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Spinoff

ETH zürich

Your specialist in fluoroalkylation

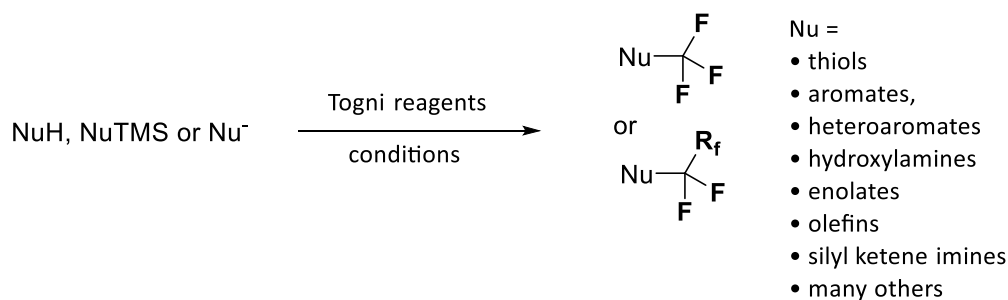
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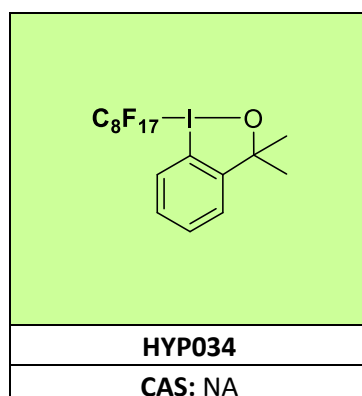
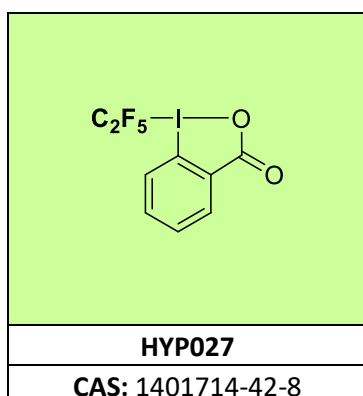
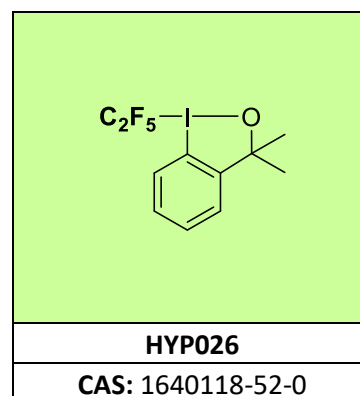
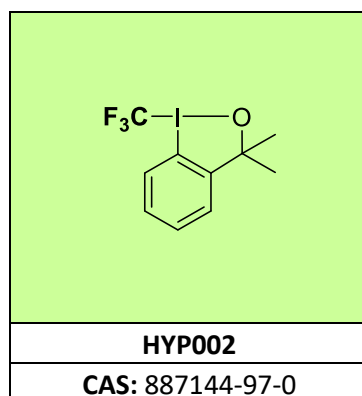
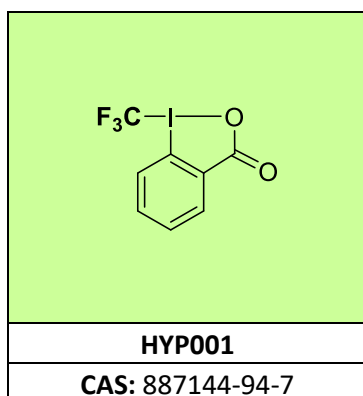
Fluoroalkylation portfolio

Togni perfluoroalkyl reagents

The so-called Togni reagents have over the last years become a standard tool that provides expedient access to trifluoromethylated and perfluoroalkylated compounds important for drug and pesticide discovery programs. In many cases, these reagents operate via trifluoromethyl or perfluoroalkyl radicals as the key reactive intermediates.

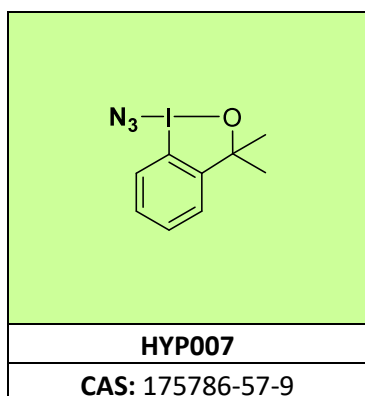
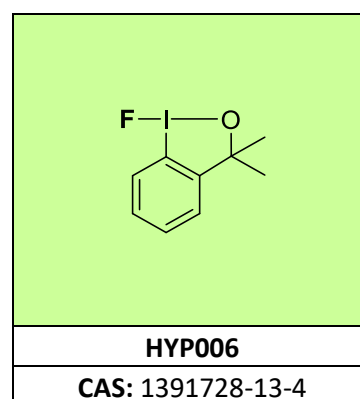
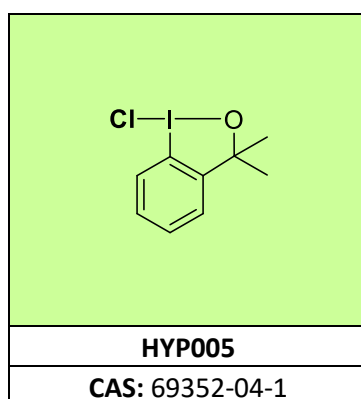
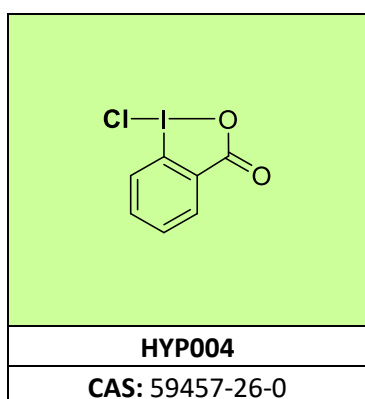
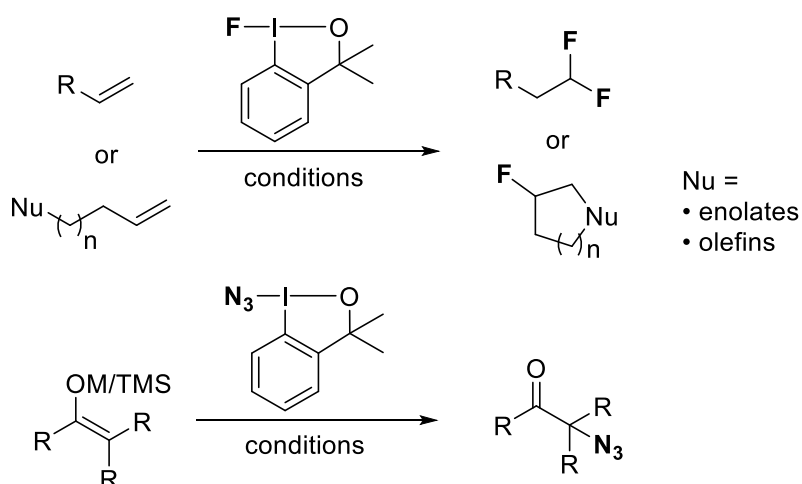


For a review, see: J. Charpentier, N. Früh, A. Togni, Chem. Rev. 2015, 115, 650-682.



Other hypervalent iodine reagents

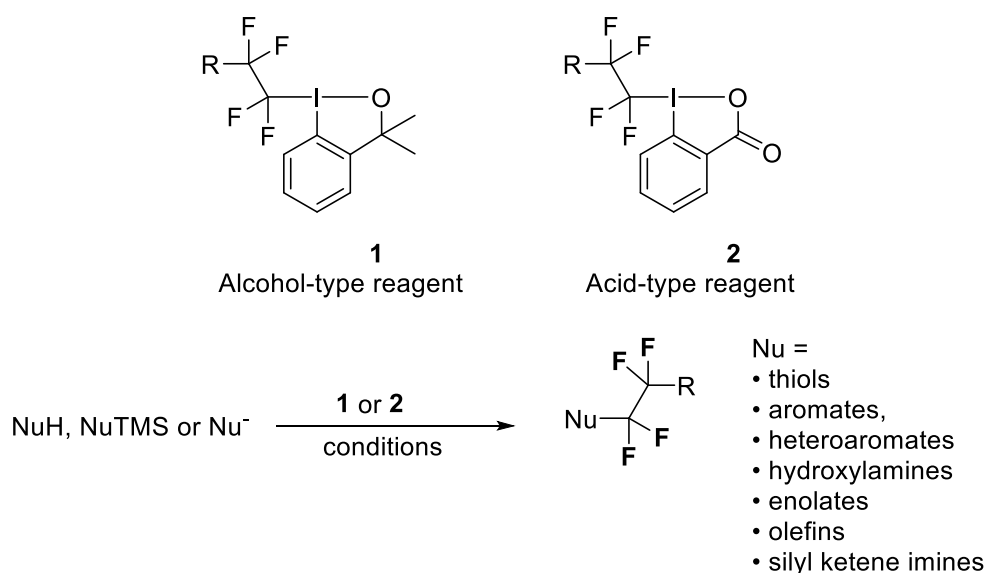
Cyclic hypervalent iodine reagents with increased hydrolytical and thermal stability have been described as mild and conveniently handled electrophilic chlorination, fluorination and azidations reagents. The shelf-stable fluoroiodane reagent allows to perform elegant fluorinative functionalisations and fluorocyclisations of olefins under mild conditions, while the azidoiodane reagent can be used to as a formally electrophilic azidation reagent for azidation of enolates.



