Organic chemistry has been developed as that of second-row elements such as carbon, oxygen, and nitrogen so far, while the synthesis and isolation of the heavier congeners of typical organic molecules as stable compounds have been one of “dreams” for organic chemists. Our main research interest is the elucidation of the similarities and differences in structures and reactivities between organic compounds and the corresponding heavier congeners. These studies are interesting and important from the standpoints of not only fundamental chemistry but also opening the way to more extensive application of main group chemistry.

Selected Publications
Characteristic Reactivity of a Diaryl-substituted Disilyne

Recently, we have reported the synthesis and isolation of the first stable 1,2-dialkyldisilyne, Bbt–Si=Si–Bbt, along with its unique properties. Reaction of the disilyne with alkenes afforded compounds having several unique skeletons depending on the kind of alkene. Moreover, the disilyne showed high reactivity with alkynes, and both polar and non-polar alkynes reacted with it to give the corresponding 1,2-disilabenzenes as the major product. Crystal structure analysis showed that the central ring of the 1,2-disilabenzenes was almost planar, and most notably, the Si–Si bond has significant trans-bent character. Evidence supporting its aromatic structure was collected by both experimental and theoretical means.

Synthesis and Properties of 1,1′-Disila-4,4′-biphenyl

The 1,1′-disila-4,4′-biphenyl, the first molecule bearing directly connected two silaaromatic rings, was synthesized by utilizing the steric protection afforded by Tbt groups and characterized by its spectroscopic and X-ray crystallographic data. Its two SiC₂ rings are twisted with respect to each other with a dihedral angle of ca. 41°. The parent biphenyl has a coplanar structure due to packing forces in the crystalline state, and its dihedral angles in solution or in the gas phase are ca. 45°. In the case of the disilabiphenyl, extremely bulky Tbt groups prevent intermolecular interactions between the disilabiphenyl units, resulting in the retention of a distorted structure even in the solid state. Its UV-vis spectrum showed not only a red shift but also a 6-fold increase in absorbance of the longest absorption maximum in its electronic spectra in comparison with those of Tbt-substituted silabenzenes, indicating that the concept of conjugation through the single bond connecting two aromatic rings is applicable even in the silaaromatic systems.