Morales-Collazo, O.; Wei, A.* “Sulfobetaines in Nanomicelle Formation and Single-Particle Encapsulation.” (*Langmuir*).

109. Arora, N. B.; Sides, J. R.; Wei, A.* “How to Capture Ferrioxamine-Binding Bacteria in 30 Seconds or Less.” (*ACS Sensors*).

110. Wei, Q.; Lee, J. T.; Agora, N. B.; Appel, E.; Tang, Z.; Scherman, O. A.; Wei, A.* "Brake-and-Release Activity of Gyromagnetic Nanostars by Cucurbiturils and Neurotransmitters." (*Nat. Chem.***?**)

111. Nguyen, A. T.; Duarte Ruiz, A.; Mehtala, J. G.; Lin, X.-M.; Wei, A.* “Halide-directed synthesis of Fe nanocrystals from FeCp(Benzene-H).”

112. Thomas, M.; Wang, J.X.; Schmitt, J. W.; Matei, D.; Wei, A.* “Gold Nanorod-Mediated siRNA Delivery for TG2 Knockdown in Ovarian Cancer Cells.”

113. Wei, Q.; Wei, A. “High-Resolution Thermometric Imaging Using Dynamic Ratiometric Fluorescence.”

IV.B.4. Patents and Non-Refereed Publications

Patents:

114. Wei, A.; Kim, B. “Nanoparticle Arrays and Sensors Using Same.” US Patent 6,899,947 (filed 9/12/2002; issued 5/31/2005).

115. Wei, A.; Boulineau, F. P. “Enantiopure 4-Deoxypentenosides, Dihydropyrans, and Tetrahydropyrans and Syntheses Thereof.” US Patent 7,521,568 (filed 12/13/2002; issued 4/21/2009).

116. Boppart, S. A.; Wei, A. “Multifunctional Plasmon-Resonant Contrast Agents for Optical Coherence Tomography.” US Patent 7,610,074 (filed 5/23/2003 through Univ. of Illinois; issued 10/27/2009).

117. Wei, A.; Zhao, Y. “Preparation of Dithiocarbamate Ligands for Nanotechnology and Biosensing Applications.” US Patent 7,803,568 (application filed 4/20/2006; issued 9/28/2010).

118. Low, P. S.; Reifenberger, R.; Wei, A.; et al. “Pathogen Detection: Selective Capture and Identification of Pathogenic Bacteria Using Immutable Ligands.” US Patent 9,250,238 (filed 6/25/2010, issued 2/2.2016).

119. Wei, A.; Mehtala, J. M. “Methods for Surfactant Removal From Nanoparticle Suspensions.” Provisional patent application USN 62/039,471, Patent application US 14/830,787 (application filed 8/22/2015).

120. Wei, A.; Kadasala, N. R.; Cheng, G. J.; Saei, M. “Additive Manufacturing of Nanoporous Substrates Using Nanoparticle Etchants.” Provisional patent application USN 62/336,553 (disclosed 5/4/2016; filed 5/13/2016).

121. Wei, A.; Yuan, C.L. “Enhanced Fluorescence from Aptamer–Nanoparticle Conjugates For Chemical Sensing.” Provisional patent application USN 62/XXX,XXX (PRF-67612; initial disclosure 5/4/2016; filed by CDT Ltd., 10/11/2016)).

122. Yuan, C.L.; Xie, J. K.; Wei, A.; Kamtekar, K.; Zuberi, S. "Two-ended Aptamer Screening Technology for Molecular Targets." Provisional patent disclosure submitted (PRF-67707; disclosed 11/1/2016).

Non-refereed Publications:

123. Sarychev, A. K.*; Genov, D. A.; Wei, A.; Shalaev, V. M. "Periodical Arrays of Optical Nanoantennas." (In *Complex Mediums IV - Beyond Linear Isotropic Dielectrics*) *Proc. SPIE* **2003**, *5218*, 81-92 (invited paper).

124. Wei, A.* "Safety Hazards Regarding Microwave-Assisted Heating." In *Fusion* (*J. Am. Sci. Glassblowers Soc.*), Aug. 2004, p. 29.

125. MacGillivray, L.;* Wei, A.* "XIIIth International Symposium on Supramolecular Chemistry, University of Notre Dame, South Bend, IN, July 25-30, 2004." *Supramol. Chem.* **2005**, *17*, 7-8. (preface)

126. Oldenburg, A. L.;* Zweifel, D. A.; Xu, C.; Wei, A.; Boppart, S. A. "Characterization of plasmon-resonant gold nanorods as near-infrared optical contrast agents investigated using a double-integrating sphere system." *Proc. SPIE* **2005**, *5703*, 50-60.

127. Oldenburg, A. L.;* Hansen, M. H.; Wei, A.; Boppart, S. A. "Backscattering albedo contrast in OCT using plasmon-resonant gold nanorods." *Proc. SPIE* **2007**, *6429*, 64291Z.

128. Huff, T. B.; Hansen, M. H.; Tong, L.; Zhao, Y.; Wang, H.; Zweifel, D. A.; Cheng, J.-X.; Wei, A.* "Plasmon-resonant nanorods for two-photon luminescent imaging and photothermal therapy." *Proc. SPIE* **2007**, *6448*, 11.

129. Oldenburg, A. L.;* Hansen, M. H.; Wei, A.; Boppart, S. A. "Plasmon-Resonant Gold Nanorods Provide Spectroscopic OCT Contrast in Excised Human Breast Tumors." *Proc. SPIE* **2008**, *6867*, 68670E.

130. Liang, X; Graf, B. W.; John, R.; Crecea, V.; Nguyen, F. T.; Ding, H.; Song, H.-M.; Popescu, G.; Boppart, S. A.*; Wei, A. "Magnetomotive Optical Coherence Microscopy for Cell Dynamics and Biomechanics." *Proc. SPIE* **2011**, *7889*, 788926.

Invited Papers (non-refereed):

131. Wei, A.* "Recent Developments in Tunable Light-Emitting Devices." *Acta Photonica Sinica*, **1998**, *27*, 45-48.

132. Kim, B.; Tripp, S. L.; Sadtler, B.; Wei, A.* "Nanostructured Materials as Biomolecular Sensors for Cell Transport." *IEEE/LEOS 2001 14th Annu. Mtng.,* 263-64.

133. Wei, A.*; Kim, B.; Zhao, Y.; Sadtler, B. "Designing Plasmonic Nanomaterials as Sensors of Biochemical Transport." *IEC NanoEngineering World Forum 2003*, E2.

134. Wei, A.* "Designing Plasmonic Nanomaterials as Sensors of Biochemical Transport." *e-J. Surf. Sci. Nanotechnol*. **2006**, *4*, 9-18.

135. Tang, Z.; Wei, A.* "Fabrication of Anisotropic Metal Nanostructures Using Innovations in Template-Assisted Lithography." *ACS Nano* **2012**, *6*, 998-1003 (Perspective Article).

Book Chapters:

136. Goekjian, P. G.; Wei, A.; Kishi, Y.* "Conformational Analysis of *C*-Glycosides and Related Compounds: Programming Conformational Profiles of *C*- and *O*- Glycosides." In *Carbohydrate-Based Drug Discovery, Volume 1*; Wong, C.-H., Ed.; Wiley-VCH: New York, 2003; pp. 305-40.

137. Wei, A.* "Plasmonic Nanomaterials: Enhanced Optical Properties From Metal Nanoparticles and their Ensembles." In *Nanoparticles: Building Blocks for Nanotechnology*; Rotello, V. M., Ed.; Kluwer: New York, 2004; pp. 173-200.

138. Wei, A.* "Metal Nanoparticle Ensembles: Collective Optical Properties." In *Encyclopedia of Nanoscience and Nanotechnology*; Schwartz, J. A.; Contescu, C.; Putyera, K., Eds.; Marcel Dekker: New York, 2004; pp. 1821-28.

139. Wei, Q.; Wei, A.* "Plasmon-resonant Gold Nanorods: Photophysical Properties Applied Toward Biological Imaging and Therapy." In *Inorganic Nanoprobes for Biological Sensing and Imaging*, Mattoussi, H., Cheon, J., Eds.; Artech House: New York, 2009; pp. 199-235.

140. Wei, Q.; Wei, A.* "Signal Generation with Gold Nanoparticles: Photophysical Properties for Sensor and Imaging Applications." In *Supramolecular Chemistry of Organic–Inorganic Hybrid Materials*, Rurack, K., Martinez-Mañez, Eds.; Wiley and Sons: New York, 2010; pp. 319-349.

141. Wei, Q.; Wei, A.* "Plasmon-Resonant Gold Nanorods as Multifunctional Agents for Diagnostics, Imaging, and Photothermal Therapy." In *Materials for Nanomedicine*, Torchilin, V. P., Amiji, M. M., Eds.; Pan Stanford Publishing: Singapore, 2010; pp.585-632.

142. Wei, A.*; Leonov, A. P.; Wei, Q. "Gold Nanorods: Multifunctional Agents for Cancer Imaging and Therapy." In *Methods in Molecular Biology Series* (*Cancer Nanotechnology*), Grobmyer, S. G., Moudgil, B., Eds.; Humana Press: New York, 2010; vol. 624, pp.119-130.

143. Wei, Q.; Wei, A.* "Cellular Interactions of Plasmon-Resonant Gold Nanorods." In *Organelle-Specific Pharmaceutical Nanotechnology*, Weissig, V.; D'Souza, G., Eds.; Wiley and Sons: New York, 2010; pp. 507-533.

144. Wei, A.*; Wei, Q.; Leonov, A. P. "Gold Nanorods as Theranostic Agents." In *Nanoplatform-Based Molecular Imaging*, Chen, X. Y., Ed.; Wiley and Sons: New York, 2010; pp. 659-681.

145. Wei, A.*; Thomas, M.; Mehtala, J. G.; Wang. J.X. "Gold Nanoparticles as Multifunctional Materials in Cancer Nanotechnology." In *Biomaterials for Cancer Therapeutics*, Park, K., Ed.; Woodhead: New York, 2013; pp. 349-386.

146. Padungros, P.; Wei, A.* "Lithium Naphthalenide." In *electronic Encyclopedia of Reagents for Organic Synthesis* (*e-EROS*), Crich, D.; Fuchs, P. L.; Charette, A. B.; Rovis, T., Eds.; Wiley and Sons: Chichester, 2014.

147. Wei, A.* "Calixarene-Encapsulated Nanoparticles: Synthesis, Stabilization, and Self-Assembly." In *Calixarenes and Beyond*, Neri, P.; Sessler, J. M.; Wang, M.-X., Eds.; Springer: Amsterdam, 2016.

148. Lin, X.-M.*; Ong, Q. K.; Wei, A. "Role of Interface in the Magnetic Exchange Bias of Core–Shell Nanoparticles." In *Magnetic Exchange Bias,* Sharma, S., Ed.; Taylor & Francis: Oxford, 2017.

IV.C. Invited Lectures (in reverse chronological order, including recent invitations)

1. "New Additive Manufacturing Processes for Polymer Substrates." Notre Dame–Purdue Workshop on Soft Materials, South Bend, IN, October 2016
2. "Adventures in Scalable Nano-Manufacturing: Process Development For Goals in Sustainability and Infectious Disease Control." Sumitomo Chemical Corporation, Tsukuba, Japan, July 2016
3. "Plasmon-Resonant Nanorods and Nanostars: Multifunctional Agents for Nanomedicine." Central Regional Meeting of the ACS (CERMACS), Covington, KY, May 2016
4. "Biophotonic Applications of Polarization-Sensitive Gold Nanorods and Nanostars." Dept. of Biomedical Engineering, Wayne State Univ., Detroit, MI, March 2016

5. "Plasmon-Resonant Nanorods and Nanostars: Multifunctional Agents for Nanomedicine." 2015 Joint Southeastern/Southwest Regional Meeting, Memphis, TN, November 2015
6. "Calixarene-Encapsulated Nanoparticles: Synthesis and Self-Assembly into Meta-materials." Dept. of Chemistry, Tokyo Institute of Technology, Yokohama, Japan, July 2015
7. "Dithiocarbamate-anchored ligands on smooth and nanostructured gold surfaces." 249th ACS National Meeting, Denver, CO, March 2015 (Functionalization of Complex Nanosurfaces)
8. "Studies on Surface-Modified Gold Nanorods." Inst. Biomol. Biomed. Engineering, Univ. of Toronto, February 2015
9. "Biophotonic Applications of Polarization-Sensitive Gold Nanorods and Nanostars." Dept. of Chemistry, Univ. Arkansas-Fayetteville, October 2014
10. Scalable Production of CTAB-free Gold Nanorods." Indo-US Workshop on Nanomaterials for Energy, Purdue University, West Lafayette, IN, September 2014
11. "Biophotonic Applications of Polarization-Sensitive Gold Nanorods and Nanostars." 248th ACS National Meeting, San Francisco, CA, August 2014 (Nanoprobes for Biological Systems)
12. "Supramolecular Control Over the Gyromagnetic Activity of Gold Nanostars." 248th ACS National Meeting, San Francisco, CA, August 2014 (Supramolecular Nanoparticles)
13. "Polarization-Sensitive Gold Nanorods and Nanostars: Characterization and Biophotonic Applications." University of Colorado, Colorado Springs, CO, September 2013
14. "Recent Progress in the Use of Gold Nanorods for Nanomedicine Applications." Siva Therapeutics, Boulder, CO, September 2013
15. "Plasmon-resonant Nanoparticles: Biosensing, Biomedical Imaging, and Cancer Nanotechnology." University Nacional de Colombia / Univ. de los Andes, Bogotá, Colombia, March 2013
16. "Plasmonic Nanomaterials for Healthcare: Biosensing, Biomedical Imaging, and Beyond." Escuela de Ingeniería de Antioquia (EIA), Medellín, Colombia, March 2013
17. "Gold Nanorods and Nanostars for Biological Imaging and Theranostics." Colombia–US Workshop on Nanotechnology, Medellín, Colombia, March 2013
18. "Cancer Nanotechnology Using Gold Nanorods and Nanostars." WALLA presentation, Lafayette, IN, March 2013
19. "Biophotonic Applications of Polarization-Sensitive Gold Nanorods and Nanostars." Gordon Research Conference on Noble Metal Nanoparticles, Mount Holyoke College, MA, June 2012
20. "Biophotonic Applications of Polarization-Sensitive Gold Nanorods and Nanostars." US–Hong Kong Workshop on Photonics, Chinese University of Hong Kong, June 2012
21. "Cell-Surface Glycans for Pathogen Detection." 7th Midwest Carbohydrate and Glycobiology Symposium, East Lansing, MI, September 2011
22. "Plasmon-Resonant Nanorods and Nanostars for Biological Imaging and Theranostics." Nicholas Copernicus Univ., Torun, Poland, July 2011
23. "Multinuclear Calixarene–Cobalt Complexes in the Nucleation, Growth, and Self-Assembly of Magnetic Nanostructures." 11th International Conference on Calixarenes (Calix 2011), Tarragona, Spain, June 2011
24. "Plasmon-Resonant Gold Nanorods and Nanorod Arrays." University of Buffalo, NY, May 2011
25. "Immutable Ligands for Microbial Detection and Capture." Univ. Cincinnati, OH, March 2011
26. "Magnetoplasmonic Nanomaterials for Biological Imaging and Nanomedicine." IUPUI, Indianapolis, IN, March 2011