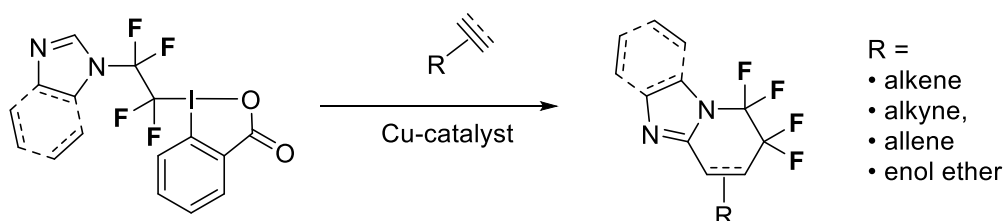
Togni - CF₂CF₂R reagents

The second generation of Togni reagents („extended Togni reagents“) incorporate substituted tetrafluoroethyl groups instead of plain perfluoroalkyls. With essentially similar reactivity patterns as the original CF₃-analogues, many types of transformations that work well with CF₃-Togni reagents can be done with these reagents as well, providing access to rare and potentially attractive fluorinated chemical space. With a set of „extended Togni reagents“ in hand, the lead compound can be diversified in the last stage of the synthesis to afford the hard-to-access fluoroalkyl-decorated derivatives.

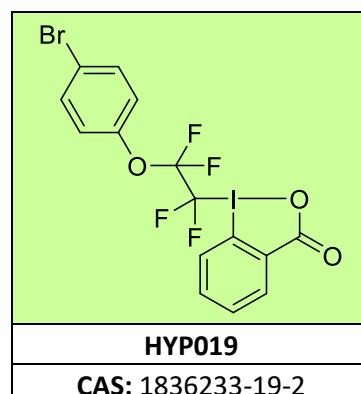
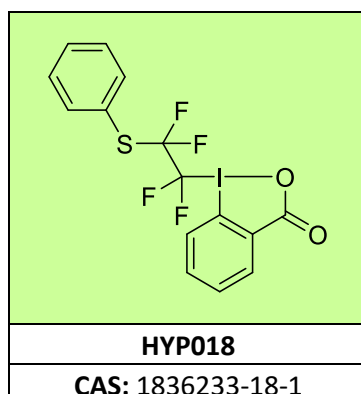
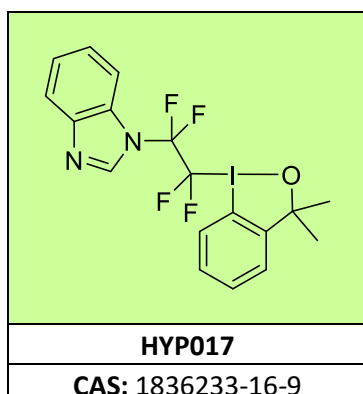
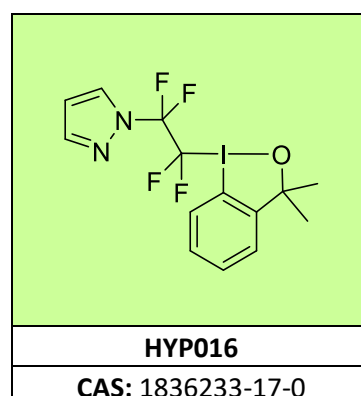
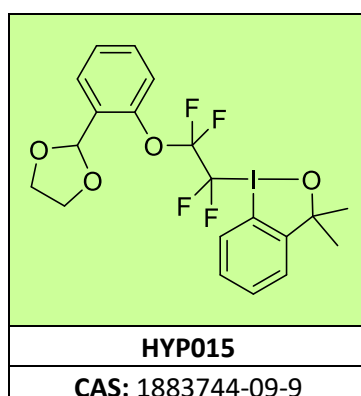
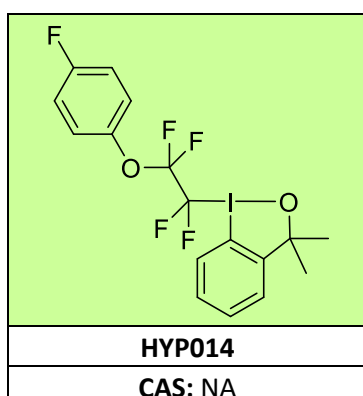
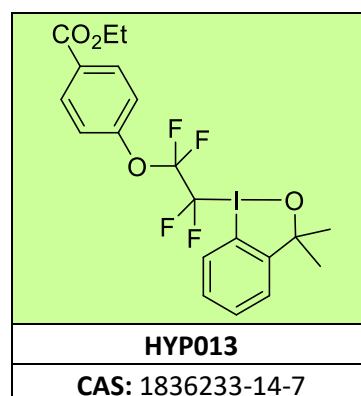
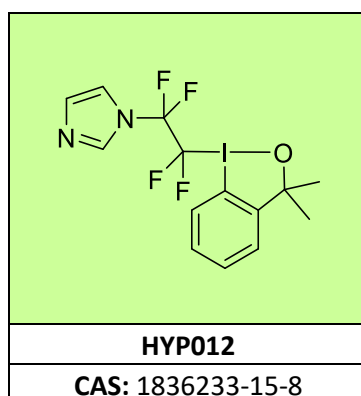
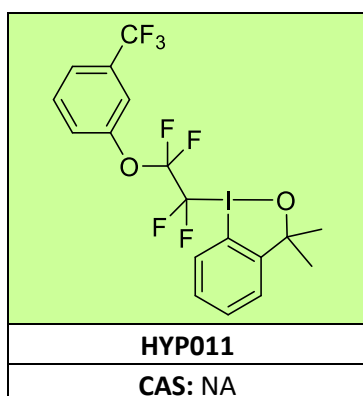
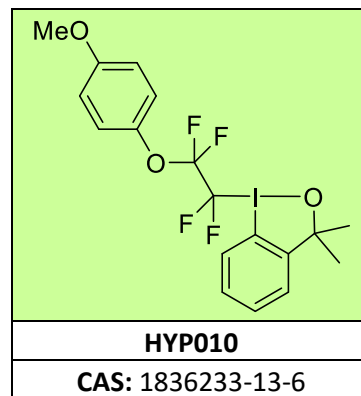
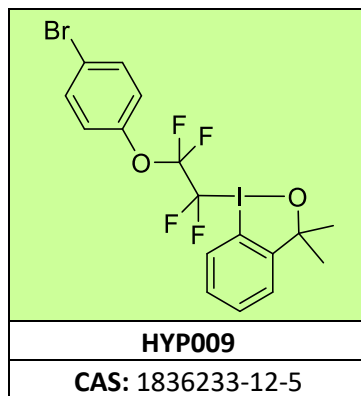
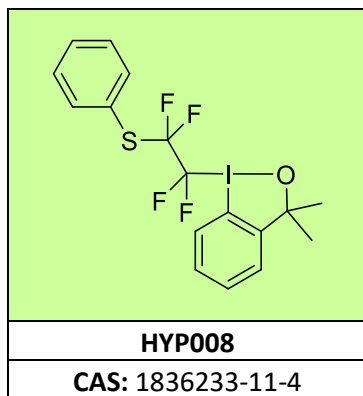
The azole-substituted —CF₂CF₂— „extended Togni reagents“ engage in a radical cyclisation reaction with olefins and acetylenes giving access to rare tetrafluorinated heterocycles. The incorporation of a —CF₂CF₂— moiety into a cyclic structure imparts the molecule a unique combination of properties called „polar hydrophobicity“ – a permanent dipole combined with the solvophobic behaviour of the tetrafluoroethylene unit.

