

## Faculty Profile

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### Faculty Directory

## Eugene Mash

Professor

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## Honors

- College of Science Innovation in Teaching Award, 1995
- IBM Paul J Flory Fellow, Almaden Research Center, 1990-1991
- College of Science Distinguished Career Teaching Award, 2009

## Education and Appointments

- B.S. 1975, The University of California, Irvine
- B.A. 1975, The University of California, Irvine
- Ph.D. 1980, The University of Utah
- NIH Postdoctoral Fellow 1981-1983, Harvard University

## Research Interests

- Organic
- Bioorganic
- Materials and Polymer Chemistry
- Synthesis/Synthetic Methods Development

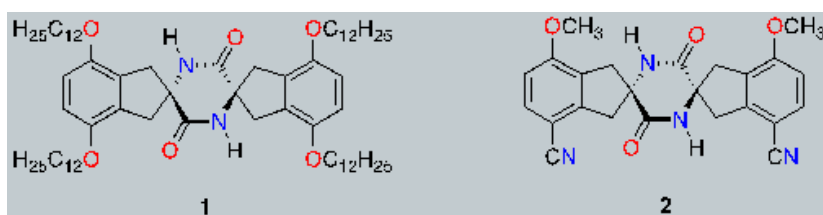
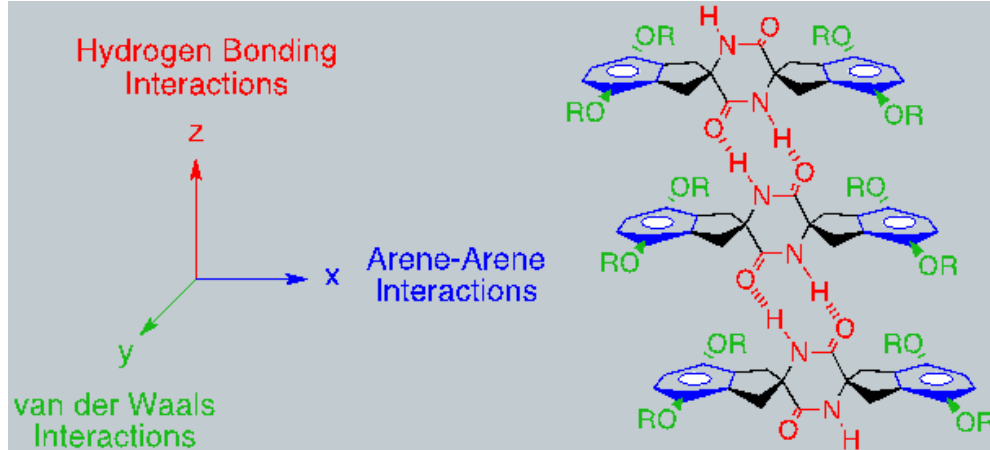
## Research Summary

### Organic Chemistry

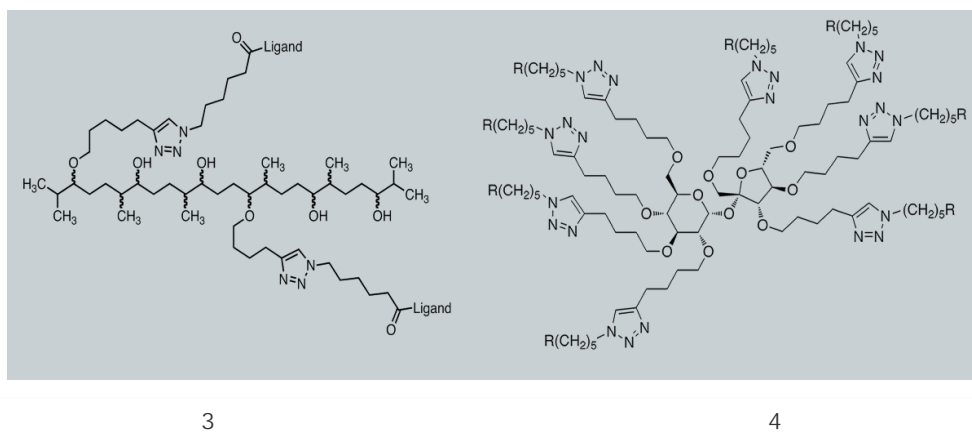
The ability to synthesize molecules is of fundamental importance and at the core of advances in every technological field. We seek to advance the synthetic art and to solve chemical problems in areas such as materials science and biology. Current focus areas include:

*Engineering organic crystals.* Non-covalent interactions are of universal importance in chemistry, materials science, and biology. Using a family of piperazinedione-containing molecules, we have demonstrated that the three-dimensional order of an organic crystal can be controlled by incorporation of three linearly independent molecular recognition elements (Figure 1). In this way we have produced bulk materials that exhibit liquid crystal properties (e.g., compound 1) or non-linear optical properties (e.g., compound 2). We are currently examining the effects of alterations of the arene substitution pattern on crystal packing and bulk properties.

Figure 1. Design of a piperazinedione for liquid crystal applications.



*Development of Multivalent Constructs.* We are developing scaffolds for the display of multiple ligands, imaging agents, and/or pro-drug moieties which may find applications in cancer imaging, diagnosis, and therapy. Scaffolds of current interest include terpene-derived scaffold 3 and sucrose-derived scaffold 4.



## Selected Publications

- Bowen, M. E.; Monguchi, Y.; Sankaranarayanan, R.; Vagner, J.; Begay, L. J.; Xu, L.; Jagadish, B.; Hruby, V. J.; Gillies, R. J.; Mash, E. A. *J. Org. Chem.* 2007, *72*, 1675-1680. "Design, Synthesis, and Validation of a Branched Flexible Linker for Bioactive Peptides."
- Jagadish, B.; Sankaranarayanan, R.; Xu, L.; Richards, R.; Vagner, J.; Hruby, V. J.; Gillies, R. J.; Mash, E. A. *Bioorg. Med. Chem. Lett.* 2007, *17*, 3310-3313. "Squalene-derived Flexible Linkers for Bioactive Peptides."
- Hammaker, J. R.; Mash, E. A. *J. Macromol. Sci., PAC* 2008, *45*, 865-871. "Synthesis and Characterization of a Poly(acrylamide) with Pendant 1,4-Piperazine-2,5-dione Moieties via Post-polymerization Cyclization."
- Ntirampebura, D.; Jagadish, B.; Nichol, G. S.; Carducci, M. D.; Dawson, A.; Rajapakshe, A.; Oliver, A. G.; Clegg, W.; Harrington, R. W.; Layne Jr., L.; Margolis, J. I.; Mash, E. A. *Crystal Growth & Design*, 2008, *8*, 3257-3270. "Organic Crystal Engineering with Piperazine-2,5-diones. 7. Crystal Packing of Piperazinediones Derived from 2-Amino-7-nitro-4-methoxyindan-2-carboxylic Acid."
- Jones, I. W.; Lynn, M. A.; Mash, E. A. *Tetrahedron* 2009, *65*, 10317-10322. "Conformational Analysis of Bridgehead-substituted Bicyclo[m.m.m]alkanes and Bicyclo[8.8.n]alkanes."
- Weatherhead, R. A.; Carducci, M. D.; Mash, E. A. *J. Org. Chem.* 2009, *74*, 8773-8778. "Synthesis of Conformationally Constrained Diaminodicarboxylic Acid Derivatives."