27. "Magnetic Nanorings from Calixarene-Encapsulated Cobalt: Nucleation, Self-Assembly, and Collective Flux Closure." Indiana University, Bloomington, IN, January 2011
28. "Multinuclear Calixarene–Cobalt Complexes in the Nucleation, Growth, and Self-Assembly of Magnetic Nanostructures." Pacifichem 2010, Honolulu, HI, December 2010 (Self-Assembly)
29. "Gold Nanorods and Nanostars for Biological Imaging and Theranostics." Pacifichem 2010, Honolulu, HI, December 2010 (Advances in Nanomedicine)
30. "Nanoparticles in Biomedical Imaging and Theranostics: Challenges and Directions." University of North Carolina, Chapel Hill, NC, October 2010
31. "Dynamic Contrast in Optical Imaging." University of Illinois, Champaign, IL, October 2010
32. "Polarization-sensitive NIR imaging modalities based on gold nanorods and nanostars." University of Florida, Gainesville, FL, October 2010
33. "Plasmon-resonant nanorods and nanostars: Multifunctional agents for imaging and theranostics." SPIE Optics & Photonics 2010, San Diego, CA, August 2010 (Biosensing III)
34. "Dynamic Contrast of Gold Nanostars with Magnetic Cores and their Biomechanical Effects on Cells." 5th KIST Symposium on Molecular Imaging and Theranostics, Seoul, Korea, June 2010
35. "Polarization-Sensitive NIR Imaging and Theranostics with Gold Nanorods and Nanostars." Univ. North Carolina, Chapel Hill, NC, May 2010
36. "Targeted delivery of gold nanorods and other plasmonic nanostructures: *en route* to theragnosis." Stanford University, Palo Alto, CA, April 2010
37. "Plasmon-resonant nanorods and nanostars for biological imaging and theranostics." Univ. Illinois, Champaign, IL, March 2010
38. "Polarization-sensitive NIR imaging modalities based on gold nanorods and nanostars." PITTCON 2010, Orlando, FL, March 2010
39. "Plasmon-resonant nanorods and nanostars for biological imaging and theranostics." Univ. Utah, Salt Lake City, UT, February 2010
40. "Calixarenes as Multivalent Ligands for Nanoparticle Synthesis and Self-Assembly." Brigham Young Univ., Provo, UT, February 2010
41. "Gyromagnetic Imaging Using Gold Nanostars with Magnetic Cores." Materials Research Society (MRS) Fall 2009 Meeting, Boston, MA, December 2009 (Biological Imaging and Sensing)
42. "Plasmonic Nanomaterials for Healthcare: Biosensing, Biomedical Imaging, and Beyond." Materials Research Society (MRS) Fall 2009 Meeting, Boston, MA, December 2009 (Tutorial)
43. "Magnetic Nanorings from Calixarene-Encapsulated Cobalt: Nucleation, Self-Assembly, and Collective Flux Closure." Nanoscience Days 2009 (plenary talk), Jyväskylä, Finland, October 2009
44. "Polarization-sensitive NIR imaging modalities based on gold nanorods and nanostars." 238th ACS National Meeting, Washington DC, August 2009 (Nanomaterials for Energy and Biomedicine)
45. "Ligand-Functionalized Particles and Surfaces for Microbial Detection and Capture." 238th ACS National Meeting, Washington DC, August 2009 (Nanoparticles in Homeland Seucurity)
46. "Calixarenes as Multivalent Ligands for Nanoparticle Synthesis and Self-Assembly." 10th International Conference on Calixarenes (Calix 2009), Seoul, Korea, July 2009
47. "Plasmon-Resonant Gold Nanorods and Nanorod Arrays." Institute for Molecular Sciences, Okazaki, Japan, July 2009
48. "Targeted delivery of gold nanorods and other plasmonic nanostructures: *en route* to theranostics." 2009 Intl. Symp. Korean Soc. for Microbiology and Biotechnology, Daejeon, Korea, June 2009

49. “Self-assembly and Magnetic Properties of Calixarene-stabilized Cobalt Nanoparticle Rings.” Universidad de Santiago, Spain, June 2009
50. “Plasmon-Resonant Gold Nanorods and Nanorod Arrays.” Universidad de Vigo, Spain, June 2009
51. “Magnetic Nanoparticle Rings: Self-Assembly and Collective Magnetic Effects.” Oak Ridge National Laboratories, TN, October 2008
52. “Self-Assembly and Flux Reversal of Magnetic Nanoparticle Rings.” 3rd International Symposium on Macrocyclic and Supramolecular Chemistry (ISMSC 2008), Las Vegas, NV, July 2008
53. “Ligand-Functionalized Gold Nanorods as Theragnostic Agents.” 3rd KIST Symposium on Molecular Imaging and Theragnostics, Seoul, Korea, June 2008
54. “Plasmon-Resonant Nanorods as Theragnostic Agents.” Particles 2008, Orlando, FL, May 2008
55. “Plasmon-resonant nanorods as multifunctional agents for biomedical imaging and therapy.” Lab Automation 2008, Palm Springs, CA, January 2008
56. “Plasmon-resonant nanorods as multifunctional agents for biomedical imaging and therapy.” Materials Research Society (MRS) Fall 2007 Meeting, Boston, MA, December 2007
57. “Dithiocarbamate-Anchored Monolayers: Surface Chemistry for Biological Interfaces.” Materials Research Society (MRS) Fall 2007 Meeting, Boston, MA, December 2007
58. “Plasmon-Resonant Nanorods as Theragnostic Agents.” 5th International Symposium on Nanomedicine and Drug Delivery, Boston, MA, November 2007
59. “Mirror-Image Carbohydrates: Can Left-Handed Molecules Function in a Right-Handed World?” Knox College, Galesburg, IL, October 2007
60. “Self-Assembly and Magnetization Reversals of Cobalt Nanoparticle Rings.” Argonne National Laboratories, Argonne, IL, October 2007
61. “Ligand-Functionalized Gold Nanorods as Theragnostic Agents.” KIST–Purdue International Symposium on Molecular Imaging and Theragnostics, West Lafayette, IN, September 2007
62. “Calixarene and Nanoparticles: A Natural Fit.” 9th International Conference on Calixarenes (Calix 2007), College Park, MD, August 2007
63. “Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials.” American Crystallographic Association (ACA), Salt Lake City, Utah, July 2007
64. “The Chemistry of 4-Deoxypentenosides: From Synthesis to Glycomimetics.” Symposium Commemorating Yoshito Kishi’s 70th Birthday, Harvard Univ., Cambridge, MA, April 2007
65. "Surface Functionalization with Dithiocarbamates: Preparation, Characterization, and Some Applications." Becton-Dickinson Technologies, Research Triangle Park, NC, April 2007
66. “Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials.” 233rd ACS National Meeting, Chicago, IL, March 2007
67. “Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials.” Univ. of Miami, Miami, FL, March 2007
68. “Plasmon-resonant nanorods as multifunctional agents for biomedical imaging and therapy.” SPIE Photonics West Symposium, San Jose, CA, January 2007
69. “Plasmon-resonant nanoparticles as multifunctional agents for cancer treatment.” Oncological Sciences Center Seminar Series, West Lafayette, IN, December 2006
70. “Plasmon-resonant nanorods: Multifunctional agents for biomedical imaging and therapies.” National Institute for Biomedical Imaging and Biotechnology, Bethesda, MD, October 2006

71. "Plasmon-resonant nanorods: Multifunctional agents for biomedical imaging and therapies." Discovery Partners Symposium on Healthcare, West Lafayette, IN, October 2006
72. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Rose-Hulman Inst. of Technology, Terre Haute, IN, October 2006
73. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Wabash College, Crawfordsville, IN, September 2006
74. "The Chemistry of 4-Deoxypentenosides: From Synthesis to Glycomimetics." Negishi–Brown Lectures, Purdue Univ., West Lafayette, IN, September 2006
75. "Calixarene-Encapsulated Nanoparticles: Expanding the Nanotechnology Toolbox." (Organic Approaches to Nanotechnology) 232nd ACS National Meeting, San Francisco, CA, September 2006
76. "Plasmon-resonant nanorods as multifunctional imaging agents." (Advances in Nanomedicine) 232nd ACS National Meeting, San Francisco, CA, September 2006
77. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." RIKEN, Saitama, Japan, May 2006
78. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Bowling Green State Univ., Bowling Green, OH, March 2006
79. "Designing Glycosylated Nanoparticles as Inhibitors of Receptor Clustering." 231st ACS National Meeting, Atlanta, GA, March 2006
80. "Designing SERS Substrates as Sensors of Biochemical Transport." PITTCON 2006, Orlando, Florida, March 2006
81. "Adventures in Glycomimetic Chemistry." Imperial College in London, England, December 2005
82. "Biological Applications of Plasmonic Nanomaterials." Univ. of Birmingham, England, November 2005
83. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Melville Lecture, University of Cambridge, England, November 2005
84. "Designing Plasmonic Nanomaterials as Sensors of Chemical Transport." 4th Intl. Symp. Surface Science and Nanotechnology (ISSS-4), Saitama, Japan, November 2005
85. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Univ. of Southampton, England, November 2005
86. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Dept. of Materials Science and Metallurgy, University of Cambridge, England, November 2005
87. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." MPI-Kohlenforschung, Mulheim am Ruhr, Germany, October 2005
88. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Sony GmbH, Stuttgart, Germany, October 2005
89. "Biological Applications of Plasmonic Nanomaterials." Dept. of Chemistry, Ludwig-Maximilian University−Großhardern, Munich, Germany, September 2005
90. "Biological Applications of Plasmonic Nanomaterials." Dept. of Physics, Ludwig-Maximilian University, Munich, Germany, September 2005
91. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." 30th Intl. Symp. on Macrocyclic Chemistry (ISMC 2005), Dresden, Germany, July 2005
92. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." 8th Conference on Calixarenes (Calix 2005), Prague, Czech Republic, July 2005

93. "Future Prospects for Bio-Nanoscience and Technology." National Institute for Materials Science (NIMS), Tsukuba, Japan, June 2005
94. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Dept. of Chemistry, University of Tsukuba, Faculty of Science, Tsukuba, Japan, June 2005
95. "Adventures in Glycomimetic Chemistry." Department of Chemistry, Tohoku University, Sendai, Japan, June 2005
96. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Division of Materials Science, Hokkaido University, Sapporo, Japan, June 2005
97. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Dept. of Chemistry, Shizuoka University, Shizuoka, Japan, May 2005
98. "Designing Plasmonic Nanoarrays as Sensors of Chemical Transport Across Cell Membranes." Dept. of Biological Chemistry, Kyoto University, Japan, May 2005
99. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Dept. of Chemistry, Nagoya Institute of Technology, Nagoya, Japan, May 2005
100. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Dept. of Materials Science, Nara Institute of Science and Technology, Nara, Japan, May 2005
101. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Dept. of Chemistry, Sophia University, Tokyo, Japan, May 2005
102. "Self-Assembly and Magnetization Reversals of Cobalt Nanoparticle Rings." CERC3 Young Chemists' Workshop, Baden-Baden, Germany, May 2005
103. "Plasmonic Nanostructures as Sensors of Biomolecular Transport." DowAgro Biosciences, Indianapolis, IN, March 2005
104. "Calixarene-Encapsulated Nanoparticles: Self-Assembly Into Functional Nanomaterials." Western Kentucky Univ., Bowling Green, KY, March 2005
105. "Magnetization Reversals in Self-Assembled Magnetic Nanorings." Materials Research Society (MRS) 2004 Fall Meeting, Boston, MA, December 2004
106. "Calixarenes as a Gateway to Nanotechnology: Nanoparticle Encapsulation, Self-Assembly and Functional Devices." Intl. Symp. Supramol. Chem. (ISSC-XIII), South Bend, IN, July 2004
107. "Self-Assembly of Functional Nanoparticle Ensembles Using Resorcinarenes." National Institute for Materials Science (NIMS), Tsukuba, Japan, June 2004
108. "Self-Assembly of Functional Nanoparticle Ensembles Using Resorcinarenes." Sumitomo Chemicals, Tsukuba, Japan, June 2004
109. "Self-Assembly and Collective Properties of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, University of Tokyo, Faculty of Science, Tokyo, Japan, June 2004
110. "Self-Assembly of Functional Nanoparticle Ensembles Using Resorcinarenes." SPM 2004, Tianjin, China, May 2004
111. "Designing Nanoparticle Arrays as Sensors of Biomolecular Transport." Particles 2004 Conference, Orlando, FL, March 2004
112. "Self-Assembly and Collective Properties of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, Georgetown University, Washington, DC, November 2003
113. "Plasmonic Nanomaterials as Chemical and Biological Sensors: Interfaces with Medicine." So. Calif. Chapter of the Am. Vacuum Soc. (SCCAVS 2003), Anaheim, CA, October 2003

114. “Self-Assembly of Nanoparticles into Functional Materials: Lessons Learned from Nature." Georgia Institute of Technology Research Institute, Atlanta, GA, August 2003

115. “Self-Assembly and Collective Properties of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemical Engineering, Purdue University, West Lafayette, IN, June 2003

116. "Designing Plasmonic Nanomaterials as Sensors of Chemical Transport Across Cell Membranes." International Engineering Consortium, NanoEngineering World Forum, Boston, MA, June 2003