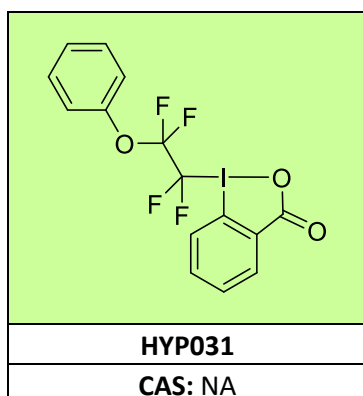
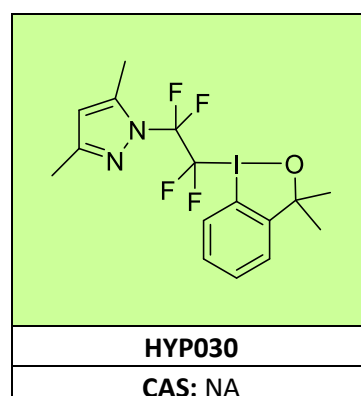
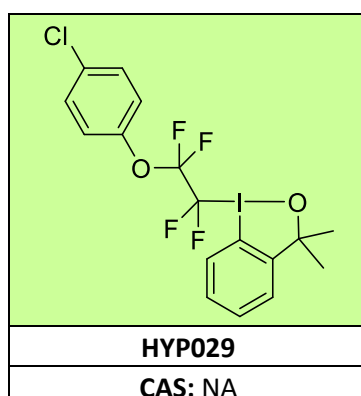
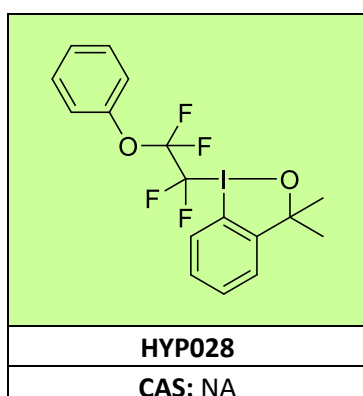
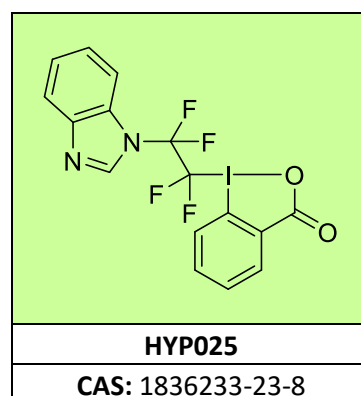
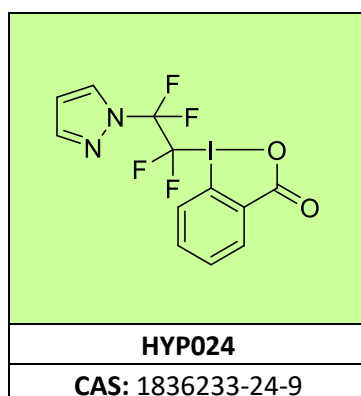
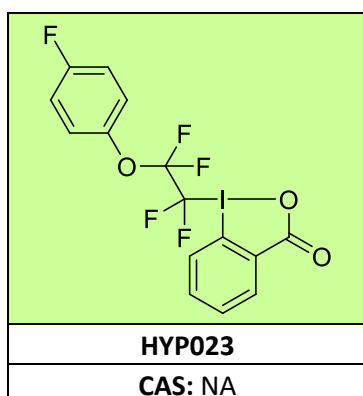
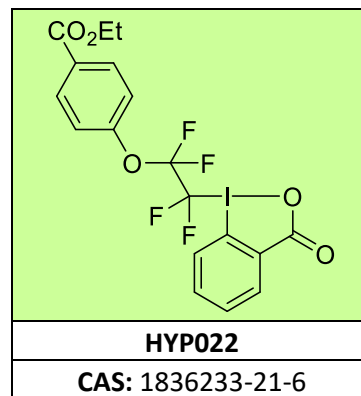
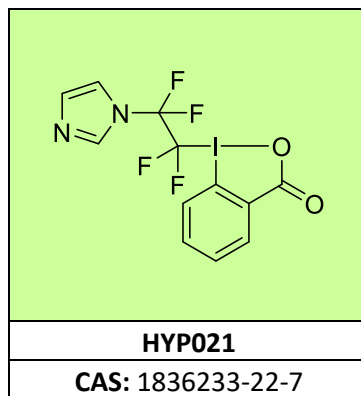
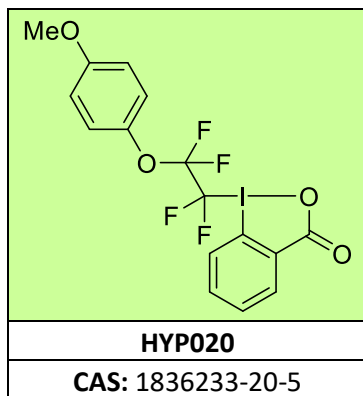


Late stage introduction of —CF₂CF₂R moieties into molecules
 Ref: Chem. Eur. J., 22: 417–424; Patent WO2016019475A1



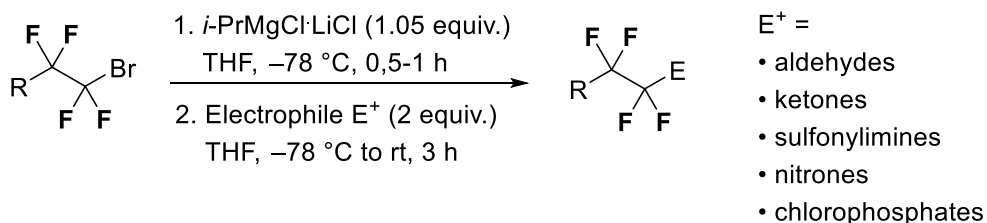
Access to tetrafluorinated di- and tetrahydro(benz)imidazopyridines
 Ref: Org. Lett., 2016, 18 (4), pp 756–759



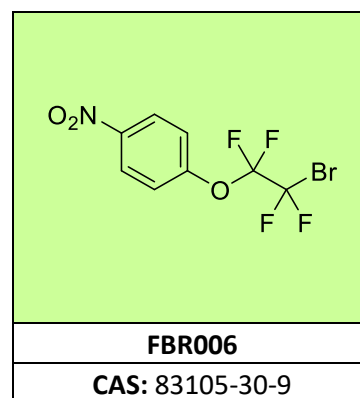
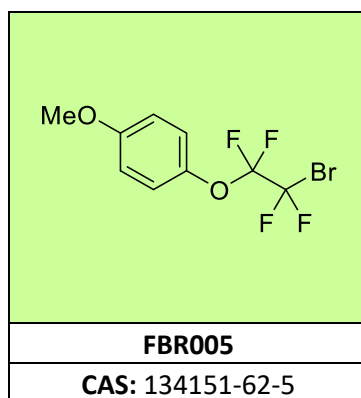
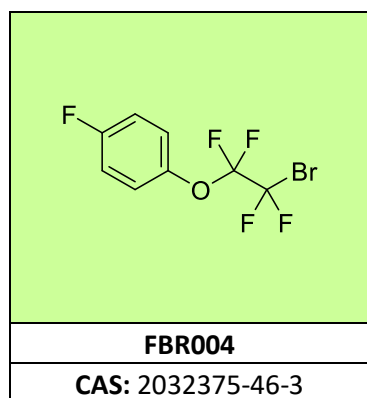
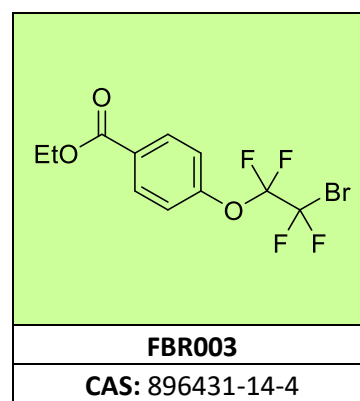
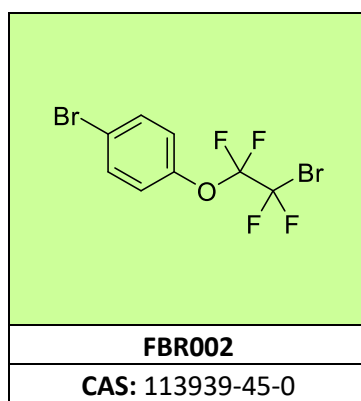
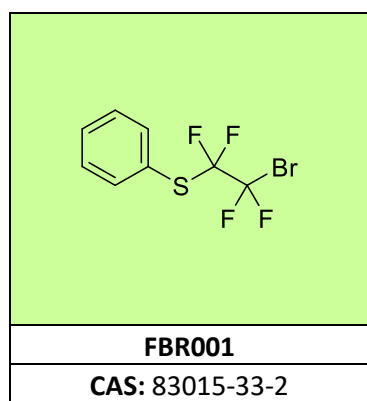


