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RESEARCH & COLLABORATION PROFILE

KEY WORDS: Supramolecule, Foldamer, Peptidomimetic, Chirality, Self-assembly



Research Snapshot. Prof. Yoo investigates bio-inspired organic supramolecular systems through the design of unnatural peptidomimetics and the control of their folding, self-assembly, and molecular recognition. His current research covers oligourea, oligourethane and peptide foldamers, hierarchical self-assembly, adaptive and dynamic supramolecular systems.

RESEARCH EXPERTISE

- **Foldamers & Peptidomimetics:** Design, synthesis, and structural characterization of sequence-defined peptidomimetics with unnatural backbones, particularly oligoureas and oligourethanes, with an emphasis on controlling their folding and functional properties.
- **Hierarchical Self-Assembly:** Controlled self-assembly of foldamers into molecular architectures ranging from nanoscale assemblies to well-defined two- and three-dimensional supramolecular structures.
- **Dynamic Supramolecular Systems:** Development of adaptive and dynamic supramolecular systems with controllable morphology, helicity, and chirality through molecular design, self-assembly, and molecular recognition
- **Porous Metal-Organic Supramolecules:** Design and construction of porous metal–organic supramolecular architectures using peptidomimetic ligands.

RECENT RESEARCH HIGHLIGHTS

- **Controlled heteromolecular self-assembly (CC 2026):** Introduced a “chiral supramolecular alloy” concept using isomorphous β-peptide foldamers, enabling composition-dependent control of two- and three-dimensional morphologies through co-assembly.
- **Adaptive molecular recognition (JACS 2022):** Developed nonpeptidic oligourea helix bundles that adaptively recognize alkyl glycosides in water, providing a biomimetic approach toward artificial glycolipid-binding proteins.
- **Functional foldamer assemblies (Small Sci. 2024):** Demonstrated self-assembled foldamers that form selective ion-channel architectures, highlighting the potential of foldamers as biomimetic functional systems.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas: Peptidomimetics development | medicinal/pharmaceutical chemistry | Soft materials | organocatalyst | porous metal-organic supramolecule

- **Development of new peptidomimetics:** Joint design and synthesis of new peptidomimetics and foldamers with tailored structures, conformations, and functions.
- **Medicinal and pharmaceutical chemistry:** Development of bioactive peptidomimetics and foldamer-based molecular systems for potential therapeutic and pharmaceutical applications.
- **Soft material:** Development of functional soft materials through the controlled self-assembly and co-assembly of peptidomimetics.
- **Organocatalyst:** Development of foldamer-based organocatalysts with well-defined chiral environments for selective organic transformations.
- **Porous metal-organic supramolecule:** Construction of porous metal–organic architectures using peptidomimetic ligands for molecular recognition, encapsulation, and functional applications.

SELECTED RECENT PUBLICATIONS

- **Chem. Commun. 2026, 62, 14202–14206 —** Chiral supramolecular alloys
- **Org. Biomol. Chem. 2024, 22, 731–734 —** Detergent binding protein mimics
- **J. Am. Chem. Soc. 2022, 144, 15988–15998 —** Protein mimics of adaptivity
- **Bull. Korean Chem. Soc. 2022, 43, 1278–1283 —** Metal-amino acid polymer
- **Chempluschem 2020, 85, 2243–2250 —** Foldamer nanotubes

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REPRESENTATIVE RESEARCH FIGURES / SCHEMES