117. “Chiral Dihydropyrans: Novel Approaches to Carbohydrate-Based Drug Design.” Dept. of Chemistry, Indiana University–Purdue University at Indianapolis, Indianapolis, IN, April 2003

118. “Designing Nanostructured Materials as Sensors of Chemical Transport Across Cell Membranes.” 225th ACS National Meeting, New Orleans, LA, March 2003

119. “Self-Assembly and Collective Properties of Colloidal Metal Nanoparticles." Center for Bio/Molecular Science and Engineering, Naval Research Laboratory, Washington, D. C., November 2002

120. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, Brown University, Providence, RI, October 2002

121. “Designing Nanostructured Materials as Sensors of Chemical Transport Across Cell Membranes.” FACSS 2002, Providence, RI, October 2002

122. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, Northwestern University, Evanston, IL, October 2002

123. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, Lund University, Sweden, June 2002

124. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, Université Louis Pasteur (Strasbourg I), France, June 2002

125. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, Université M. et P. Curie (Paris VI), France, June 2002

126. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” 34th Great Lakes ACS Regional Meeting, Minneapolis, MN, June 2002

127. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, Southern Illinois University, Carbondale, IL, May 2002

128. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, Stanford University, Palo Alto, CA, April 2002

129. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry (Physical Division), Purdue University, West Lafayette, IN, March 2002

130. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Argonne National Laboratory, Argonne, IL, March 2002

131. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” James Franck Institute, University of Chicago, Chicago, IL, March 2002

132. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry, University of Illinois at Urbana-Champaign, Urbana, IL, March 2002

133. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Dept. of Chemistry and Biochemistry, University of California, Los Angeles, CA, February 2002

134. “Self-Assembly of Resorcinarene-Encapsulated Nanoparticles.” Division of Chemistry and Chemical Engineering, California Institute of Technology, February 2002

135. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, Carnegie-Mellon University, Pittsburgh, PA, February 2002

136. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, Pennsylvania State University, State College, PA, February 2002

137. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry and Radiation Laboratory, University of Notre Dame, South Bend, IN, February 2002

138. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, University of Maryland, College Park, MD, February 2002

139. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Materials Science, Johns Hopkins University, Baltimore, MD, February 2002

140. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry and Biochemistry, University of Texas at Austin, TX, January 2002

141. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, Texas A&M University, College Station, TX, January 2002

142. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, University of Houston, Houston, TX, January 2002

143. "Self-Assembly of Resorcinarene-Encapsulated Nanoparticles." Dept. of Chemistry, Hope College, Holland, MI, January 2002

144. "Nanostructured Materials as Biomolecular Sensors for Cell Transport." San Diego, CA, November 2001 (published in *IEEE/LEOS 2001 14th Annu. Mtng.,* 263-64)

145. "Self-Assembled Nanostructures from Resorcinarene-Encapsulated Nanoparticles." Biopraxis, Inc., San Diego, CA, November 2001

146. "Self-Assembled Nanostructures from Resorcinarene-Encapsulated Nanoparticles." NSF Materials Chemistry Workshop, October 2001

147. "Nanotechnology: A Chemical Perspective." Bradley College, Peoria, IL, September 2001

148. "Nanotechnology: A Chemical Perspective." Sumitomo Chemicals Research Laboratory, Takatsuki-city, Osaka, Japan, July 2001

149. "Resorcinarene-Stabilized Nanoparticles as Materials for Assays and Chemical Detection." Cambridge Healthtech Institute (CHI) Advances in Assays, Washington, DC, May 2001

150. "Resorcinarene-Stabilized Nanoparticles as Materials for Assays and Chemical Detection." Johns Hopkins University Applied Physics Laboratory, Laurel, MD, May 2001

151. "Self-Organization and Optical Properties of Large Gold Nanoparticle Arrays." National Institute of Standards and Technology (NIST), Gaithersburg, MD, May 2001

152. "Tuning the Optical Properties of Large Gold Nanoparticle Arrays." Materials Research Society (MRS) 2001 Spring Meeting, San Francisco, CA, April 2001

153. "Synthesis and Applications of Nanoparticle-Based Materials." Antioch College, Yellow Springs, OH, March 2001

154. "Self-Organization and Optical Properties of Large Gold Nanoparticle Arrays." Particles 2001 Conference, Orlando, FL, February 2001

155. "Synthesis and Applications of Nanoparticle-Based Materials." Proctor and Gamble, Cincinnati, OH, December 2000

156. "Synthesis and Applications of Nanoparticle-Based Materials." 3M Advanced Materials Technology Center, Saint Paul, MN, November 2000

157. "Heparin-like Oligosaccharides as Inhibitors of Fibroblast Growth Factor-Mediated Activities." Purdue Cancer Center Annual Retreat, Lafayette, IN, September 2000

158. "Resorcinarenes at the Interface of Nanoscale Materials and Biosensors." in Bio/Micro Interface Seminar Series, Purdue University, West Lafayette, IN, June 2000

159. "Supramolecular Organic Chemistry at Purdue." Kalamazoo College, Kalamazoo, MI, Jan. 2000

160. "Encapsulation of Neutral Gold Nanoparticles by Resorcinarenes." Shizuoka University, Hamamatsu, Japan, July 1999

161. "Recent Developments in Tunable Light-Emitting Devices." International Symposium on Advanced Laser and Optoelectronics, Lushan, China, July 1998.

IV.D. Other Presented Papers (in reverse chronological order)

162. "Lasing Action in Gold Nanorod Hyperbolic Metamaterials." (presented by R. Chandrasekar) Conference on Lasers and Electro-Optics (CLEO) 2016, San Jose, CA, June 2016

163. "Green Synthesis of Magnetic Gold Nanoclusters." (presented by L. Lin) Ctrl. Reg. Mtng. ACS (CERMACS), Covington, KY, May 2016

164. "Ferrioxamine Microarrays for the Rapid Detection and Discrimination of Pathogenic Bacteria." (presented by N. Arora) Ctrl. Reg. Mtng. ACS (CERMACS), Covington, KY, May 2016

165. "Laser-Driven Nanopore Formation Using Magnetically Guided Nanochisels." (presented by N. Kadasala) Ctrl. Reg. Mtng. ACS (CERMACS), Covington, KY, May 2016

166. "Synergistic Effects of Gold Nanorod Heating and Cisplatin in Ovarian Cancer Models." 5th International Nanomedicine Conference, Sydney, Australia, July 2014

167. "Perfluoroalkyl-Substituted Ethylene Carbonates: Novel Electrolyte Additives for High-Capacity Lithium Ion Batteries." (presented by Y. Zhu) 224th ECS Meeting, San Francisco, CA, October 2013

168. "Neurochemically gated activity of gyromagnetic nanostars." 244th ACS National Meeting, Indianapolis, IN, September 2013

169. "In Search of Cobalt Nanoclusters: Using MALDI to Study Cobalt–Calixarene Complexes." (presented by A. J. Evans) 244th ACS National Meeting, Indianapolis, IN, September 2013

170. **"**Pathogen Detection Using Fast Fourier Transform Analysis of Immutable Ligand Arrays." (presented by T. R. Maltais) 244th ACS National Meeting, Indianapolis, IN, September 2013

171. **"**Synergistic effects of cisplatin and photothermally active gold nanorods on ovarian cancer cells." (presented by J. G. Mehtala) 244th ACS National Meeting, Indianapolis, IN, September 2013

172. "Label-Free Pathogen Detection by Fourier Analysis of Immutable Ligand Arrays." Materials Research Society 2012 Fall Meeting, Boston, MA, November 2012

173. "Pre-clinical Assessment of Cancer Nanomedicines: Opportunities and Challenges Beyond Proof-of-Principle." Workshop on Drug Delivery and Cancer, West Lafayette, IN, Oct. 2011

174. "Dithiocarbamate-Coated SERS Substrates: Sensitivity Gain by Partial Surface Passivation." (presented by J. N. Newton) Argonne Undergraduate Research Symposium, Argonne, IL, Nov. 2009

175. "Standing-Wave Plasmon Resonances in Gold Nanorod Arrays." (presented by D. Lyvers) Materials Research Society 2009 Spring Meeting, San Francisco, CA, April 2009

176. "Reversal of Flux Closure States in Cobalt Nanoparticle Rings With Coaxial Magnetic Pulses." (presented by J. Liu) Materials Research Society 2008 Fall Meeting, Boston, MA, December 2008

177. "Plasmon-resonant gold nanorods: *en route* to theragnosis." 236th ACS National Meeting, Philadelphia, PA, August 2008

178. "Gold Nanostars with Magnetic Cores For Dynamic Optical Contrast." (presented by Q. Wei) 236th ACS National Meeting, Philadelphia, PA, August 2008

179. "Surface Functionalization and Cellular Uptake of Gold Nanoprisms." (presented by A. Leonov) Materials Research Society 2007 Fall Meeting, Boston, MA, December 2007

180. "Crosslinking and Functionalization of Resorcinarene-Encapsulated Gold Nanoparticles." (presented by R. Balasubramanian) 233rd ACS National Meeting, Chicago, IL, March 2007

181. "Assembly and vibrational spectroscopy of biomolecules on gold nanostructures." (presented by T. Nagao) 4th Intl. Symp. Surface Sci. and Nanotechnology (ISSS-4), Saitama, Japan, November 2005

182. "Toward Glycosylated Nanoparticle Libraries." (presented by J. Hernandez) 227th ACS National Meeting, Anaheim CA, March 2004

183. "Tunable Optical Responses from Colloidal Gold Nanoparticle Arrays." NANO-7/ECOSS-21, Malmö, Sweden, June 2002.

184. "Tunable Optical Properties of Large Gold Nanoparticle Arrays." Materials Research Society 2001 Fall Meeting, Boston, MA, November 2001

185. "Resorcinarene-Encapsulated Nanoparticles: Materials Properties and Applications." 222nd ACS National Meeting, Chicago, IL, August 2001

186. "Stereoselective Synthesis and Conformational Analysis of C6-Substituted β-Amino-2-Deoxyglucopyranosides." (presented by J. Achkar) 222nd ACS National Meeting, Chicago, IL, August 2001

187. "Self-Assembled Nanostructures from Resorcinarene-Encapsulated Nanoparticles." ISMC Satellite Symposium, Hiroshima University, Hiroshima, Japan, July 2001

188. "Self-Assembled Nanostructures from Resorcinarene-Encapsulated Nanoparticles." 26th International Symposium on Macrocyclic Chemistry, Fukuoka, Japan, July 2001

189. "Self-Organization and Optical Properties of Large Gold Nanoparticle Arrays." Materials Research Society 2000 Fall Meeting, Boston, MA, December 2000

190. "Nanoparticles Encaged in Crosslinked Resorcinarene Shells." Functional Nanostructures Symposium, 220th ACS National Meeting, Washington, DC, August 2000

191. "Plastic-Coated Quantum Dots: Nanoparticles Encaged in Crosslinked Monolayers of Calix[4]resorcinarenes." 11th International Symposium on Supramolecular Chemistry, Fukuoka, Japan, July 2000

192. "Synthesis and Characterization of Resorcinarene-Encapsulated Nanoparticles." Materials Research Society 1999 Fall meeting, Boston, MA, December 1999

193. "Nanoparticle Encapsulation using Resorcinarene-Based Systems." Materials Research Society 1998 Fall meeting, Boston, MA, December 1998

Poster Presentations (presenters underlined):

194. "Cellulose Nanomaterials: Chemo-mechanical Surface Modifications and Chemical Composition Analysis." Mavlan, M.; Maltais, T. R.; Wei, A. Notre Dame–Purdue Workshop on Soft Materials, South Bend, IN, October 2016

195. "Rapid Uptake and Photodynamic Inactivation of Specific Microbial Pathogens With Proto-porphyrin IX Derivatives." Morales-de-Echegaray, A. V.; Maltais, T. R.; Younis, W.; Kadasala, N. R.; Dutta, S.; Seleem, M. N.; Wei, A. PI4D Graduate Student/Postdoc Symposium; West Lafayette, IN, August 2016

196. "Cysteine-34 MonoPEGylated Human Serum Albumin For The Solubilization And Delivery Of Chemotherapeutics." Lavan, M.; Mehtala, J. G.; Kulczar, C.; Knipp. G. T.; Wei, A. Center for Pharmaceutical Processing Research IAB Meeting, San Juan, Puerto Rico, May 2016

197. "Rapid and Label-free Optical Detection of Bacterial Pathogens Using Immutable Ligand Microarrays." Arora, N. B.; Morales-de-Echegaray, A. V.; Maltais, T. R.; Sides, J. R.; Wei, A. OSA/SPIE Student Symposium, Birck Nanotechnology Center, April 2016

198. "Scalable manufacturing of nanoporous membranes using magnetically guided optoporation**."** Kadasala, N. R.; Saei, M.; Cheng, G. F.; Wei, A. Birck Industry Day, West Lafayette, IN, June 2015

199. "Inkjet printing of microarrays for rapid detection of pathogenic bacteria**."** Arora, N. B.; Maltais, T. R.; Wei, A. Birck Industry Day, West Lafayette, IN, June 2015

200. "Proteomic Visualization of Nanoparticle Cellular Entry Pathways." Wang, L.; Yang, L.; Kadasala, N.; Pan, L.; Wei, A.; Tao, W. A. ASMS 2015, St. Louis, MO, June 2015

201. "Inkjet printing of siderophore microarrays for rapid pathogen detection by pattern recognition." Arora, N. B.; Kim, Y.; Low, P. S; Wei, A. 249th ACS National Meeting, Denver, CO, March 2015

202. GNRs-mediated RNA interference in an ovarian cancer model." Wang, J.-X.; Thomas, M.; Morales-Collazo, O,; Wei, A. 2014 Annual Meeting of the Purdue University Center for Cancer Research, West Lafayette, IN, November 2014

203. "Nanometric Resolution in the Hydrodynamic Size Analysis of Ligand-Stabilized Gold Nanorods." Mehtala, J. G.; Zemlyanov, D.; Max, J. P.; Zhao, S.; Kadasala, N.; Wei, A. Gordon Research Conference on Noble Metal Nanoparticles, Mount Holyoke College, MA, June 2014