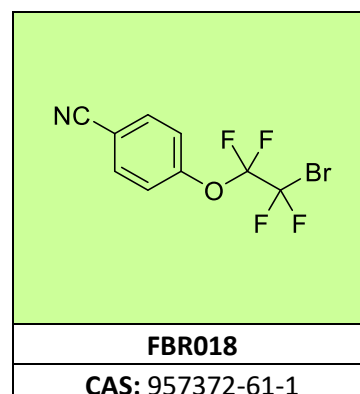
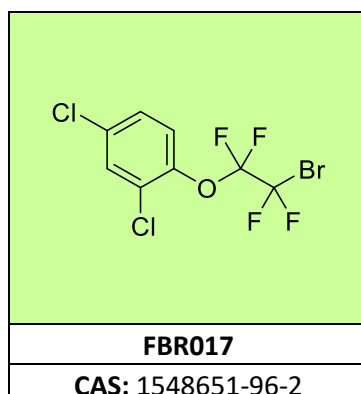
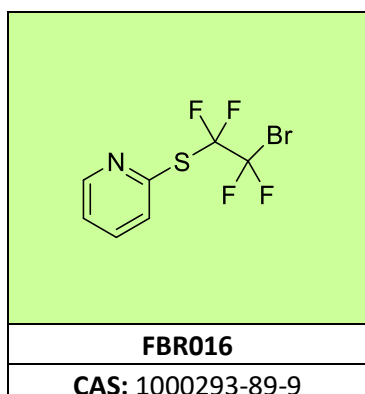
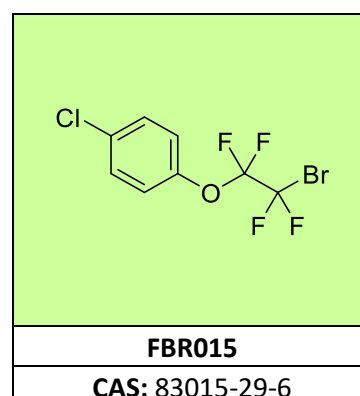
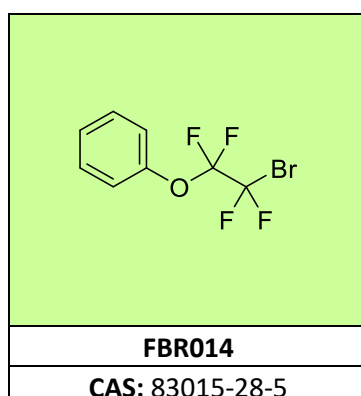
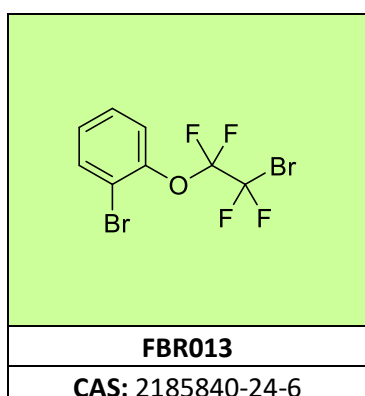
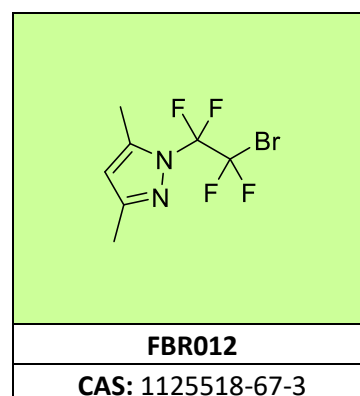
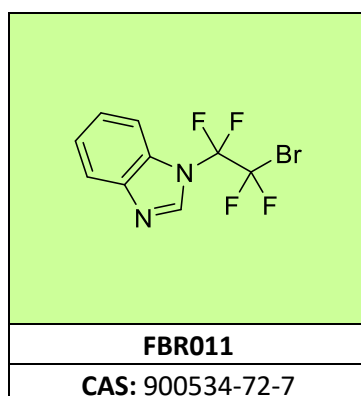
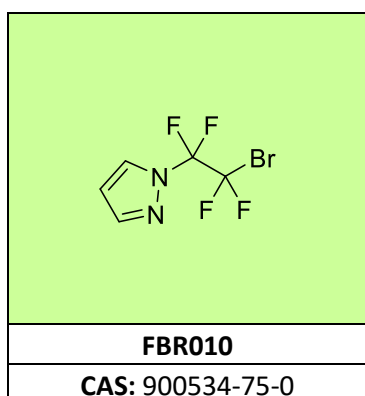
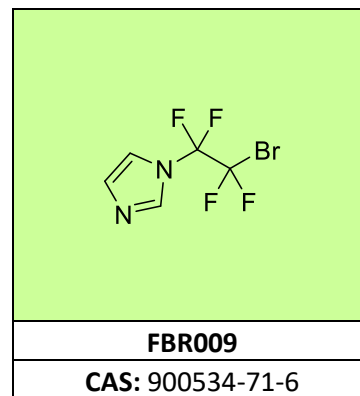
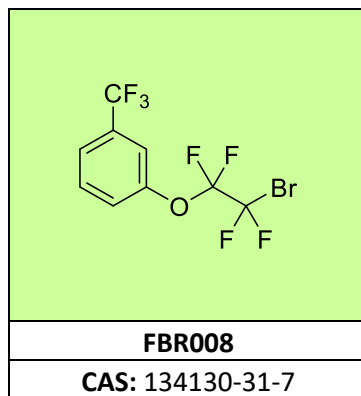
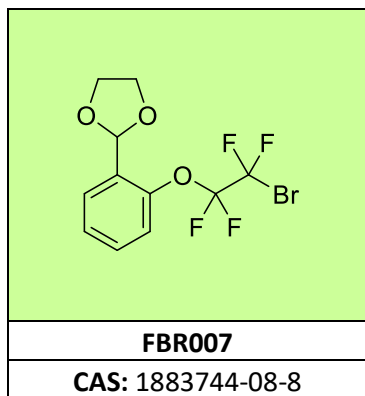
Fluoroalkyl bromides

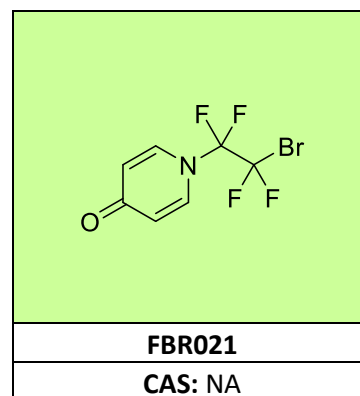
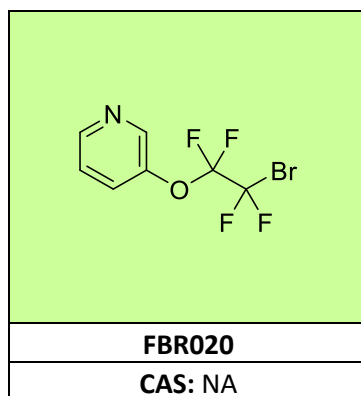
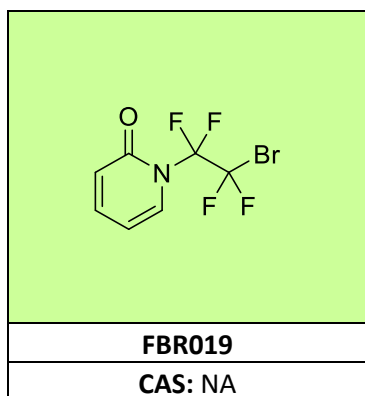
Substituted fluoroalkyl bromides turn into powerful nucleophilic fluoroalkylation reagents after being metallated with isopropylmagnesium chloride-lithium chloride complex (Turbo-Grignard). The in-situ generated fluoroalkylmagnesium chloride intermediate is moderately stable up to $-40\text{ }^{\circ}\text{C}$ and can be efficiently trapped with various electrophiles to afford the $-\text{CF}_2\text{CF}_2-$ linked products.