- Murigi, F. N.; Nichol, G. S.; Mash, E. A. *J. Org. Chem.* 2010, *75*, 1293-1296. "Synthesis of the Conformationally Constrained Tyrosine Analogs, (R)- and (S)-5-Hydroxy-2-aminoindan-2-carboxylic Acids."
- Xu, L.; Vagner, J.; Alleti, R.; Rao, V.; Jagadish, B.; Morse, D. L.; Hruby, V. J.; Gillies, R. J.; Mash, E. A. *Bioorg. Med. Chem. Lett.* 2010, *20*, 2489-2492. "Synthesis and Characterization of a Eu-DTPA-PEGO-MSH(4) Derivative for Evaluation of Binding of Multivalent Molecules to Melanocortin Receptors."
- Alleti, R.; Rao, V.; Xu, L.; Gillies, R. J.; Mash, E. A. *J. Org. Chem.* 2010, *75*, 5895-5903. "A Solanesol-Derived Scaffold for Multimerization of Bioactive Peptides."
- Raghunand, N.; Guntle, G. P.; Gokhale, V.; Nichol, G. S.; Mash, E. A.; Jagadish, B. *J. Med. Chem.* 2010, *53*, 6747-6757. "Design, Synthesis, and Evaluation of 1,4,7,10-Tetraazacyclododecane-1,4,7-triacetic Acid-Derived, Redox-Sensitive Contrast Agents for Magnetic Resonance Imaging."
- Ahad, A.M.; Zuohe, S.; Du-Cuny, L.; Moses, S.A.; Zhou, L.L.; Zhang, S.; Powis, G.; Meuillet, E.J.; Mash, E.A. *Bioorg. Med. Chem.* 2011, *19*, 2046-2054. "Development of Sulfonamide AKT PH Domain Inhibitors."
- Jagadish, B.; Brickert-Albrecht, G.L.; Nichol, G.S.; Mash, E. A.; Raghunand, N. *Tetrahedron Lett.* 2011, *52*, 2058-2061. "On the Synthesis of 1,4,7-Tris(tert-butoxycarbonylmethyl)-1,4,7,10-tetraazacyclododecane."
- Rao, V.; Alleti, R.; Xu, L.; Tafreshi, N. K.; Morse, D. L.; Gillies, R. J.; Mash, E. A. *Bioorg. Med. Chem.* 2011, *19*, 6474-6482. "A Sucrose-Derived Scaffold for Multimerization of Bioactive Peptides."
- Navath, S.; Rao, V.; Woodford, R.-M. T.; Midura-Kiela, M. T.; Ahad, A. M.; Kiela, P. R.; Mash, E. A. *ACS Med. Chem. Lett.* 2012, *3*, 710-714. "Design, Synthesis, and Testing of a Molecular Truck for Colonic Delivery of 5-Aminosalicylic Acid."
- Guntle, G. P.; Jagadish, B.; Mash, E. A.; Powis, G.; Dorr, R. T.; Raghunand, N. *Translational Oncology* 2012, *5*, 190-199. "Tumor Xenograft Response to Redox-active Therapies Accessed by Magnetic Resonance Imaging Using a Thiol-bearing DOTA Complex of Gadolinium."
- Wells, K.E.; Weatherhead, R. A.; Murigi, F. N.; Nichol, G. S.; Carducci, M. D.; Selby, H. D.; Mash, E. A. *Cryst. Growth Des.* 2012, *12*, 5056-5068. "Organic Crystal Engineering with 1,4-Piperazine-2,5-diones. 8. Synthesis, Crystal Packing, and Thermochemistry of Piperazinediones Derived from 2-Amino-4,7-dialkoxyindan-2-carboxylic Acids."
- Mash, E. A. (2012) "Synthetically Derived Chiral Auxiliaries: Uses of Derivatives of Non-Carbohydrate Aldehydes and Ketones in Asymmetric Synthesis." In: Carreira E.M. and Yamamoto H. (eds.) *Comprehensive Chirality*, Volume 3, pp. 377-407; Amsterdam: Elsevier.
- Jagadish, B.; Guntle, G. P.; Zhao, D.; Gokhale, V.; Ozumerzifon, T. J.; Ahad, A. M.; Mash, E. A.; Raghunand, N. *J. Med. Chem.* 2012, *55*, 10378-10386. "Redox-active Magnetic Imaging Contrast Agents: Studies with Thiol-bearing 1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetracetic Acid Derivatives."
- Xu, L.; Josan, J. S.; Handl, H.L.; Vagner, J.; Caplan, M. R.; Hruby, V. J.; Mash, E. A.; Lynch, R. M.; Morse, D. L.; Gillies, R. J. *Proc. Natl. Acad. Sci. USA* 2012, *109*, 21295-21300. "Heterobivalent Ligands Target Cell-surface Receptor Combinations in Vivo."
- Martinez, G. V.; Navath, S.; Sewda, K.; Rao, V.; Foroutan, P.; Alleti, R.; Moberg, V. E.; Ahad, A. M.; Coppola, D.; Lloyd, M. C.; Gillies, R. J.; Morse, D. L.; Mash, E. A. *Bioorg. Med. Chem. Lett.* 2013, *23*, 2061-2064. "Demonstration of a Sucrose-derived Contrast Agent for Magnetic Resonance Imaging of the GI Tract."

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