204. "4-Deoxypentenosyl Glycosides: Novel Synthons for Oligosaccharide Synthesis." Wei, A.; P. Padungros, P.; Alberch, L.; Casselman, M. D.; Khatri, H. R.; Cheng, G.; Fan, R.-H. 27th International Carbohydrate Symposium, Bangalore, India, January 2014

205. "PEGylated human serum albumin for enhanced drug binding and delivery of poorly soluble drugs." Mehtala, J. G., Kulczar, C., Knipp, G. T., Wei, A. Purdue Cancer Center 2013 Annual Retreat, West Lafayette, IN, November 2013

206. "PEGylated human serum albumin for enhanced drug binding and delivery of poorly soluble drugs." Mehtala, J. G.; Kulczar, C.; Knipp, G. T.; Wei, A. AAPS Annual Meeting and Exposition, San Antonio, TX, November 2013

207. "Synthesis of iron nanoparticles from iron–arene sandwich complexes." Nguyen, A. T.; Duarte Ruiz, A.; Chen, Z.; Wei, A. 244th ACS National Meeting, Indianapolis, IN, September 2013

208. "Magnetically responsive gold nanoparticles for surface-enhanced Raman scattering applications." Kadasala, N.; Wei, A. 244th ACS National Meeting, Indianapolis, IN, September 2013

209. **"**Synthesis of heparin-like compounds using a diversity-oriented approach." Khatri, H. R.; Padungros, P.; Bai, Y.; Wei, A. 244th ACS National Meeting, Indianapolis, IN, September 2013

210. **"**Glucosamine-based sulfoforms as affinity ligands for *Chlamydia trachomatis*." Morales-Collazo. O.; Casselman, M. D.; Liu, R. H.; Wei, A. 244th ACS National Meeting, Indianapolis, IN, Sept. 2013

211. **"**Utilizing Piezoelectric Inkjet Printing of Protein-Conjugated Siderophores for Rapid Pathogen Detection by Fast Fourier Transform Analysis." Maltais, T. R.; Arora, N. B.; Adak, A.; Durugkar, K.; Lyvers, D. P.; Kim, Y.; Reifenberger, R.; Low, P.; Wei, A. 244th ACS National Meeting, Indianapolis, IN, September 2013

212. **"**Gold nanorods: A multifunctional agent in the combat against cancer." Wang, J. X.; Mehtala, J. G.; Thomas, M.; Wei, A. 244th ACS National Meeting, Indianapolis, IN, September 2013

213. "Fluorous Synthesis of Heparan Sulfate Disaccharides." Casselman, M. D.; Wei, A. 30th H. C. Brown Lectures, West Lafayette, IN, April 2013

214. "Hyperthermia-enhanced Chemotherapies: Synergistic Effects of Cisplatin and Photothermally Active Gold Nanorods on Ovarian Cancer Cells." Mehtala, J. G.; Torregrosa-Allen, S.; Elzey, B. D.; Wei, A. 30th H. C. Brown Lectures, West Lafayette, IN, April 2013

215. "Cyclohexadienyl(Fe^0)Cyclopentadienes as precursors in iron nanoparticle synthesis." Nguyen, A. T.; Duarte Ruiz, A.; Chen, Z.; Wei, A. 30th H. C. Brown Lectures, West Lafayette, IN, April 2013

216. "Controlled Nucleation and Growth of Cobalt Nanoparticles Using a Ligand-Based Approach." Evans, A. J.; Chen, Z.; Liu, J.; Wei, A. 30th H. C. Brown Lectures, West Lafayette, IN, April 2013

217. "Synthesis of Di- and Trisaccharides for Heparin Binding Proteins and Chlamydia." Morales-Collazo, O.; Casselman, M. D.; Liu, R. H.; Wei, A. 30th H. C. Brown Lectures, West Lafayette, IN, April 2013

218. "Synergistic effects of cisplatin and gold nanorods on an ovarian cancer model: Chemotherapy enhanced by mild hyperthermia." Mehtala, J. G.; Torregrosa-Allen, S.; Elzey, B. D.; Wei, A. US-Colombia Workshop on Nanotechnology, Medellín, Colombia, March 2013

219. "Synergistic effects of cisplatin and gold nanorods on an ovarian cancer model: Chemotherapy enhanced by mild hyperthermia." Mehtala, J. G.; Torregrosa-Allen, S.; Elzey, B. D.; Wei, A. Gordon Research Conference on Noble Metal Nanoparticles, Mount Holyoke College, MA, June 2012

220. "Tissue Tranglutaminase Targeting by Multifunctional Field Responsive Gold Nanoparticles." Schmitt, J. W.; Thomas, M.; Caperell-Grant, A.; Chelladurai, B.; Cao, L.; Methala, J. G.; Wei, A.; Matei, D. AACR Annual Meeting, Chicago, IL, April 2012

221. "Synthesis of Glucosamine-Based Sulfoforms for Affinity Screening with Heparin-Binding Proteins." Morales-Collazo, O., Casselman, M.; Lui, R.; Wei, A. Annu. Biomed. Res. Conf. for Minority Students (ABRCMS), St. Louis, MO, Nov. 2011

222. "Synthesis of Glucosamine-Based Sulfoforms for Affinity Screening with Heparin-Binding Proteins." Morales-Collazo, O., Casselman, M.; Lui, R.; Wei, A. 7th Midwest Carbohydrate and Glycobiology Symposium, East Lansing, MI, September 2011

223. "Fluorous-Phase Synthesis of Glucosamine Sulfoforms." Casselman, M. D.; Wei, A. 7th Midwest Carbohydrate and Glycobiology Symposium, East Lansing, MI, September 2011

224. "Stereoelectronic Factors in the Stereoselective Epoxidation of Glycals and 4-Deoxy-pentenosides." Alberch, L., et al. 7th Midwest Carbohydrate and Glycobiology Symposium, East Lansing, MI, September 2011

225. "Glycal Assembly by *in situ* Generation and Activation of Glycosyl Dithiocarbamates." Padungros, P.; Alberch, L.; Wei, A. 7th Midwest Carbohydrate and Glycobiology Symposium, East Lansing, MI, September 2011

226. "Brake-and-Release Activity of Gyromagnetic Nanostars Mediated by Neurotransmitters," Wei, Q., et al. Birck BioNano Symposium, West Lafayette, IN, September 2011

227. "Synthesis of glucosamine-based sulfoforms for affinity screening with heparin-binding proteins." Morales-Collazo, O.; et al. Pacifichem 2010, Honolulu, HI, December 2010

228. "Dithiocarbamate-anchored Calixarene Monolayers as Selective Chemosensors for Trihalo-methanes in Water." Casselman, M. D.; Wei, A. Pacifichem 2010, Honolulu, HI, December 2010

229. "Magnetomotive imaging of plasmon-resonant nanoparticles and nanostars in tumor cells and macrophages." Wei, Q.; Song, H.-M.; Wei, A. Pacifichem 2010, Honolulu, HI, December 2010

230. "Magnetomotive imaging of plasmon-resonant nanoparticles and nanostars in tumor cells and macrophages." Wei, Q.; Song, H.-M.; Wei, A. Turkey Run Analytical Chemistry Conference, Marshall, IN, October 2010

231. "Surface-Modified Gold Nanorods for Applications in Nanomedicine." Leonov, A. P.; Zheng, J.; Stern, S. T.; Patri, A. K.; Wei, A. Gordon Research Conference on Noble Metal Nanoparticles, Mt. Holyoke College, South Hadley, MA, June 2010

232. "Measuring the magnetic moments of Co nanoparticle rings from their Aharonov-Bohm phase shift." Beleggia, M.; Kasama, T.; Dunin-Borkowski, R. E.; Liu, J.; Wei, A. Aharonov-Bohm Effect and Berry Phase 50th Anniversary Meeting, Bristol, UK, Dec. 2009

233. "Synthesis and Cell Uptake of Gold Nanostars with Magnetic Cores." Song, H.-M.; Ong, Q. K.; Wei, Q.; Wei, A. Materials Research Society 2009 Fall Meeting, Boston, MA, December 2009

234. "Surface-Modified Gold Nanorods for Applications in Nanomedicine." Leonov, A. P.; Zheng, J.; Stern, S. T.; Patri, A. K.; Wei, A. 6th International Symposium on Nanomedicine and Drug Delivery, Indianapolis, IN, October 2009

235. "Exchange bias in Fe/Fe_3O_4 core/shell magnetic nanoparticles mediated by frozen interfacial spins." Ong, Q. K.; Wei, A.; Lin, X.-M. CNM Users Meeting 2009. Argonne National Laboratory, Argonne, IL, September 2009

236. "Calix[6]arene-Functionalized Gold Substrates by *in situ* Dithiocarbamate Formation." Casselman, M. D.; Wei, A. 3rd International Symposium on Macrocyclic and Supramolecular Chemistry (ISMSC 2008), Las Vegas, NV, July 2008

237. "Magnetic Properties of Functionalized Hollow Cobalt Ferrite Nanoparticles." Ong, Q. K.; Lin, X.-M.; Kuebel, C.; Oldenburg, A. L.; Wei, A. Materials Research Society 2007 Fall meeting, Boston, MA, December 2007

238. "Off-Axis Electron Holography of Self-Assembled Co Nanoparticle Rings." Kasama, T.; Dunin-Borkowski, R. E.; Scheinfein, M. R.; Tripp. S. L.; Wei, A. Materials Research Society 2007 Fall meeting, Boston, MA, December 2007

239. "Self-Assembly and Magnetization Reversals of Cobalt Nanoparticle Rings." Kasama, T.; Dunin-Borkowski, R. E.; Scheinfein, M. R.; Tripp. S. L.; Liu, J.; Wei, A. Gordon Research Conference on Supramolecules and Assemblies, Il Ciocco, Italy, May 2007

240. "Two-Photon Luminescence Imaging and Optical Hyperthermia of Tumor Cells with Functionalized Gold Nanorods." Tong, L.; Zhao, Y.; Huff, T. B.; Hansen, M. H.; Wei, A.; Cheng, J.-X. IUCC Cancer Research Day, Indianapolis, IN, May 2007

241. "Templated Synthesis of Cobalt Nanoparticles from a Co_{16}–Resorcinarene Complex." Liu, J.; Wei, A. 233rd ACS National Meeting, Chicago, IL, March 2007

242. "Protein-Resistant Surfaces Based on Dithiocarbamate Assembly." Zhu, H.; Irudayaraj, J.; Wei, A. 233rd ACS National Meeting, Chicago, IL, March 2007

243. "Preparation of hollow cobalt ferrite nanoparticles." Ong, Q. K.; Keubel, C.; Oldenburg, A. L.; Wei, A. 233rd ACS National Meeting, Chicago, IL, March 2007

244. "Synthesis and Cryoprotection Properties of L- and *meso*-Trehalose." Seo, S.-K.; McClintock, M. L.; Wei, A. 233rd ACS National Meeting, Chicago, IL, March 2007

245. "Zinc bromide-mediated *syn* additions to 4-epoxypentenosides: stereoselective syntheses of L-idosides." Cheng, G.; Wei, A. 233rd ACS National Meeting, Chicago, IL, March 2007

246. Synthetic strategies for generating sulfated oligosaccharide libraries on solid-phase supports." Liu, R.; et al. 233rd ACS Natl. Meeting, Chicago, IL, March 2007

247. "Synthesis and Cryoprotection Properties of L- and *meso*-Trehalose." Seo, S.-K.; McClintock, M. L.; Wei, A. 2nd CRC Intl. Symposium on Cross-Coupling, West Lafayette, IN, September 2006

248. "*Syn*-addition of 4-Epoxypentenosides and Study of High Facioselectivity of DMDO Epoxidation by Polarized-π Frontier Molecular Orbital Theory." Cheng, G.; Wei, A. 2nd CRC Intl. Symposium on Cross-Coupling, West Lafayette, IN, September 2006

249. "Controlled Growth of Gold Nanorod Arrays in Polyethylenimine-coated Alumina Templates." Moon, J.-M.; Wei, A. Materials Research Society 2005 Fall Meeting, Boston, MA, December 2005

250. "Dithiocarbamate Assembly on Gold: Amines as Replacement Ligands for Thiols." Zhao, Y.; Pérez-Segarra, W.; Shi, Q.; Wei, A. Advances in Supramolecular Chemistry, Strasbourg, France, July 2005

251. "Dithiocarbamate Assembly on Gold: Amines as Replacement Ligands for Thiols." Zhao, Y.; Pérez-Segarra, W.; Shi, Q.; Wei, A. 8th Conference on Calixarenes, Prague, Czech Republic, July 2005

252. "Dithiocarbamate Assembly on Gold: Amines as Replacement Ligands for Thiols." Zhao, Y.; Pérez-Segarra, W.; Shi, Q.; Wei, A. 30th Intl. Symposium on Macrocyclic Chemistry (ISMC 2005), Dresden, Germany, July 2005

253. "Assembly of Dithiocarbamates on Gold." Zhao, Y.; Pérez-Segarra, W.; Shi, Q.; Wei, A. H. C. Brown Lectures in Organic Chemistry, West Lafayette, IN, April 2005

254. "Synthesis and Conformational Analysis of 6-*C*-Methyl Substituted 2-Acetamido-2-Deoxy-β-D-Glucopyranosyl Mono- and Disaccharides." Achkar, J.; Johnson, C. A.; Sanchez-Larraza, I. H.; Wei, A. Purdue Undergraduate Research Day, West Lafayette, IN, April 2005

255. Superparticles as Intracellular Nanoprobes." Zhao, Y.; Sadtler, B.; Wei, A. Intl. Symposium on Supramolecular Chem. XIII, South Bend, IN, July 2004

256. Spontaneous Formation of Dithiocarbamates on Gold Surfaces." Pérez-Segarra, W.; Zhao, Y.; Wei, A. Intl. Symposium on Supramolecular Chem. XIII, South Bend, IN, July 2004

257. "Self-Assembly of Resorcinarene-Encapsulated Au Nanoparticles: Effect of Surface Charge and Surfactant Structure." Kim, B.; et al. Intl. Symp. Supramol. Chem. XIII, South Bend, IN, July 2004

258. "Resorcinarene-Encapsulated Nanoparticles: Building Blocks for Functional Nanostructures." Kim, B.; Tripp, S. L.; Balasubramanian, R.; Wei, A. Calix2003, Vancouver, Canada, August 2003

259. "Resorcinarene-Encapsulated Nanoparticles: Building Blocks for Functional Nanostructures." Kim, B.; et al. NanoEngineering World Forum, Boston, MA, June 2003

260. "Synthesis of a Chitin-Like Tetrasaccharide and Its Tetra-*O*-Methyl Derivative." Liew, S.-T.; Wei, A. Gordon Research Conference on Carbohydrates, Tilton, NH, June 2003

261. "Resorcinarene-Encapsulated Nanoparticles: Building Blocks for Functional Nanostructures." Wei, A. et al., 38th Natl. Organic Symp., Bloomington, IN, June 2003

262. "Toward Glycosylated Nanoparticle Libraries." Hernández-Torres, J. M.; Balasubramanian, R.; Wei, A. 38th Natl. Organic Symp., Bloomington, IN, June 2003

263. "Access to L-Sugars and Mirror-Image Oligosaccharides from 4-Deoxypentenosides and L-Glycals." Boulineau, F. P.; Wei, A. 38th Natl. Organic Symp., Bloomington, IN, June 2003

264. "Synthesis of a Chitin-Like Tetrasaccharide and Its Tetra-*O*-Methyl Derivative." Liew, S.-T.; Wei, A. 38th Natl. Organic Symp., Bloomington, IN, June 2003

265. "Synthetic Studies Toward Heparin-like Glycoconjugates." Achkar, J.; Wei, A. Gordon Research Conference on Glycobiology, Ventura, CA, March 2003.