Ref: Org. Lett., 2016, 18 (22), pp 5844–5847

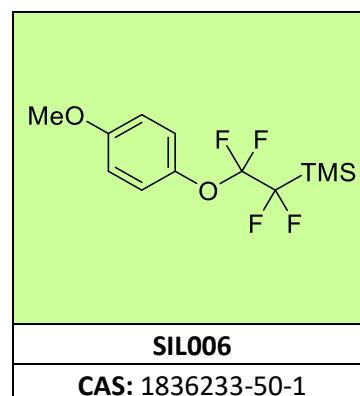
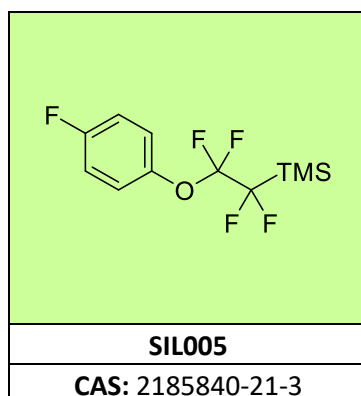
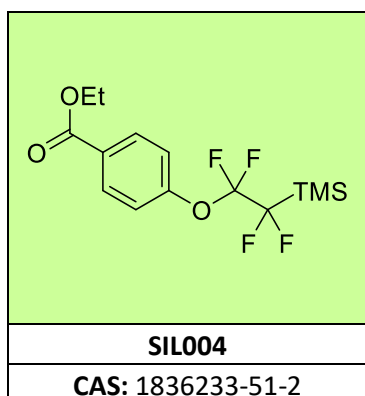
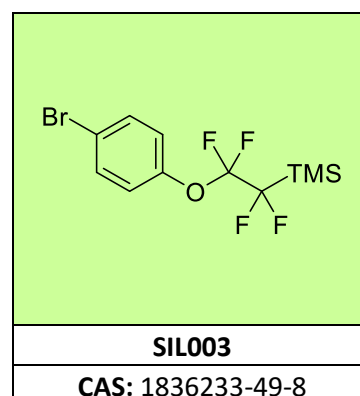
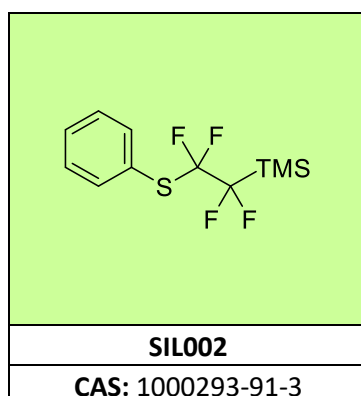
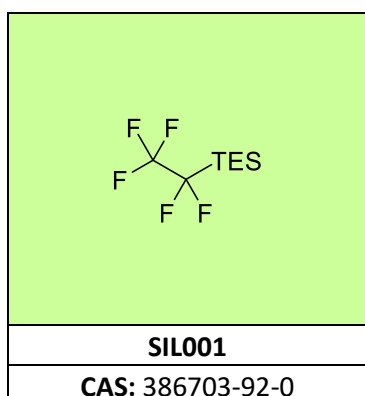
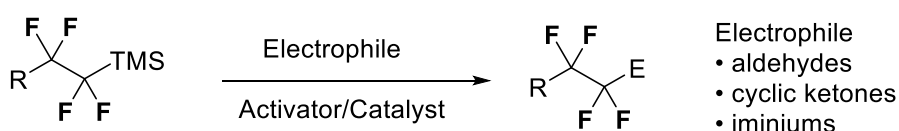


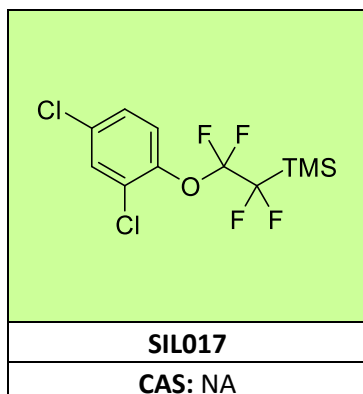
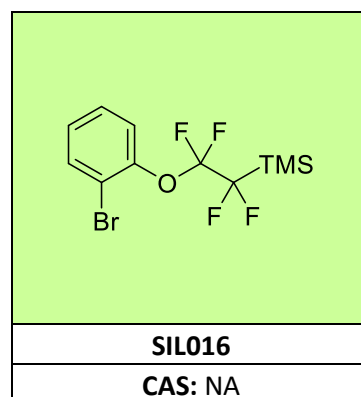
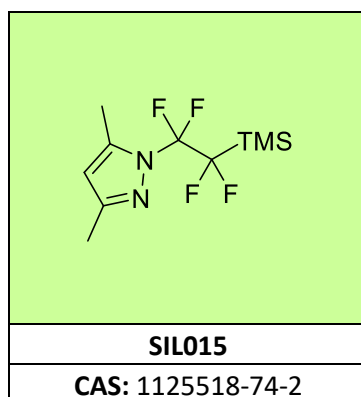
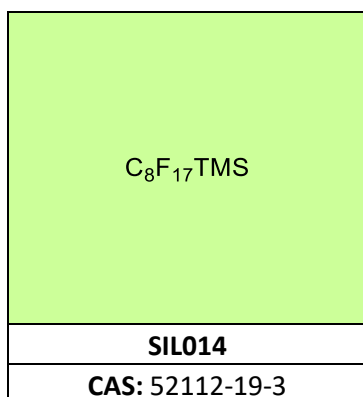
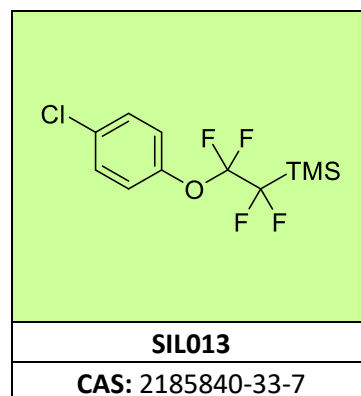
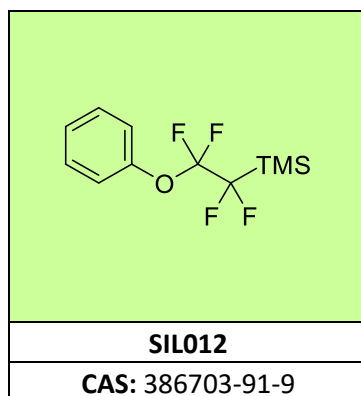
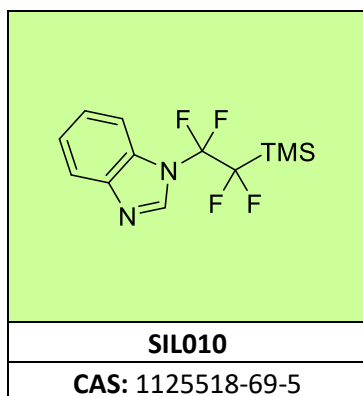
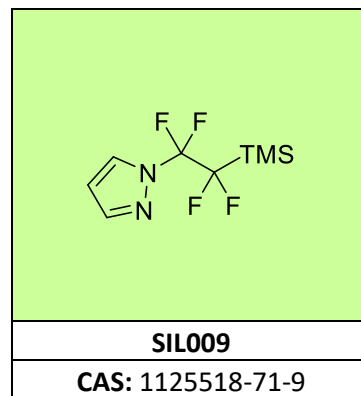
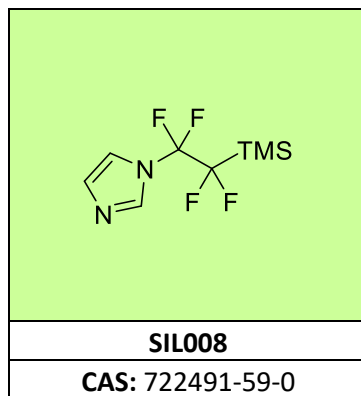
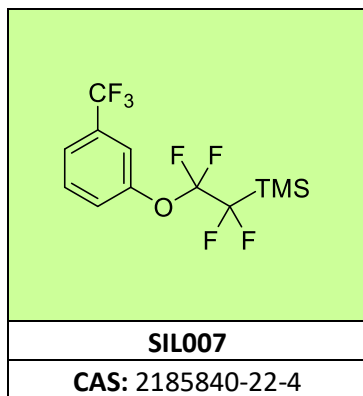




