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Control of Stereogenic Oxygen in a Helically Chiral Oxonium Ion
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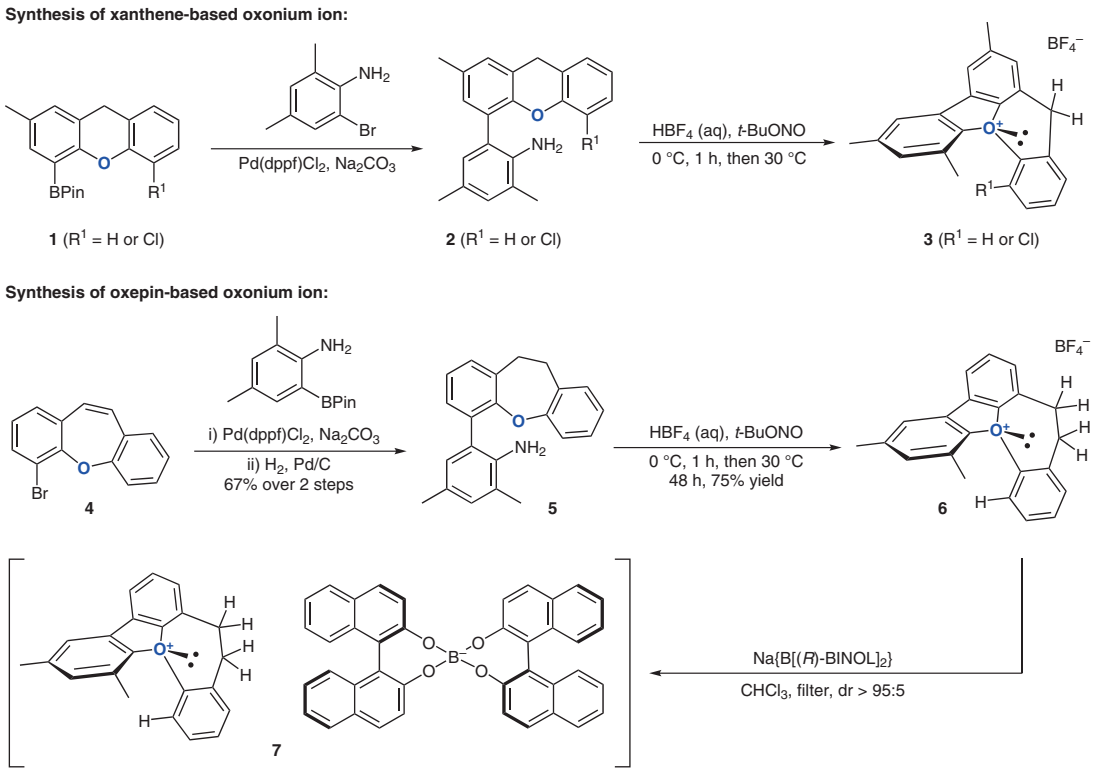
Chirality at Oxygen!!



Significance: While the pyramidal inversion of trisubstituted amines, phosphines and sulfonium salts is a well-established stereochemical process with a broad understanding of the factors influencing the magnitude of the inversion barrier, the corresponding study of oxonium ions, which are often cited as transient intermediates in synthetic transformations, has been hindered by difficulties associated with their isolation owing to their instability. The current report describes the synthesis of a stable, chiral oxonium ion, which features a fused triaryl ring system that prevents the stereogenic oxygen from inverting.

Comment: The design of helically chiral oxonium ions sought to exploit the known enhanced stability of triaryloxonium ions while utilizing a linker to join the aromatic rings to increase the barrier to oxygen inversion. Initially dibenzofuran-xanthene-based scaffold **1** was evaluated with the synthesis achieved through intramolecular O-arylation with a diazonium salt though this series highlighted the challenge of achieving high enough inversion barriers to obtain configurational stability without compromising stability. Computational studies indicated that an additional sp^3-carbon in a seven-membered dihydrodibenzooxepine (**5**) would avoid steric destabilization in the ground state with a higher barrier to inversion, owing to transition-state destabilization. Synthesis and subsequent classical resolution of the racemate with (*R*)-BINOL borate led to isolation of a diastereomerically pure salt (**7**), which was shown to be conformationally stable at temperatures up to 50 °C with an enantiomerization barrier determined by chiral HPLC to be 111 kJ/mol.

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Category
Synthesis of Heterocycles

Key words
oxonium ions
stereogenic oxygen
oxepin
xanthene
pyramidal inversion
quantum calculation

Synfact of the Month