266. "TEM Image Analysis of Self-Organized Large Gold Nanoparticle Arrays." Tripp. S. L.; Kim, B.; Wei, A. Microscopy & Microanalysis 2002, Quebec City, Canada, August 2002

267. "Dispersion and Stability Studies of Resorcinarene-Encapsulated Gold Nanoparticles." Balasubramanian, R.; Kim, B.; Tripp. S. L.; Wang, X.; Lieberman, M.; Wei, A. 76th ACS Colloid and Surface Science Symposium, Ann Arbor, MI, June 2002

268. "Self-Organization and Optical Properties of Large Gold Nanoparticle Arrays." Kim, B.; Tripp. S. L.; Wei, A. 76th ACS Colloid and Surface Science Symposium, Ann Arbor, MI, June 2002

269. "Fabrication and Characterization of Core-Shell Nanoparticle Assemblies." Sadtler, B.; Wei, A. Materials Research Society 2002 Spring Meeting, San Francisco, CA, April 2002.

270. "Self-Organization and Optical Properties of Large Gold Nanoparticle Arrays." Kim, B.; Tripp. S. L.; Wei, A. Center for Nanoscale Materials Workshop, Argonne National Laboratory, Argonne, IL, October 2001

271. "Self-Organization and Optical Properties of Large Gold Nanoparticle Arrays." Kim, B.; Tripp. S. L.; Wei, A. Gordon Research Conference on Supramolecules and Assemblies, Connecticut College, New London, CT, July 2001

272. "Resistance Measurements on Highly Insulating Self-assembled Monolayers on Au(111) by Scanning Tunneling Spectroscopy." Tripp, S. L.; Labonte, A. P.; Wei, A.; Reifenberger, R. 222nd ACS National Meeting, Chicago, IL, August 2001

273. "Self-Organization and Optical Properties of Large Gold Nanoparticle Arrays." Kim, B.; Tripp. S. L.; Wei, A. 222nd ACS National Meeting, Chicago, IL, August 2001

274. "Conformational Studies of [^{13}C]-Methyl 2-[^{15}N]-Amino-2-Deoxy-β-Glucopyranoside Derivatives." Boulineau, F. P.; Wei, A. 222nd ACS National Meeting, Chicago, IL, August 2001

275. "Self-Assembled Nanostructures from Resorcinarene-Encapsulated Nanoparticles." Wei, A., et al. 26th International Symposium on Macrocyclic Chemistry, Fukuoka, Japan, July 2001

276. "Encaged Nanoparticles: Enhanced Stabilization by Crosslinking of Adsorbed Resorcinarene Surfactants." Pusztay, S. V.; et al. Particles 2001, Orlando, FL, February 2001

277. "A Resorcin[4]arene-Based Surfactant System for Nanoparticle Encapsulation." Stavens, K. B.; Pusztay, S. V.; Andres, R. P.; Wei, A. 33rd Int. Symp. Macrocyclic Chem., Turtle Bay, HI, June 1998

IV.E. Other Professional Activities (also see Section V.E)

a) Co-organizer for the NSF Workshop for Physical Organic Chemistry, Bandera, TX, June 1999

b) Co-organizer for the 13th International Symposium on Supramolecular Chemistry (ISSC-XIII), South Bend, IN, July 2004

c) Three-time organizer for "Advances in Nanomedicine" symposia: 232nd ACS National Meeting, San Francisco, CA (September 2006); 236th ACS National Meeting, Philadelphia, PA (August 2008); Pacifichem 2010, Honolulu, HI (December 2010)

d) Co-organizer for "Supramolecular Nanomaterials" symposium, 246th ACS National Meeting, Indianapolis, IN (September 2013)

e) Steering committee for NSF Workshop on Complexity & Emergent Phenomena, Washington, DC, May 2007

f) Panel member of proposal site reviews for: Science Foundation Ireland (Univ. College Dublin, 2005), NSERC (Univ. Toronto, 2008)

g) External reviewer of tenure promotion packages: Univ. of Connecticut (2006), Rice University (2007), Virginia Commonwealth Univ. (2008), Univ. Central Florida (2010).

h) Review panelist for CAREER grant proposals for NSF (Bioengineering Division), November 2002

i) Review panelist for NIH study sections: Annually since 2003

j) External reviewer of grant proposals for: NSF, NIH, ACS-PRF, DoE, NOAA, Research Corporation, Civilian Research Development Foundation.

k) Co-founder of PathoChip, Inc. (with Phil Low, Ron Reifenberger, Yeong Kim), June 2004

l) Guest Editor for: *Supramolecular Chemistry* (2005), *Nanomedicine* (2007), *J. Control. Release* (2012)

m) Associate (overseas) editor for *Science and Technology of Advanced Materials* (Institute of Physics (IOP) Publishing Ltd., http://stam.edmgr.com/), 2006-present

n) Editorial Board, *Nanomedicine* (Future Medicine Ltd; http://www.futuremedicine.com/loi/nnm)

o) Editorial Advisory Board for *Langmuir*, 2013-2015

IV.F. Interdisciplinary Activities (in approximate chronological order)

a) *Purdue University Center for Cancer Research*. Program Leader, Drug Delivery and Molecular Sensing (2009-); ACS Small Grants Committee (1999, 2000); *ad hoc* member of the Executive Committee (2001 external review, 2003 cluster hires); PCC Seminar Program Committee (2007-08).

b) *Center for Sensing Science and Technology*. Member of Task Force 8 (BioChem Nanosensors) for sensor technology research (2000); current involvement in rapid pathogen detection and screening.

c) *Purdue Materials Consortium (MATCON)*. Organizer of intramural workshop on bioengineering/ materials science (March 2002).

d) *Birck Nanotechnology Center and Discovery Park.* Official Chemistry liaison for BNC; committee member of Policies and Procedures committee (2006); internal advisory board member (2007). Participant in various campus-wide initiatives involving nanoscience and technology, including multi-PI grant proposals such as the Institute for Soldier Nanotechnology (2001), Nanoscale Science and Engineering Center (2002), NCI Center for Cancer Nanotechnology (2005, 2014), SEM instrumentation through DURIP (2005) and NSF-MRI (2006).

e) NSF Research Experience for Undergraduates (REU) in Chemical Biology (summer 2004).

f) Consultant for bio-nanotechnology, DowAgro Biosciences, Zionsville, IN (March 2005).

g) NSF-sponsored U.S. representative for Young Chemists' Workshop (CERC3) in functional nanomaterials, Baden-Baden, Germany (May 2005).

h) Co-PI (Associate Director) on multi-PI NSF proposal for a Materials Research Science and Engineering Center (MRSEC) at Purdue (reverse site visit, June 2005).

i) Lead PI of research/training grant proposals (2010, 2015, 2017).

j) Lead PI on Center for Chemical Innovations Phase I NSF proposal (2016).

Interdisciplinary research collaborations, past and present.

At Purdue:
Single-cell biosensors: Greg Hockerman (MCMP).
L-sugars as selectively toxic insecticides: Gary Bennett (ENTM), Michael Scharf (ENTM).

Heparin–growth factor cell proliferation assay: Kevin Hannon (BMS).
Molecular electronics: Ronald Reifenberger (PHYS), Ronald Andres (CHME), David Janes (ECE).
Frozen-solution REDOR spectroscopy: Dan Raftery (CHEM).
Dispersion of bentonite-soil mixtures: Antonio Bobet, Marika Santagata (CIVL), Cliff Johnston (AGRO).
Nanoscale magnetoelectronics: Ronald Reifenberger (PHYS), Tim Sands (MSE/ECE).
Nanophotonics: Vladimir Shalaev (ECE), Andrew Weiner (ECE), Michael Melloch (ECE).
Nonlinear optical properties of gold nanorods: Ji-Xin Cheng (BME).
Photothermally activated combination therapies using gold nanorods: Bennett Elzey (BMS).
Immutable ligands for pathogen detection: Phil Low (CHEM), Ron Reifenberger (PHYS).
SHG studies of DTC assembly on Au: Garth Simpson (CHEM); Jean Chmielewski (CHEM).
ST12-Ge nanoparticles: Carol Handwerker (MSE), Eric Stach (MSE).
Gyromagnetic imaging of magnetically responsive nanostars: Ken Ritchie (PHYS).
Nanotoxicology of silver nanoparticles: Maria Sepulveda (FNR), Marshall Porterfield (ABE).
Spectroscopic analysis of asphaltenes: Hilkka Kenttamaa (CHEM)
Magnetic gold nanoclusters for etching nanopores in plastic membranes: Gary Cheng (IE)
Fe_3O_4-coated PLGA nano-carriers for magnetophoretic drug delivery: Yoon Yeo (IPPH)
PEG-functionalized albumin for drug delivery applications: Gregory Knipp (IPPH)
Optokinetic trapping of live bacteria: Steve Wereley (ME)
Proteomics analysis of protein corona on nanoparticles: W. Andy Tao (Biochemistry)
Surface functionalization of cellulose nanomaterials: Jeff Youngblood, Pablo Zavatieri (MSE)
In situ analysis of roll-to-roll processing conditions: George Chiu (ME)
Microwave-CVD growth of graphene nanometals and diamond films: Tim Fisher (ME)
Targeted detection and drug delivery of antibiotics: Mohamed Seleem (Vet. Sch. Med.)
Field effects on catalyst-modified surfaces: Christopher Uyeda (CHEM)
DNA aptamer-based chemical sensors: Chongli Yuan (CHME)
Low-cost carbon-based chem. and biosensors: Lia Stanciu (MSE), Dimitri Peroulis (ECE)
Large-area crystallization in thin films: Chengde Mao, Christina Li (CHEM), Miko Cakmak, Alejandro Strachan (MSE).
Fabrication of thin-film thermoelectric generators: Luna Lu (CIVL/MSE)
Development of in vitro co-culture models: Ryan Grant (DNS)

Other U.S. Institutions:
NIR contrast agents for biomedical imaging: Stephen Boppart (Univ. Illinois)
Preclinical evaluation of gold nanorods: Anil Patri (NCI-NCL)
Surface magnetism and exchange bias of core-shell nanoparticles: Xiaomin Lin (Argonne)
Photoacoustic tomography of gold nanostars: Lihong Wang (Washington Univ.)
Gold nanorods for in vivo siRNA delivery to ovarian tumors: Daniela Matei (I.U. School Med.)
Au nanoparticles as radiosensitizing agents: Indra Das (I.U. School of Med.)
Large-area crystallization in thin films: Ying Diao (Univ. Illinois), Jin Wang (Argonne)

International collaborations:
Synthetic nano-muscles: Jean-Pierre Sauvage (Univ. of Strasbourg, France).
Electron holography of cobalt nanorings: Rafal Dunin-Borkowski (Technical Univ. Denmark, Lyngby)
Surface-initiated polymerization: Wilhelm Huck (Univ. Cambridge, England).
Nanostar dynamics controlled by supramolecular handcuffs: Oren Scherman (Univ. Cambridge).
STM studies of aromatic dithiocarbamates on Au(111): Florian von Wrochem (Sony GmbH, Germany)
SERS detection of trace metal ions: Ramon Alvara-Puebla (Univ. Rovira i Virgili, Tarragona, Spain)
Ex vivo photoacoustic tomography of gold nanorods: Chulhong Kim (POSTECH, Korea)
Multivalent complexes for nanoparticle nucleation: Alvaro Duarte-Ruiz (Univ. Nac. Colombia. Bogota)
Nano-encapsulation with V-shaped amphiphiles: Michito Yoshizawa (Tokyo Inst. Technol., Japan)

IV.G. Funding

IV.G.1. Brief Summary of Funding Support

My research program has received $7.4 million dollars* in external research support, including multiple peer-reviewed NIH and NSF grants as the lead PI. An additional $400K in research funds have been obtained through internal grant competitions or industrial consortia. Additional research support has been awarded by the Nanomaterials Characterization Laboratory (Fredricksburg, MD) for preclinical (ADME/T) evaluation of functionalized gold nanorods, with an estimated value of $300–500K. In addition, I provided co-PI support in four successfully funded instrumentation proposals (solid-state NMR spectrometer, Raman spectrometer; small-angle x-ray diffractometer, dual-beam environmental SEM), and the renewal of two $7.5 M NCI shared-resources grant for the Purdue Center for Cancer Research (2009-14; 2015-19).