Fluoroalkyl silanes

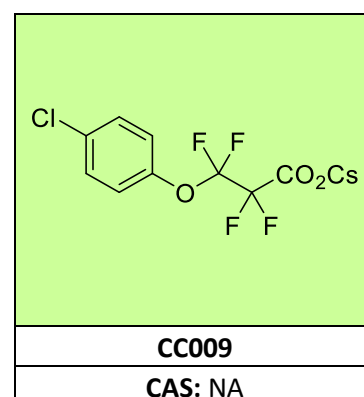
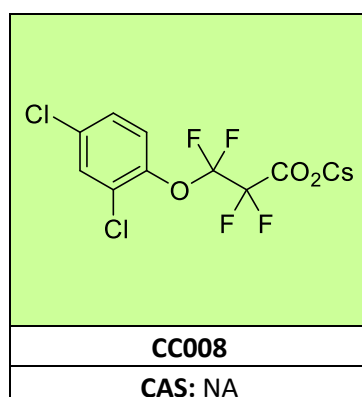
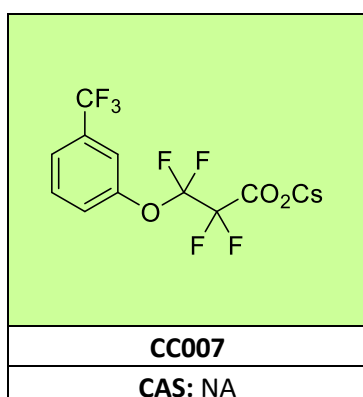
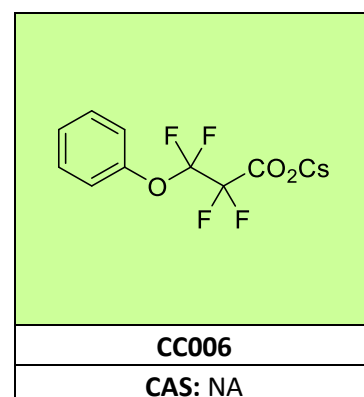
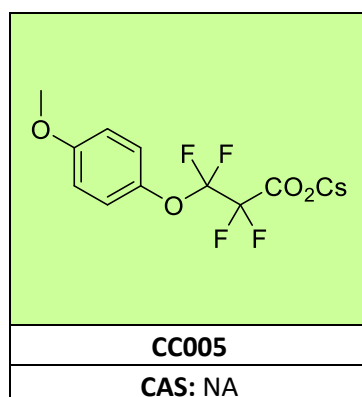
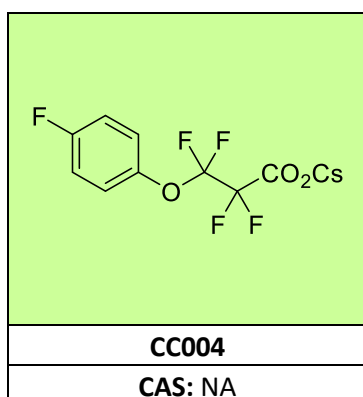
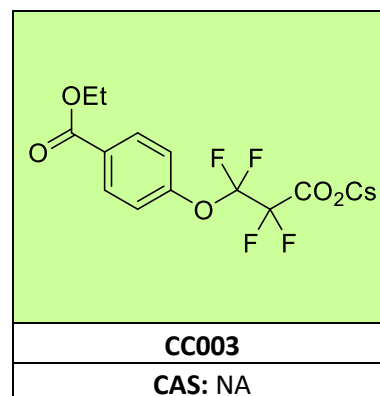
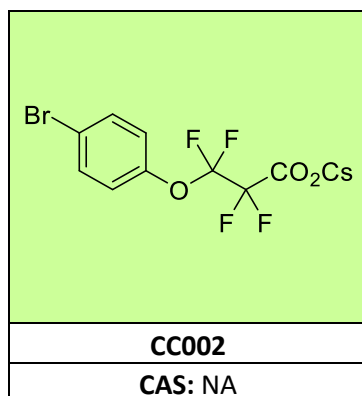
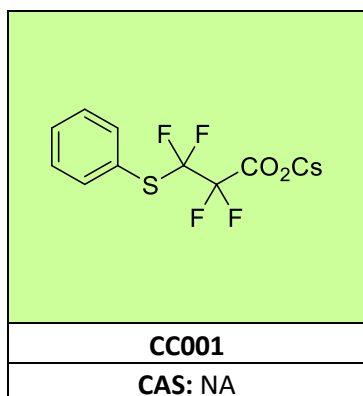
Substituted fluoroalkyl silanes serve as traditional nucleophilic sources of the fluoroalkyl synthon. Upon activation with catalytic fluoride or alkoxide, they can fluoroalkylate a range of aldehydes, reactive ketones or iminiums. The silanes can also engage in transition-metal catalyzed formation of R-CF₂CF₂-substituted aromatics.

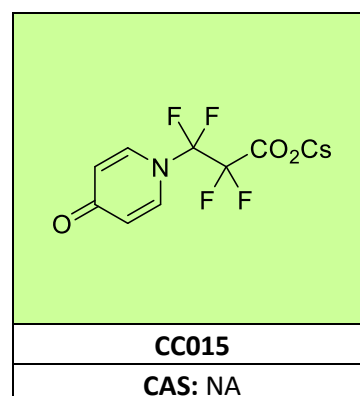
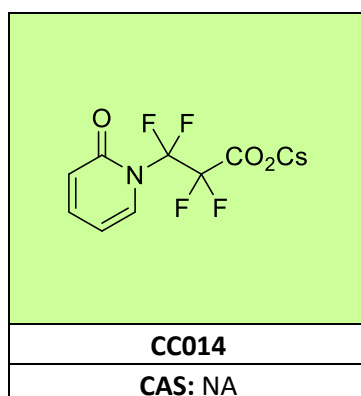
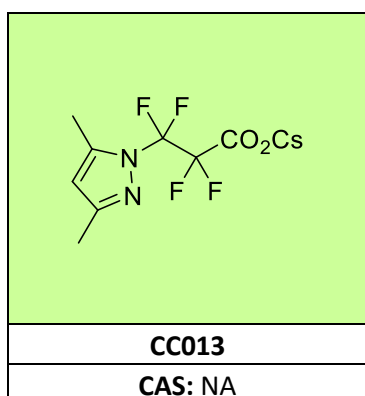
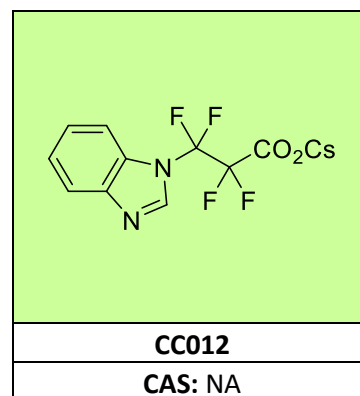
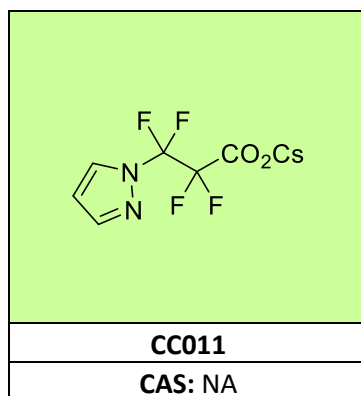
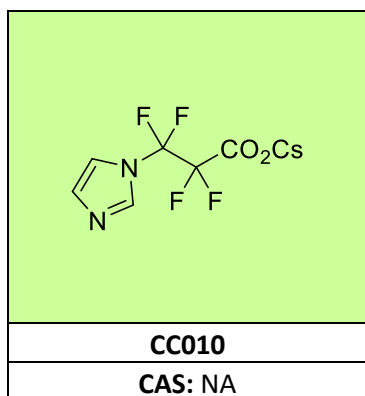




Tetrafluoropropionates

β -Substituted caesium tetrafluoropropionates are convenient starting materials for construction of fluoroalkyl carboxamides. The pKa values of such amide groups are significantly lower than their non-fluorinated counterparts, offering potential to modulate the behaviour of drug candidates. The caesium salts can be easily handled on air due to their reduced hygroscopicity compared to the highly hygroscopic free carboxylic acids.