IV.G.2. Current, Previous, and Pending Support

Current Awards

Grant Activity 1

1. NSF 13-545 / Scalable Nanomanufacturing: "Large scale manufacturing of low-cost functionalized carbon nanomaterials for energy storage and biosensor applications."
2. Duration of Funding*:* four (4) years, 12/1/2013–11/30/2017
3. Total amount of award: **$1,497,905**
4. Role: co-PI (PI: Raman (ME), Fisher (ME), Alexeenko (AEE), Bae (ME), Marinero (MSE))
5. Percent funding responsibility: 20%

Grant Activity 2

1. NSF 13-545 / Scalable Nanomanufacturing: "Roll-to-Roll and Additive Layer Manufacturing of Films Based on Cellulosic Nanomaterials."
2. Duration of Funding*:* four (4) years, 12/1/2014–11/30/2018
3. Total amount of award: **$1,477,970**
4. Role: co-PI (PI: Youngblood (MSE), Chiu (ME), Zavattieri (MSE))
5. Percent funding responsibility: 25%

Grant Activity 3

1. NIH / NCI: "Cancer Center Core Grant Renewal."
2. Duration of Funding*:* five (5) years, 7/1/2015–6/30/2020
3. Total amount of award: **$7,600,000**
4. Role: co-PI (PI: Tim Ratliff)
5. Percent funding responsibility: *n/a* (FY 16-17: $8K salary/FB contribution; $5K direct)

Grant Activity 4

1. Sumitomo Chemical Corporation: "Nano-brighteners for chemical sensing of urinary analytes" (Low-Cost Diagnostic Platforms)
2. Duration of Funding*:* one (1) year, 11/1/2015–1/31/2017 (no-cost extension)

* Total modified direct cost; does not include instrumentation grants. In the case of multi-PI or shared-resources grants, only those portions used in direct support of my research program or salary are counted (see % funding responsibility).

3. Total amount of award: **$248,204**
4. Role: PI (co-PI: Chongli Yuan)
5. Percent funding responsibility: 50%

Grant Activity 5

1. Shaoguan Lanwei: "Testing agreement for Detergent–Chlorine Dioxide Mixture."
2. Duration of Funding*:* eight (8) months, 10/1/2016–5/31/2017
3. Total amount of award: **$45,441**
4. Role: PI
5. Percent funding responsibility: 100%

Grant Activity 6

1. Birck Nanotechnology Center: "SMART Films Consortium."
2. Duration of Funding*:* eighteen (18) months, 6/1/2016–12/31/2017
3. Total amount of award: **$55,000**
4. Role: Co-I (PI: Ali Shakouri)
5. Percent funding responsibility: 100%

Previous funding support

Previous Support 1

1. American Chemical Society / Petroleum Research Fund Type G: "Solid-State Studies on Synthetic Oligosaccharides."
2. Duration of Funding*:* two (2) years, 9/1/1998–8/31/2000
3. Total amount of award: **$20,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 2

1. Purdue Research Foundation / PRF Summer Faculty Grant: "Insights into Carbohydrate Architecture via Solid-State Studies on Synthetic Oligosaccharides."
2. Duration of Funding*:* two (2) months, 6/15/1998–8/15/1998
3. Total amount of award: **$5,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 3

1. Purdue Research Foundation / Special Initiatives Fellowship: "Plastic-Coated Nanoparticles: A Generic Encapsulation Method."
2. Duration of Funding*:* One (1) year, 6/1/1998–5/31/1999
3. Total amount of award: **$12,000**
4. Role: PI (co-PI: Ronald Andres, CHME)
5. Percent funding responsibility: 100%

Previous Support 4

1. NSF / Chemistry Research Instrumentation and Facilities: “Acquisition of a 400 MHz Solid-State NMR Spectrometer.”
2. Duration of Funding*:* One (1) year, 7/1/1998–6/30/1999
3. Total amount of award: **$342,000**
4. Role: co-PI (PI: Dan Raftery, CHEM)
5. Percent funding responsibility: n/a

Previous Support 5

1. NSF / Chemistry Research Instrumentation and Facilities: “Purchase of a High-Performance Recycling Size-Exclusion Chromatography System.”
2. Duration of Funding*:* One (1) year, 1/1/1999–12/31/1999
3. Total amount of award: **$74,561**
4. Role: PI (co-PI: Richard A. Walton, CHEM)
5. Percent funding responsibility: 100%

Previous Support 6

1. Research Corporation / Research Innovation Award: "Encaged Nanoparticles: A Generic Strategy for the Manipulation of Nanoscale Materials."
2. Duration of Funding*:* One (1) year, 1/1/1999–12/31/1999
3. Total amount of award: **$35,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 7

1. American Cancer Society / Institutional Research Grant: "A Rapid Entry into Heparinoid Oligosaccharides."
2. Duration of Funding*:* One (1) year, 1/1/1999–12/31/1999
3. Total amount of award: **$20,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 8

1. American Chemical Society / Petroleum Research Fund Summer Faculty Research Fellowship: "Solid-State Studies on Synthetic Oligosaccharides."
2. Duration of Funding*:* Two (2) months, 6/1/1999–7/31/1999
3. Total amount of award: **$6,500**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 9

1. Purdue Research Foundation / PRF Research Grant: "Synthetic and Structural Studies of Heparin Oligosaccharides."
2. Duration of Funding*:* Two (2) years, 6/1/1999–5/31/2001
3. Total amount of award: **$26,600**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 10

1. Indiana Elks / Purdue Cancer Center Grant: "Inhibition of Smooth Muscle Cell Proliferation by Heparinoids."
2. Duration of Funding*:* One (1) year, 1/1/2000–12/31/2000
3. Total amount of award: **$25,000**
4. Role: PI (co-PI: Kevin Hannon, BMS)
5. Percent funding responsibility: 100%

Previous Support 11

1. Purdue Materials Consortium / MATCON Equipment Competition: "Portable Raman Imaging Instrument for Micro-Chemical Materials Diagnostics."
2. Duration of Funding*:* One (1) year, 1/1/2000–12/31/2000
3. Total amount of award: **$30,000**
4. Role: co-PI (PI: Dor Ben-Amotz, CHEM)
5. Percent funding responsibility: n/a

Previous Support 12

1. Purdue Research Foundation / Global Initiative Faculty Grant: "Fabrication of One-Dimensional Nanostructured Materials."
2. Duration of Funding*:* Three (3) months, 5/15/2000–8/15/2000
3. Total amount of award: **$2,500**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 13

1. Roche Diagnostics, Inc.: "Undergraduate Summer Research Internship."
2. Duration of Funding*:* Three (3) months, 5/15/2000–8/15/2000
3. Total amount of award: **$6,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 14

1. American Chemical Society / Petroleum Research Fund Type AC: "Understanding the Importance of Sidechain Interactions in Chitin."
2. Duration of Funding*:* two (2) years, 9/1/2000–8/31/2002
3. Total amount of award: **$60,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 15

1. US Army TACOM: "Synthesis of Resorcinarene Surfactants."
2. Duration of Funding*:* one (1) year, 6/15/2001–6/14/2002
3. Total amount of award: **$15,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 16

1. NAVSEA/NSWC Crane: "Integrated Detection of Energetic & Hazardous Materials (IDHM) Task Force 8: BioChem Nanosensors."
2. Duration of Funding*:* one (1) year, 7/1/2001–6/30/2002
3. Total amount of award: **$300,000**
4. Role: co-PI (PIs: Yeong Kim, Ron Reifenberger, PHYS)
5. Percent funding responsibility: 25%

Previous Support 17

1. Purdue Research Foundation / PRF Cancer Center Research Grant: "Synthesis and Evaluation of Fibroblast Growth Factor Receptor Inhibitors."
2. Duration of Funding*:* two (2) years, 1/1/2001–12/31/2002
3. Total amount of award: **$26,140**
4. Role*:* PI
5. Percent funding responsibility: 100%

Previous Support 18

1. Materials Research Society / Undergraduate Materials Research Initiative: "Fabrication and Characterization of Core-Shell Nanoparticle Assemblies."
2. Duration of Funding*:* one (1) year, 1/1/2002–12/31/2002
3. Total amount of award: **$750**
4. Role*:* PI (co-PI: Bryce Sadtler)
5. Percent funding responsibility: 100%

Previous Support 19

1. Purdue Research Foundation / Global Initiative Faculty Grant: "Designing Functional Nanoscale Muscles."
2. Duration of Funding*:* three (3) months, 5/15/2002–8/15/2002
3. Total amount of award: **$2,500**
4. Role*:* PI
5. Percent funding responsibility: 100%

Previous Support 20

1. American Heart Association / Scientist Development Grant: "Evaluation of Synthetic Heparinoids as Regulators of Fibroblast Growth Factor-Mediated Angiogenesis."
2. Duration of Funding*:* three (3) years, 7/1/2000–6/30/2003
3. Total amount of award: **$247,500**
4. Role*:* PI (co-PI: Kevin Hannon, BMS)
5. Percent funding responsibility: 100%

Previous Support 21

1. American Heart Asso. / AHA Predoctoral Fellowship: "Synthetic Strategies Toward Sulfated Oligosaccharides Regulating Fibroblast Growth Factor-Mediated Angiogenesis."
2. Duration of Funding*:* two (2) years, 7/1/2001–6/30/2003
3. Total amount of award: **$47,000**
4. Role: co-PI (PI: Jihane Achkar)
5. Percent funding responsibility: 100%

Previous Support 22

1. American Cancer Society / Research Scholar Grant: "Glycosylated Nanoparticles as Inhibitors of Receptor Clustering."
2. Duration of Funding*:* four (4) years, 7/1/2003–6/30/2007
3. Total amount of award: **$720,000** *(replaced 6/1/2004 by NIH grant)*
4. Role*:* PI
5. Percent funding responsibility: 100%

Previous Support 23

1. NSF / Biophotonics Initiative: "Receptor-Functionalized Gold Nanoprobes as Raman-Active Sensors of Ion and Neurotransmitter Transport."
2. Duration of Funding*:* three (3) years with no-cost extension, 9/1/2000–8/31/2004
3. Total amount of award: **$438,000**
4. Role*:* PI (co-PI: Greg Hockerman, MCMP)
5. Percent funding responsibility: 70%

Previous Support 24

1. NSF / Small Grant for Exploratory Research: “Antibody-conjugated Nanoparticle Films as Spectroscopic Sensors of Chemical Agents.”
2. Duration of Funding*:* one (1) year with no-cost extension, 9/1/2002–8/31/2004
3. Total amount of award: **$100,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 25

1. DoD–ARO (subcontract from Temeku Technologies, Inc) / ArmyNext Program: “Phase III 2003."
2. Duration of Funding*:* fourteen (14) months + no-cost extension, 3/1/2003–12/31/2004
3. Total amount of award: **$100,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 26

1. NIH / RO1 minority supplement (NIBIB): "Plasmon-Resonant Nanorods as Multifunctional Contrast Agents for Optical Coherence Tomography."
2. Duration of Funding*:* Sixteen (16) months, 5/1/2004–8/31/2005
3. Total amount of award: **$59,906**
4. Role*:* PI (co-PI: Stephen Boppart, Illinois)
5. Percent funding responsibility: 100%

Previous Support 27

1. NSF / Major Research Instrumentation: “Acquisition and Customization of a Facility for the In-situ X-ray Structural Analysis of Nanomaterials.”
2. Duration of Funding*:* Two (2) years, 10/1/2003-9/30/2005
3. Total amount of award: **$531,000**
4. Role: co-PI (PI: Hugh Hillhouse, CHME)
5. Percent funding responsibility: n/a

Previous Support 28

1. Temeku Technologies, Inc: “Magnetic Nanoparticle Dispersions in Epoxy Resin." (subcontract)
2. Duration of Funding*:* ten (10) months, 1/1/2005–10/31/2005
3. Total amount of award: **$80,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 29

1. DARPA (Birck Nanotech. Center): “Nanomagnetics Research at Purdue.”
2. Duration of Funding*:* three (3) years, 6/1/2003–5/31/2006
3. Total amount of award: **$210,000**
4. Role: PI (co-PIs: Ron Reifenberger (PHYS), Timothy Sands (MSE/ECE)
5. Percent funding responsibility: 33% (Y1–Y3: $70,000)

Previous Support 30

1. NSF / 02-02 (CHE): "Self-Assembly and Collective Properties of Resorcinarene-Encapsulated Nanoparticles."
2. Duration of Funding*:* four (4) years, 7/1/2003–7/31/2007
3. Total amount of award: **$327,500**
4. Role: PI
5. Percent funding responsibility: 100% (FY 07-08: $0K)

Previous Support 31

1. NSF / (PD 98-1636): "Soil Treatment with Thixotropic Fluids: An Autoadaptive Design for Liquefaction Prevention."
2. Duration of Funding*:* Three (3) years, 8/1/2004–7/31/2007
3. Total amount of award: **$340,000**
4. Role*:* co-PI (PI: Antonio Bobet, CIVL)
5. Percent funding responsibility: 40%

Previous Support 32

1. NSF / NIRT: "Plasmonic Nanophotonics and Optoelectronics."
2. Duration of Funding*:* five (5) years, 8/1/2002–12/31/2007
3. Total amount of award: **$1,300,000**
4. Role*:* co-PI (PI: Vladimir Shalaev, ECE)
5. Percent funding responsibility: 25%

Previous Support 33

1. DoD / AF-139: "Detection of Trihalomethanes with Calixarene-Coated Cantilevers- Phase I”
2. Duration of Funding*:* four (4) months, 4/15/2008–8/15/2008
3. Total amount of award: **$30,000**
4. Role: PI (subcontract from Triton Systems, Inc.)
5. Percent funding responsibility: 100%

Previous Support 34

1. NSF / MRI: "Dual-beam scanning electron microscope for hydrated and soft material applications."
2. Duration of Funding*:* two (2) years, 8/1/2006–7/31/2008
3. Total amount of award: **$673,000**
4. Role: co-PI (PI: Maureen McCann, BIO)
5. Percent funding responsibility: n/a

Previous Support 35

1. DoD / ECBC-04: "Rapid and Accurate Pathogen Identification/Detection (RAPID) Program." (Y1)
2. Duration of Funding*:* Eighteen (18) months, 8/1/2007–1/31/2009
3. Total amount of award: **$1,180,700**
4. Role: co-PI (co-PIs: Phil Low (CHEM), Ron Reifenberger (PHYS), Yeong Kim (PHYS))
5. Percent funding responsibility: 33%

Previous Support 36

1. NIH / R13 (NCI): "Advances in Nanomedicine Symposium at the 236th National Meeting of the American Chemical Society."
2. Duration of Funding*:* One (1) year, 8/1/2008–7/31/2009
3. Total amount of award: **$5,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 37

1. NIH / R01 (NIBIB): "Plasmon-Resonant Nanorods as Multifunctional Contrast Agents for Optical Coherence Tomography."
2. Duration of Funding*:* Five (5) years, 9/15/2003–7/31/2009 (no-cost extension)
3. Total amount of award: **$1,811,043**
4. Role: PI (co-PI: Stephen Boppart, Univ. Illinois)
5. Percent funding responsibility: 50%

Previous Support 38

1. NIH / RO1 (NIGMS): "Glycosylated Nanoparticles as Inhibitors of Receptor Clustering."
2. Duration of Funding*:* five (5) years, 6/1/2004–12/31/2009
3. Total amount of award: **$1,168,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 39

1. DoD / ECBC-04: "Rapid and Accurate Pathogen Identification/Detection (RAPID) Program." (Y2)
2. Duration of Funding*:* One (1) year, 2/15/2009–2/14/2010
3. Total amount of award: **$1,080,700**
4. Role: co-PI (co-PIs: Phil Low (CHEM), Ron Reifenberger (PHYS), Yeong Kim (PHYS))
5. Percent funding responsibility: 33%

Previous Support 40

1. Purdue Research Foundation / PRF Research Grant: "Magnetomotive Optical Probes for Viscoelastic Imaging in Cells."
2. Duration of Funding*:* One (1) year, 6/1/2009–5/31/2010
3. Total amount of award: **$16,795**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 41

1. Purdue Research Foundation / PRF Research Grant: "Screening Heparin-like Sulfoforms as Inhibitors of Urokinase–μPAR Activation."
2. Duration of Funding*:* One (1) year, 6/1/2010–5/31/2011
3. Total amount of award: **$16,795**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 42

1. DoD / AF-139: "Detection of Trihalomethanes with Calixarene-Coated Cantilevers—Phase II."
2. Duration of Funding*:* two (2) years, 10/1/2009–7/31/2011
3. Total amount of award: **$50,000**
4. Role: PI (subcontract from Triton Systems, Inc.)
5. Percent funding responsibility: 100%

Previous Support 43

1. DoD / ECBC-04: "Rapid and Accurate Pathogen Identification/Detection (RAPID) Program." (Y3)
2. Duration of Funding*:* One point five (1.5) years, 2/15/2010–8/28/2011
3. Total amount of award: **$1,438,584**
4. Role: co-PI (co-PIs: Phil Low (CHEM), Ron Reifenberger (PHYS), Yeong Kim (PHYS))
5. Percent funding responsibility: 33%

Previous Support 44

1. NIH / NCI (RC1-CA147096): "Investigating Tumor Growth Dynamics Using Multimodal Contrast Agents and Optical Coherence Elastography."
2. Duration of Funding*:* two (2) years, 10/1/2009–12/31/2011
3. Total amount of award: **$998,945**
4. Role: PI (co-PI: Stephen A. Boppart, Univ. of Illinois)
5. Percent funding responsibility: 50%

Previous Support 45

1. Lilly Seed Grants / Application of Nanotechnology to Cancer Therapeutics: "Enhancing the Antitumor Potency of Antimitotic Agents Using Albumin-coated Gold Nanorods."
2. Duration of Funding*:* two (2) years, 1/1/2010–12/31/2011
3. Total amount of award: **$100,000**
4. Role: PI (co-PIs: Arun Ghosh (CHEM/MCMP), Bennett Elzey (SVM)
5. Percent funding responsibility: 35%

Previous Support 46

1. DOE/Advanced Battery Research Program: "Novel Electrolytes for Lithium-Ion Batteries."
2. Duration of Funding*:* Three (3) years, 7/1/2010–6/30/2013
3. Total amount of award: **$90,000**
4. Role: PI (subcontract from Argonne National Laboratories)
5. Percent funding responsibility: 100%

Previous Support 47

1. NSF / CHE: "Nucleation and Growth of Annular Magnetic Nanostructures."
2. Duration of Funding*:* three (3) years, 4/1/2010–3/31/2013
3. Total amount of award: **$422,000**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 48

1. NSF / CHE: "Nucleation and Growth of Annular Magnetic Nanostructures." (AGEP supplement)
2. Duration of Funding*:* one (1) year, 10/1/2010–9/30/2013
3. Total amount of award: **$48,232**
4. Role: PI
5. Percent funding responsibility: 100%

Previous Support 49

1. Oncological Sciences Center / Walther Cancer Institute: "Nanorod Lancets: Suppressing the Metastatic Potential of Ovarian Cancer by Photothermal Injection of siRNA."
2. Duration of Funding*:* two (2) years, 4/1/2011–5/31/2013
3. Total amount of award: **$181,429**
4. Role: PI (Co-PI: Daniela Matei, IUPUI)
5. Percent funding responsibility: 100% (separate budget to D. Matei)

Previous Support 50

1. CTSI / Pilot Research Project: "Enhanced radiosensitization by tumor cell uptake of gold nanoparticles."
2. Duration of Funding*:* six (6) months, 12/1/2013–5/31/2014
3. Total amount of award: **$10,400**
4. Role: PI (co-PIs: Indra Das, Joe Dynlacht (IUPUI))
5. Percent funding responsibility: 100%

Previous Support 51

1. NIH / NCI: "Cancer Center Core Grant Renewal."
2. Duration of Funding*:* five (5) years, 7/1/2010–6/30/2015
3. Total amount of award: **$7,500,000**
4. Role: co-PI (PI: Tim Ratliff)
5. Percent funding responsibility: *n/a* (7% 12-mo. salary contribution)

Previous Support 52

1. Purdue / IN-MAC Research Thread Development: " Roll-to-roll manufacturing of thermal-switch separator (TSS) membranes for self-regulating Li-ion batteries."
2. Duration of Funding*:* two (2) years, 9/1/2013–8/31/2015
3. Total amount of award: **$106,500**
4. Role: PI (student fellow: Nigam Arora)
5. Percent funding responsibility: 100%

Pending funding support

Pending Grant Activity

1. United Technologies Corp.: "Self-Powered Platforms for Remote Chemical Sensing and Monitoring"
2. Duration of Funding*:* two (2) years, 1/1/2017–12/31/2019
3. Total amount of award: **$400,000**
4. Role: co-PI
5. Percent funding responsibility: 33%

Pending Grant Activity

1. Sumitomo Chemical Corporation: "Nano-brighteners for chemical sensing of urinary analytes" (Low-Cost Diagnostic Platforms)
2. Duration of Funding*:* one (1) year, 1/1/2017–12/31/2017

3. Total amount of award: **$250,000**
4. Role: PI (co-PI: Chongli Yuan)
5. Percent funding responsibility: 50%

Pending Grant Activity

1. NSF / CHE: "Center for Continuous Crystallization" (Center for Chemical Innovation, preproposal)
2. Duration of Funding*:* 1/1/2017–6/30/2017
3. Total amount of award: **$1**
4. Role: PI (co-PIs: Chengde Mao, Miko Cakmak, Alejandro Strachan, Christina Li, Ying Diao (UIUC)
5. Percent funding responsibility: 100%

Pending Grant Activity

1. NSF / CBET: "Collaborative Research: Elucidation of Molecular Factors and Mechanisms That Correlate Chronic Toxicity With Long-Term Exposure to Nano-Pollutants."
2. Duration of Funding*:* three (3) years, 4/1/2017–3/31/2020
3. Total amount of award: **$560,000** (plus $29,142 to Arizona State Univ.)
4. Role: PI (co-PI: Maria Sepulveda, Karen Watanabe (Arizona State Univ.)
5. Percent funding responsibility: 50%

Planned Grant Activity

1. NSF / CHE: "Center for Continuous Crystallization" (Center for Chemical Innovation, Phase I)
2. Duration of Funding*:* three (3) years, 7/1/2017–6/30/2020
3. Total amount of award: **$1,800,000**
4. Role: PI (co-PIs: Chengde Mao, Miko Cakmak, Alejandro Strachan, Christina Li, Ying Diao (UIUC)
5. Percent funding responsibility: 100%

Planned Grant Activity

1. NIH / NIGMS: "Pre-doctoral Training Program in Drug Discovery."
2. Duration of Funding*:* five (5) years, 9/1/2018–8/31/2023
3. Total amount of award: **$1,348,377**
4. Role: PI
5. Percent funding responsibility: 100% (0% AY salary contribution)

Planned Grant Activity

1. DoD-USAMRC (W81XWH-16-R-BAA1): "Protoporphyrin–nanosilver conjugates as topical antiseptics for Gram-positive pathogens"
2. Duration of Funding*:* three (3) years, 4/1/2017–3/31/2020
3. Total amount of award: **$750,000**
4. Role: PI
5. Percent funding responsibility: 50%

Planned Grant Activity

1. NIH / CTSI: "Macrophage-Tumor Cell Co-cultures for Recapitulation of Tumor Microenvironment" (Core Facilities grant)
2. Duration of Funding*:* two (2) years, 6/1/2017–5/31/2019
3. Total amount of award: **$10,000**
4. Role: PI
5. Percent funding responsibility: 100%

Planned Grant Activity

1. NSF / CHE: "Synthesis and Galvanization of Iron Nanoparticles."
2. Duration of Funding*:* three (3) years, 6/1/2018–5/31/2021
3. Total amount of award: **$450,000**
4. Role: PI
5. Percent funding responsibility: 100%

Planned Grant Activity

1. ACS–PRF (New Directions): "Fabrication of Chemical Sensors of Fumarate on Thermoplastic Thin Films."
2. Duration of Funding*:* two (2) years, 6/1/2018–5/31/2020
3. Total amount of award: **$110,000**
4. Role: PI
5. Percent funding responsibility: 100%

Planned Grant Activity

1. NIH / NCI (R21): "Reduction of Ovarian Cancer Metastasis by Magnetothermal Knockdown of Tissue Transglutaminase."
2. Duration of Funding*:* two (2) years, 10/1/2018–9/30/2020
3. Total amount of award: **$465,000**
4. Role: PI (co-PI: Daniela Matei)
5. Percent funding responsibility: 50%

IV.H. Involvement in Graduate Research Program

IV.H.1. Graduated M.S./Ph.D. Students

M.S (8): Stephen V. Pusztay (2001), Joseph Jean (2004), Waleska Pérez-Segarra (2004), Chris Zacharias (2005), Daniel A. Zweifel (2005), Matthew N. Hansen (2006), Heng Zhu (2008), Anh Nguyen (2014).

Ph.D. (24): Steven L. Tripp (2003), Jihane Achkar (2003), Fabien Boulineau (2003), Siong-Tern Liew (2004), Beomseok Kim (2004), Jesús Hernández (2005), Gang Cheng (2008), Seungkee Seo (2008), Runhui Liu (2009), Quy Ong (2010), Jie Liu (2010), Hyon-Min Song (2011), David Lyvers (2011), Laura Alberch (2011), Panuwat Padungros (2011), Qingshan Wei (2011), Jonathan Mehtala (2013), Matthew Casselman (2013), Andrew Evans (2014), Oscar Morales (2014), Thora Maltais (2015), Naveen Kadasala (2016), Hari Khatri (2016), Nigam Arora (2016).

IV.H.2. Current Research Group:

Visiting Scholars: Mr. Yuichiro Watanabe (Yamagata Univ., Japan, May 2016-Apr. 2017), Mr. Chuanzhou Zhu (Nankai Univ., China, July 2016-Jan. 2017).

Current PhD Candidates (7): Mr. Jianxin Wang (est. May 2017), Ms. Ana Morales-Echegaray (G4), Ms. Lu Lin (G3), Ms. Ericka Kistler (G2), Mr. Miran Mavlan (G2), Mr. Matthew Hewitt (G2), Tae Hoo Chang (G1, MSE)

BS Candidates (4): Yan Yu (SR), Shijie Yuan (SR), Wanna Sungnoi (JR), David Wu (SO)

HS student (1): Brian Mi

V. Service

V.A. Discussion of Service

I have served the Chemistry department in numerous roles, including 2 years as head of the Organic Division (2011-2012), 2 years on the graduate studies committee, 2 years as the head of the graduate student recruiting committee, 6 years on the undergraduate studies committee, and over 50 OP and/or thesis committees (including my own students). I have also been actively supporting the undergraduate research experience in Chemistry, both as a research advisor in CHM 499 (over 30 students) as well as the Chemistry Honors coordinator for CHM 197(00).