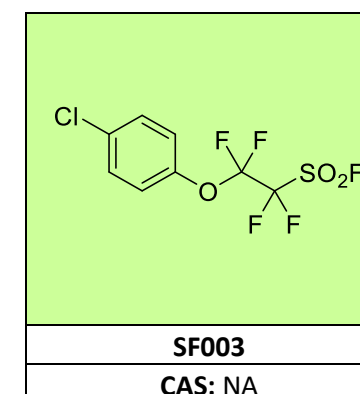
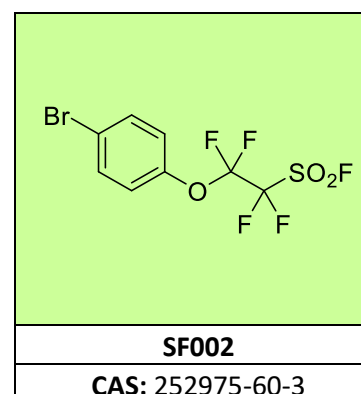
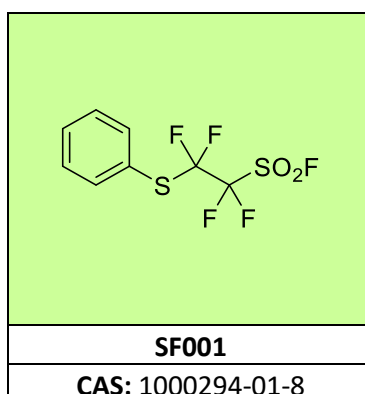


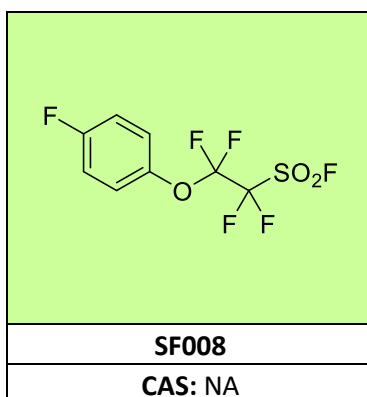
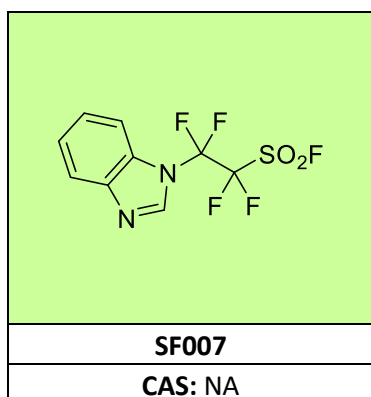
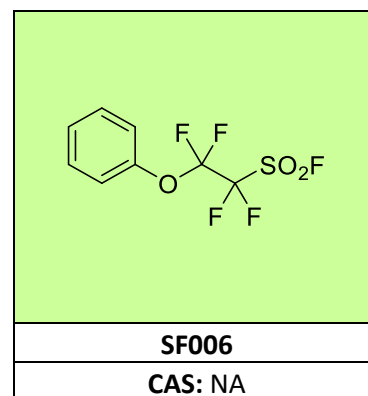
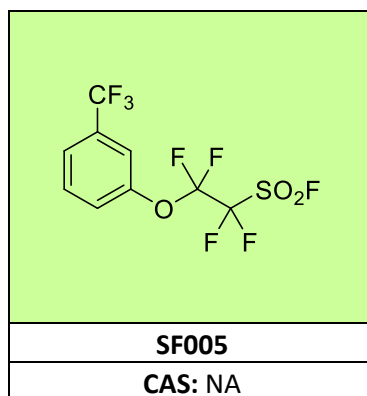
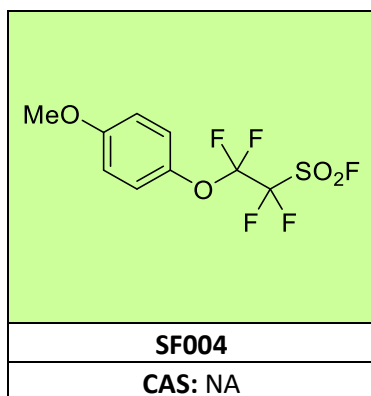


Fluoroalkylsulphonyl fluorides

Fluoroalkylsulphonyl fluorides can be used as moderately reactive electrophilic fluoroalkylsulphonylation reagents. Whereas the related fluoroalkylsulphonyl chlorides can also behave as electrophilic chlorination reagents towards amines affording undesirable *N*-chloroamines, the fluoroalkylsulphonyl fluorides give slower, yet very clean nitrogen sulphonylation to give the corresponding sulphonamides.

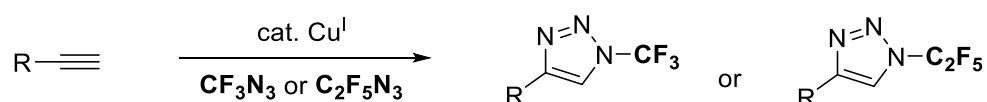
Fluoroalkylsulphonylation of the amine nitrogen greatly lowers the pKa value of NH and can be used to modulate the behaviour of the drug candidate or build additional molecular complexity around the highly acidic fluoroalkylsulphonamide nitrogen.





Fluoroalkylazides

Trifluoromethylazide, pentafluoroethylazide, difluoromethylazide and trifluoroethylazide represent four examples of exotic fluoroalkylazides that are potentially very attractive for medicinal chemistry and agrochemistry discovery programmes. Generally, fluoroalkylazides show much higher thermal stability than their alkyl counterparts, resulting in a good safety profile. Using the well-established copper catalyzed alkyne-azide cycloaddition, various alkynes can be reacted with trifluoromethylazide or pentafluoroethylazide affording regioselectively the 1,4-disubstituted *N*-CF₃ or *N*-C₂F₅ triazoles that would be otherwise very hard to access. *N*-trifluoromethylated azoles have been shown to be robust alternatives to potentially metabolically weak *N*-methyl analogues.



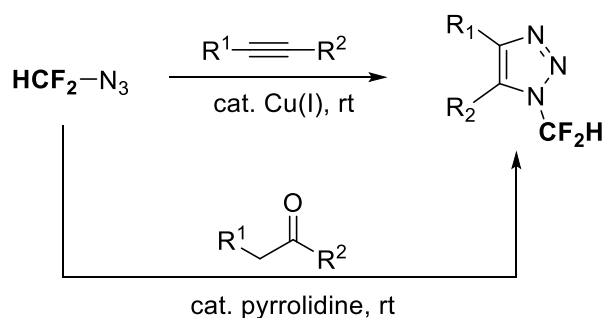
Straightforward and regioselective access to rare *N*-CF₃ and *N*-C₂F₅-1,4-disubstituted triazoles

Ref: Angew. Chem. Int. Ed. 2017, 56, 346

Difluoromethylazide shares practically the same reactivity as trifluoromethylazide in copper catalyzed alkyne-azide cycloadditions, providing expedient access to five-membered *N*-CF₂H heterocycles. Difluoromethylazide provides similar synthetic benefits as other fluoroalkylazides – a broad substrate

scope of regiochemically defined *N*-difluoromethylazoles can be accessed in a much simpler manner than with other synthetic routes.

Besides the established copper catalyzed alkyne-azide cycloaddition, difluoromethylazide was shown to undergo an enamine mediated azide-ketone [3+2] cycloadditions, affording the corresponding *N*-CF₂H triazoles.



Ref: Eur. J. Org. Chem 2018 doi:10.1002/ejoc.201800650

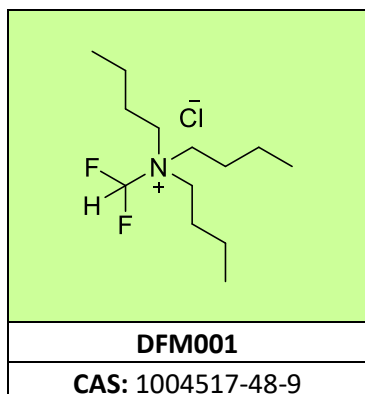
3,3-Trifluoroethylazide represents a complementary fluorinated azide that can be used to access *N*-trifluoroethylated triazoles in a regioselective fashion using the established copper catalyzed azide-alkyne cycloaddition.

CF_3N_3 0,5 M in THF	$\text{C}_2\text{F}_5\text{N}_3$ 0,15 M in THF	HCF_2N_3 1,2 M in DME
FAZ001	FAZ002	FAZ003
CAS: 3802-95-7	CAS: 2055167-74-1	CAS: 41796-84-3
$\text{CF}_3\text{CH}_2\text{N}_3$ 0,6 M in DME		
FAZ004		
CAS: 846057-92-9		

Difluoromethylation reagents

N-Difluoromethyltributylammonium chloride is an effective source of difluorocarbene for difluoromethylation of O-,S-,N-,C- centred nucleophiles under mild conditions. Using only 1.2 equivalent of this reagent, difluoromethylated products can be obtained in moderate to excellent yields under mild conditions.

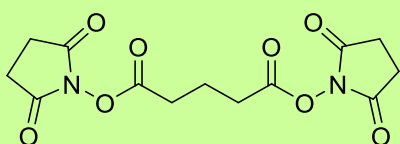
Ref: Chin. J. Chem., 2011, 29, 2717-1721



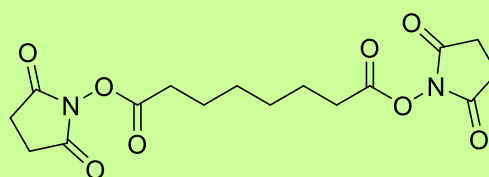
Bioconjugation portfolio

Protein crosslinkers

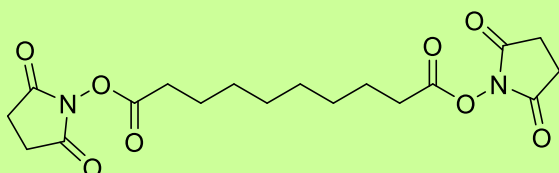
Protein cross-linkers are chemical reagents that play an important role in immunotechnology, structural biochemistry and biology. Protein cross-linking agents can be used to elucidate protein structure and study various protein-protein interactions. Formation of stable covalent bonds between reactive groups contained in protein framework allows easy identification of spatially close domains. The cross-linked conjugates can be identified for example by mass-spectroscopy.

**PCL001**

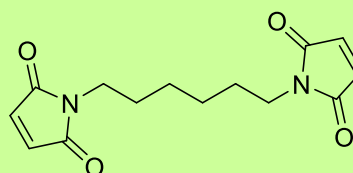
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**PCL002**

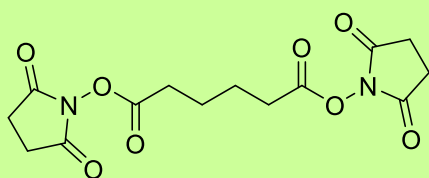
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**PCL003**

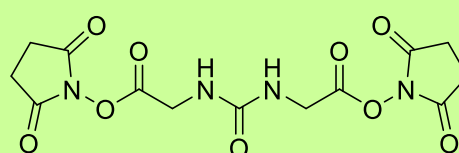
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**PCL004**

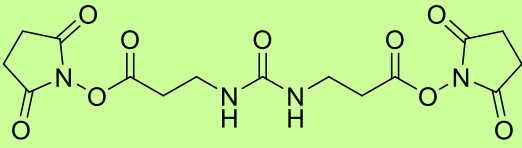
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**PCL005**

CAS: 59156-70-6

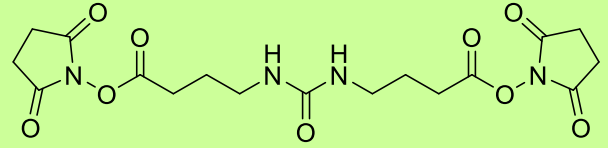
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CAS: 211029-82-2



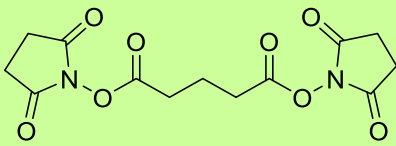
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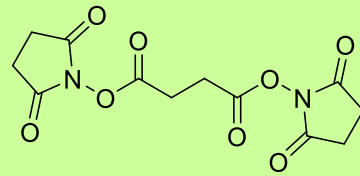
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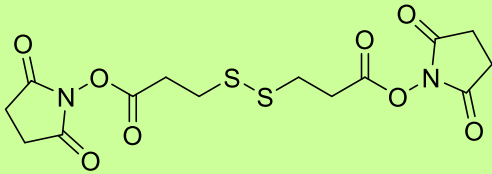
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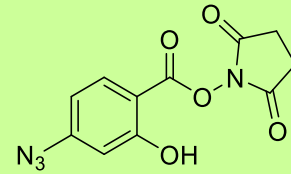
PCL010

CAS: 30364-60-4



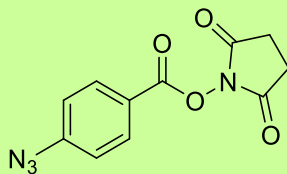
PCL011

CAS: 57757-57-0



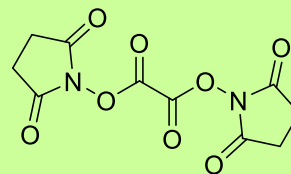
PCL012

CAS: 96602-46-9



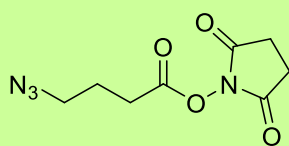
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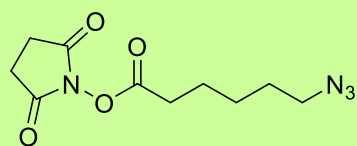
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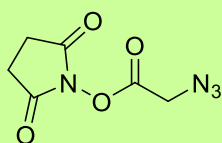
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CAS: 943858-70-6



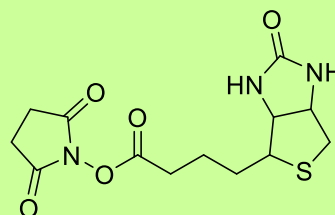
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CAS: 866363-70-4



PCL022

CAS: 824426-32-6



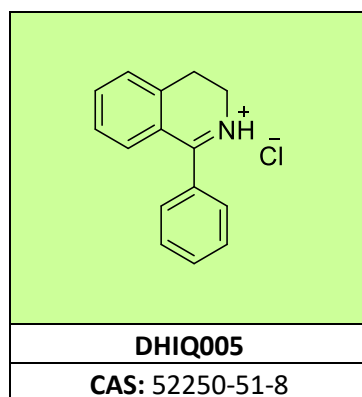
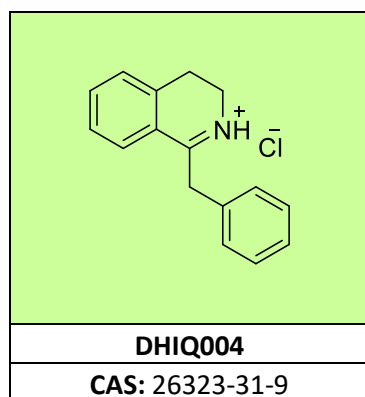
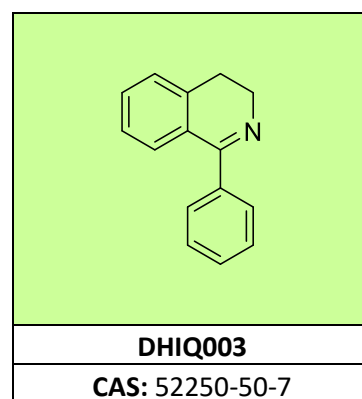
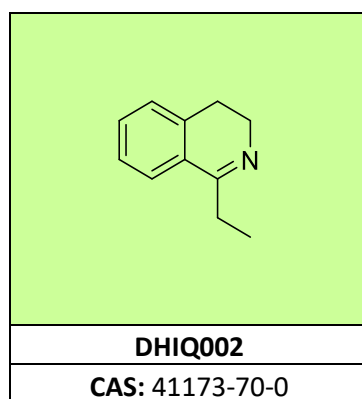
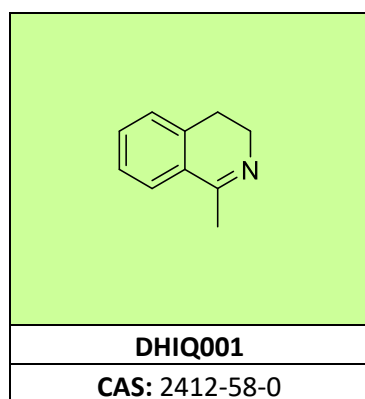
PCL023

CAS: 35013-72-0

Speciality chemicals

Dihydroisoquinolines

Substituted dihydroisoquinolines serve as useful entry points to synthesis of enantiopure tetrahydroisoquinolines by asymmetric hydrogenation, for example by the established enantioselective Ru-catalyzed transfer hydrogenation pioneered by Noyori *et. al.* Furthermore, the imine moiety of the dihydroisoquinolines can be oxidized to the corresponding nitrones which undergo a (3+2) cycloaddition with a range of olefins and acetylenes.



Azide building blocks

We offer a selection of azide building blocks for synthesis.