V.B. Departmental Services

a) Head, Organic Division (Jan. 2011- Jun. 2012).

b) Chair, Organic Faculty Hiring Committee (2011-12).

c) Chair, H. C. Brown Lectures in Organic Chemistry (2011). Organization of annual conference, featuring four internationally recognized lecturers. Estimated attendance: 150.

d) Chair, NMR committee (2010-11). Maintain oversight of usage and budget of interdepartmental NMR Center; assist in the coordination of repair costs and various sources of revenue.

e) Chair, Internal Promotions Committee (2015-). Oversight of Jianguo Mei's progress toward promotion with tenure.

f) Department Head Search Committee (2012-13).

g) External Faculty Search Committees. For tenure-track position in Organic materials (2013-14), senior hire in Analytical Chemistry (2015-17).

h) Development Committee (2008–2010). Identified candidates for outstanding alumni, as well as potential donors to the Chemistry Department.

i) Executive Committee (2011-12). Advise Department Head on possible directions and near-term hiring possibilities.

j) Facilities and Centers Committee (2006–2007): To discuss the status of various departmental facilities and centers, including the Jonathan Amy Facility for Chemical Instrumentation, the Laser Laboratory Facility, and the Purdue Laboratory for Chemical Nanotechnology.

k) Faculty Awards Committee (2011-12). Promoted nomination of outstanding faculty.

l) Graduate Studies Committee (2008–2010). Provide guidance for reaccreditation of the Ph.D. program at the departmental level.

m) Graduate Student Awards Committee (1999, 2002, 2003, 2008, 2009). Evaluated nominees for the Abbott and Brown Student Research Awards; chairman in 2008, 2009.

n) Graduate Student Recruiting Committee (1997–2000, 2009–11). Organized discussion on the planning and execution of events leading to the annual Graduate Student Symposium Weekend; served as liaison to the Organic division for student contact. Served as chair of International Graduate Student Recruiting for two years.

o) Graduate student recruitment (voluntary, 2014): Prepared Materials Chemistry brochure for attracting graduate student applicants; updated corresponding website.

p) Materials Chemistry Focus Group (voluntary, 2016): Providing informal leadership on departmental initiative to increase visibility and formal student training in materials chemistry research

q) Internal Promotions Committees (since 2010): currently 6 faculty, including Jianguo Mei (Chair), Chris Uyeda, Suzanne Bart, Nikolai Skyrinnikov, Paul Wenthold, Chen Yang.

r) Peer Teaching Evaluation Committees: Profs. Chen Yang (Chair), Suzanne Bart, Mingji Dai.

s) Library Committee (2007)

t) Seminar and Colloquium Organizer, Organic Division (1997, 2002, 2009, 2013).

u) Undergraduate Studies Committee (1999–2006): Discussed changes (or need thereof) in the curricula for undergraduate chemistry majors, upgrades of teaching laboratory needs, and the development of guidelines for students enrolled in CHM 499. Served on *ad hoc* committee for the conception of CHM 136, an honors general chemistry course.

v) Undergraduate Honors Coordinator (2000–present): Promoted the quality of the educational and research experiences of the Chemistry department's honors-level undergraduates, starting at the freshman level (CHM 197); administrated guidelines for oral and written communication of their research activities, particularly with respect to senior theses.

w) VISION Committee (2011). Developed strategic statement to promote construction of a new building centered on the molecular sciences.

x) Graduate Student Thesis Committees:

Current: Mr. Jianxin Wang (Wei), Ms. Ana Morales (Wei), Ms. Lu Lin (Wei), Ms. Ericka Kistler (Wei), Mr. Miran Mavlan (Wei), Mr. Matthew Hewitt (Wei), Mr. Tae Hoo Chang (Wei/Stanciu), Mr. Michael Drolet (Ramachandran), Ms. Kelsey Cantwell (Abu-Omar), Ms. Joann Max (Kenttamaa), Ms. Hanan Haymour (Low), Ms. Kelly McNear (Yang), Mr. Dan Feng (Raman, ME), Mr. Ross VerHeul (D. Thompson), Mr. Nick Sortedahl (Wirth), Ms. Amy Godfrey (Sepulveda, FNR), Mr. Wei-Tai Chen (Chiu, ME), Mr. Reaz Chowdhury (Youngblood, MSE), Mr. Ben Daum (C. Thompson), Ms. Heather Siebert (Wilker), Mr. Michael Tandiary (Dai), Mr. Zaikuan Yu (Kenttamaa), Mr. Yixiu Wang (Wu, IE).

Previous: Dr. Ken Gigstad (Lipton), Dr. Jeremy Boomer (Thompson), Dr. Fang Liu (Negishi), Dr. Joseph Michaelic (McMillin), Dr. Larry Timberlake (Morrison), Dr. Shouzhong Zou (Weaver), Dr. Jennifer Laurence (LiWang), Dr. Yves Dumond (Negishi), Dr. Brian Burke (Regnier), Dr. Dave Meyers (Fuchs), Mr. Stephen Pusztay (Wei), Dr. Sandra Tobias (MCMP: Borch), Dr. Indraneel Ghosh (Chmielewski), Dr. Jake Reder (Bein), Dr. Marcy Hernick (MCMP: Borch), Dr. Steven Tripp (Wei), Dr. Mike Bowman (Chmielewski), Dr. Elton Menon (Morrison), Dr. Salve Cacatian (Fuchs), Dr. Yuzhong Chen (Fuchs), Dr. Sungho Park (Ben-Amotz), Dr. Tony Thompson (Grutzner), Dr. Carl Lecher (IUPUI: Moser), Dr. Wei Li (Fuchs), Dr. Jihane Achkar (Wei), Dr. Fabien Boulineau (Wei), Dr. Siong-Tern Liew (Wei), Dr. Devanesan Loganathan (Morrison), Dr. Eduardo Torres (Fuchs), Ms. Melinda Mead (MCMP: Weatherman), Ms. Megann Honsbruch (MCMP: Gibbs), Dr. Alison Edsall (MCMP: Cushman), Mr. Joseph Jean (Wei), Ms. Waleska Pérez-Segarra (Wei), Dr. Beomseok Kim (Wei), Dr. Michael Wilson (McMillin), Mr. Chris Zacharias (Wei), Mr. Daniel Zweifel (Wei), Dr. Jesús Hernández (Wei), Mr. Steve Howell (Wilker), Dr. Al Hinton (Simpson), Mr. Matthew Hansen (Wei), Dr. Michael Murcia (IUPUI: Naumann), Dr. Yannick Fillon (Chmielewski), Mr. David Cranfill (Lipton), Ms. Michelle Williams (Savinov), Dr. Matthew Siegfried (Choi), Ms. Heng Zhu (Wei), Dr. Hsiao-Kuan Yuan (ECE: Shalaev), Dr. Gang Cheng (Wei), Dr. Seung-kee Seo (Wei), Dr. Lan Sun (ABE: Irudayaraj), Dr. Hongling Han (McLuckey), Dr. Wei Xia (Low), Dr. Brandon Huff (Cheng), Dr. Quy Ong (Wei), Dr. Jie Liu (Wei), Dr. Hyon Min Song (Wei), Dr. Ken Chantramontri (McLuckey), Dr. David Lyvers (Wei), Dr. Laura Alberch (Wei). Dr. Wan Pyo Hong (Fuchs), Dr. Qingshan Wei (Wei), Dr. Panuwat Padungros (Wei), Dr. Evgeny Kiselev (MCMP: Cushman), Mr. Eric Jones (Ramachandran), Dr. Levi Haupert (Simpson), Ms. Deanna Kalafut (Chmielewski), Mr. Dennis Cladis (Bart), Dr. Zhaorui Zhang (Wirth), Dr. David Anderson (Ghosh), Dr. Aditya Kulkarni (Thompson), Dr. Mary Jones (Abu-Omar), Dr. Liang-Liang Chen (Ruan: ME), Dr. Mark Riofski (Colby: MCMP), Dr. Matt Casselman (Wei), Dr. Jonathan Mehtala (Wei), Mr. Anh Nguyen (Wei), Dr. Ben Wegenhart (Abu-Omar), Dr. Sarah St. John (Lipton), Dr. Anyin Li (Cooks), Dr. Andrew Evans (Wei), Dr. Oscar Morales-Collazo (Wei), Dr. Gayatri Joshi (Sardar, IUPUI), Dr. Cori Jenkins (Wilker), Dr. Linna Wang (Tao), Dr. Chris Collins (D. Thompson), Dr. Thora Maltais (Wei), Dr. Naveen Kadasala (Wei), Dr. Hari Khatri (Wei), Dr. Yu Bai (Dai), Dr. Robert Hazlitt (Colby), Dr. Jiejun Gao (Sepulveda, FNR).

V.C. College and University Services

a) College of Science:

i) Alliance for Graduate Education and the Professoriate (AGEP) at Purdue (*since 2005*): engaged in increasing enrollment and retention of underrepresented minority graduate students at Purdue.

ii) COALESCE Nanoscience Hiring Committee (2004-2007): Reviewed applicant files and interviewed faculty candidates having profiles with a strong nanotechnology focus. Resulted in 1 successful hire in Physics (associate professor) and 1 assistant professor hire in Chemistry/Physics.

iii) Faculty Diversity Committee (2000-2003): discuss strategies to enhance educational opportunities and hiring practices for underrepresented minority students and faculty at Purdue.

iv) National Center for Learning and Teaching (NCLT, 2007): Engaged in nanotechnology discussion with high school teachers.

v) *University Faculty Scholar Selection Committee (2008)*

vi) Grade Appeals Committee, alternate (2009-2011): Reviewed one appellate case, Jan. 2010.

b) Discovery Park:

i) Birck Nanotechnology Center (2006-present): Policies and Procedures committee and Internal Advisory Council (2006-2007); working group on nano-manufacturing (2012-present).

ii) Faculty Hiring Task Force (2010-11): Identified potential faculty candidates with a strong research program at the biology–nanoscience interface.

c) Purdue Center for Cancer Research:

i) Program leader, Drug Delivery & Molecular Sensing (2010-): coordination of research activities and collaborations for 18 faculty with expertise in bioanalytical chemistry, imaging, and drug delivery, and biomedical engineering; recruitment of new members; monthly meetings on the Executive Committee.

ii) Organizer/Chair, Drug Delivery Workshop (2011): Planning of 2-day workshop at Purdue University on current challenges and paradigm changes in drug delivery for cancer treatments. Participants include 16 international experts on drug delivery.

ii) Cluster Hiring Committee (2003-04): Reviewed applicant files and interviewed faculty candidates having chemical biology profiles with a strong cancer focus. This resulted in two successful hires, in Chemistry (one assistant and one associate professor-level position).

iii) *Grants Review Committee (1998–2000, 2002, 2005, 2010, 2012)*: reviewed and recommended research proposals for various funding agencies (American Cancer Society, Indiana Elks, pilot and collaborative projects, postdoctoral fellowships, etc.)

V.E. Professional Services

a) Editorial:

k) Associate Editor, *Science and Technology of Advanced Materials* (Institute of Physics Publishing; http://stam.edmgr.com/)

ii) Editorial Advisory Board, *Langmuir* (2013–2015)

iii) Editorial Advisory Board, *Nanomedicine* (Future Med. Ltd; http://www.futuremedicine.com/loi/nnm)

iv) Guest editor: Special issues in *Supramolecular Chemistry* (ISSC Symposium; 2005), *Nanomedicine* (ACS Symp. on Nanomedicine; 2007), *Journal of Controlled Release* (Drug Delivery and Cancer: Challenges and New Directions for Cancer Therapy; 2012), *Science and Technology of Advanced Materials* (Focus Issue on Organic Electronics; 2014).

v) Peer review of journal manuscripts (~10/yr., down from ~50/yr) including: *ACS Nano*, *Advanced Materials*, *Advanced Functional Materials*, *Analytical Chemistry*, *Angewandte Chemie, Applied Physics Letters, Bioconjugate Chemistry, Carbohydrate Research, Cancer Letters, Chemical Communications, Chemistry-A European Journal, Chemistry Letters, Chemistry of Materials, ChemPhysChem, Chirality, Journal of Applied Physics, Journal of Controlled Release, Journal of Colloid and Interface Science, Journal of Materials Chemistry, Journal of Organic Chemistry, Journal of Organometallic Chemistry, Journal of Physical Chemistry (A, B, C), Journal of the American Chemical Society, Langmuir, Macromolecular Rapid Communications, Microporous and Mesoporous Materials, Nano Letters, Nanomedicine, Nature Nanotechnology, Organic Letters, Physical Chemistry & Chemical Physics, Proceedings of the National Academy of Sciences USA*, *Science and Technology of Advanced Materials, Small*, *Supramolecular Chemistry*, *Tetrahedron*, *Tetrahedron Letters, Thin Solid Films.*

vi*)* Textbook reviewer (2003): organic chemistry textbook

b) External grant reviews:

i) NSF CAREER awards review panel (2002): reviewed research proposals submitted to BES (ENG).

ii) *NSERC external review panel (2008):* site visit for Bioplasmonics center in Toronto, Canada

iii) NIH proposal reviews and panels: reviewed 10−15 NIH grant applications per year, including numerous *ad hoc* reviews of submissions to omnibus solicitations.. Panels include: NCI/IMAT Phased Innovation Program (PAR 01-104), Instrumentation and Systems Development Program (PAR 03-045), NIBIB Quantum Grants (EB-06-001), Centers for Cancer Nanotechnology Excellence (CA-09-012), SBIR Contracts on Therapeutics and Theranostics Based on Nanotechnology (PHS 2011-1). [needs update]

iv) Individual external grant reviews: ~5 grant applications per year, from: NSF, Research Corporation (College Science Awards), ACS Petroleum Research Fund (type AC, B Awards), Department of Energy, National Oceanic and Atmospheric Admin. (NOAA), Ireland Science Foundation, Israel Binational Science Foundation.

c) External promotions and dissertations:

i) Faculty Promotion and Tenure: (5 to Assoc. Prof.) I2CNER−Kyushu Univ. (Japan); Rice Univ.; Southern Illinois Univ.−Carbondale; Univ. of Connecticut; Univ. Texas−M. D. Anderson Cancer Center; Virginia Commonwealth Univ. *(3 to Full Prof.)* Rice Univ.; Univ. Central Florida, Okinawa Inst. Sci. Technol.

ii) Ph.D. Thesis (3): National Univ. of Singapore (SG), Univ. of Technology, Sydney (AUS), Univ. of Jyvaskyla (FIN).

d) Other professional services:

i) Engagement with DowAgro Sciences (Zionsville, IN). Provide recommendations on emerging core competencies in bio-nanotechnology.

ii) Participant in NCI-sponsored workshop on "Future Directions for Cancer and Nanotechnology: In-vivo Diagnostics and Imaging."

iii) Participant in ACS-sponsored strategic planning session, Div. Colloids and Surface Science

iv) Professional consulting: provided expert opinions to several law and venture capital firms.

V.F. Public Services (outreach)

a) Served as project advisor to a high school student in the School of Science High School Scholars Program (summer 2001);

b) Provided keynote lecture to local American Heart Association fundraising event (July 2002).

c) Participated in fundraising for American Heart Association (September 2002).

d) Assisted 8th-grade student with class project on nanotechnology research and the scientific peer-review process (Spring 2003).

e) *Destination: Purdue* (Spring 2003): provided keynote lecture to Purdue-bound high school students with underrepresented minority backgrounds.

f) Consultant to CIA on the use of nanomaterials in security-related issues (February 2006).

g) Assisted 5th-grade student with an interview on nanotechnology and self-assembly (March 2006).

h) Collaborated with high-school senior (Thomas Jefferson H.S., VA) on science fair project on nanoscale viscometry (Fall 2009-10).

i) Consultant to high-school sophomore (Valley Stream H.S., NY) on nanomedicine (Spring 2011).

j) Presented cancer-related seminar to members of the Wabash Area Lifetime Learning Association (WALLA), a local group of senior citizens in the Lafayette area (March 2013).

k) Discussed nanomedicine-related topics with high school teachers ("Research Goes to School" summer workshop), Discovery Learning Research Center, Purdue University (July 2015).

l) Presented poster on light-scattering nanoparticles to students and public (NanoDays, Birck Nanotechnology Center, May 2016).

l) Research advisor to local high-school senior (Brian Mi) on nano-manufacturing project (Fall 2016).