Cross-linking

Cross-linking is an attachment of 2 molecules. The resulting "conjugate" is usually expected to associate properties of each initial component, serving several applications in detection and therapeutics.
Beside affinity-based interaction (with antibody or nucleic acid probes), chemical conjugation is the most useful method to cross-link biomolecules, yielding a stable conjugate. Conjugation can be oriented to specific sites of biomolecules, through several chemical reactivities and strategies (see cross-linking methods (reactivities) and technical tips). Cross-linking may require previous or further chemical modifications (page B34), and can be combined to diverse genetic approaches to introduce target sites (usual or non usual nucleotides or amino acids) in nucleic acids or proteins.

Cross-linking Methods and Technical Tips

Cross-linker general structure

Cross-linking reagents have basically two reactive groups at their ends, connected by a spacer arm.

Terminal groups can be :

- **Reactive to highly reactive,** with more or less selectivity for specific target chemical groups. These are typical cross-linkers, used to conjugate other (bio)molecules.One terminus may be non reactive and one call the reagent a "modifier", rather than a linker. Homo-bifunctional cross-linkers have the same reactive groups at both ends, while hetero-bifunctional cross-linkers have different ones.
- **Blocked by protective groups** (t-boc, t-butyl) that can be removed. Such cross-linkers are so rather called linkers, or building blocks.
- **Not or poorly reactive** (COOH, OH) and thus should be activated by organic chemistry methods. Such cross-linkers are so rather called blockers, or building blocks.
- A **label** or a **ligand** may also derivatize one terminus, in so-called "labeling or probing agents".

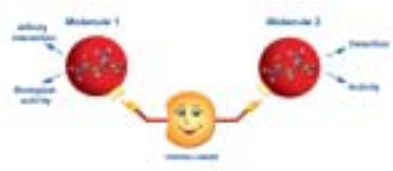
The **spacer** arm separating the reactive groups can vary in nature (acyl chain, cyclohexane or aryl that constraint the structure,...), in lengh, stability...The spacer confers to the conjugate specific properties, depending on its length (i.e. flexibility), structure (i.e. hydrophilicity), as well cleavability or additional functional groups (allowing the cross-linker molecule to be labeled, i.e.iodinated).The important features of spacers are presented page B12.

Cross-linking and modification reactions schemes

For biology applications, cross-linkers with reactivity that is specific of amines, sulfhydryls and aldehydes, and that preferably operates at physiological conditions (NHS, Maleimide), are privileged.

Reactivity to Amines

N-Hydroxysuccinimide esters (**NHS esters**) react with primary amines (lysine and amino termini). Because lysine residues are abundant on the surface of most proteins, these cross-linkers bind efficiently to almost any protein. NHS ester reactions are carried out at pH 7.0-9.0. Cross-linkers that contain NHS esters are usually not water-soluble and are able to cross cell membranes. They are commonly used to couple proteins inside live cells. The sulfonated form of NHS esters (Sulfo-NHS) is water-soluble and is often used for coupling proteins on a cell surface because they are unable to penetrate cell membranes.
Other useful reactivities for amine couplings are **Imido esters** (for more alkaline conditions), **Thiocyanates** (less amine selective), and **TFP.**



Cross-linking of proteins

Protein cross-linking is a widely used method for determining near-neighbor relationships of proteins, three-dimensional structures of proteins, enzyme-substrate orientation, and molecular associations in cell membranes. Cross-linkers are also useful for solid-phase immobilization of proteins, hapten-carrier conjugation, antibody-enzyme conjugation, and immunotoxin and other labeled protein reagent preparation.
Most protein cross-linking reactions occur on side groups of target molecules (i.e. protein) and are nucleophilic reactions, resulting in a portion of the end of the cross-linker being displaced in the reaction (the leaving group). Nucleophilic attack is dependent on the pH, temperature and ionic strength of the cross-linking buffer. When the buffer is of one to two pH units below the pKa of the side chain, the target group is highly protonated and is most reactive. One to two pH units above the pKa, the species are not protonated and not reactive. The majority of proteins have available lysines at the surface of the protein, providing primary amines. Some proteins have cysteines that provide free sulfhydryls when not involved in disulfide bonds. These are the two most commonly used groups for protein cross-linking strategies. Cross-linking strategies may also use hydroxyls from carbohydrates, carboxyls or other functional groups.
Many factors must be considered to obtain optimal cross-linking for a particular application. Factors that affect protein folding (e.g., pH, salt, additives and temperature) may alter conjugation results. Other factors such as protein concentration, cross-linker concentration, number of reactive functional groups on the surface of a protein, cross-linker spacer arm length, and conjugation buffer composition must also be considered.

For more information on cross-linking, please consult the product technical sheets, or refer to 'Bioconjugate Techniques, Greg T. Hermanson, Academic Press, 1996'. (Available as product #366660).

Cross-linking of nucleic acids

Cross-linking and modifying agents for nucleic acids are used for nucleotide synthesis (including automated synthesis) and probe building, as well as for R&D purposes. They use organic chemistry conventional methods, including OH or phosphate specific reactivities. One interesting approach consists to genetically introduce an aminoallyl-nucleotide that can be easily coupled with amine selective reagents (i.e. NHS, see below). See also oligonucleotide-peptide conjugation (application 2 page B31)

Reactivity to Sulfhydryls

Maleimide-containing reagents are most popular for specific, controlled and stable conjugation methods. Maleimides react preferentially with sulfhydryls at pH 6.5-7.5. At higher pH maleimides may cross-react with amines. **Methane thiosulfonate** gives also interesting specific reactions for sulfhydryls.
Other useful reactivities for amine couplings: 1/**Vinyl Sulfone** ; 2/**Haloacetyl**-containing cross-linkers are stable in solution, but they are somewhat less specific to sulfhydryl reaction; 3/**Pyridyl disulfides** are reactive at pH 8.0 or higher and produce a mixed disulfide that can undergo further reduction to break the cross-link.

Sulfhydryl addition or disulfide reduction

The sulfhydryl acts as a convenient "handle" for generating specific cross-links to the protein, because they are not largely present. One approach consists in introducing free sulfhydryl groups into a protein, chemically or by genetic engineering. SATA, SPDP and Traut's Reagent are popular to modify primary amines converting them to free or protected sulfhydryls. TCEP>DTT>ME>2MEA>cysteine (by order of decreasing reducing strength) generate free sulfhydryls from disulfides within the protein. They differ by their ability to cleave in hydrophilic (TCEP) and hydrophobic (DTT) protein regions. Free sulfhydryls are favored at pH <7.0. Disulfide formation is favored above pH 7.5. Addition of EDTA can prevent oxidation of sulfhydryls by trace metals. Degassing buffers further protects sulfhydryls from oxidation. Sulfhydryls are not well stable in solution and should be processed as soon as possible. Desalting is the best approach for removing sulfhydryl derivatization reagents and reductants as it can be accomplished quickly.

Reactivity to Aldehydes (& Hydroxyls from Carbohydrates)

Carbohydrates are often oxidized with sodium periodate to form aldehyde groups. The aldehyde groups react with **hydrazides** to form a stable cross-link. Amines are also reactive with oxidized carbohydrate, but they typically require the addition of a reductant to form a stable cross-link. Our hydrazone chemistry is a breakthrougput (page B31).

Reactivity to Carboxyls

Using **Carbodiimides**, carboxylate groups can be coupled to primary amines at pH 4.0-7.0. EDC is a zero-length cross-linker that activates carboxyl to react with primary amines, forming amide bonds.

Photo reactivity (Non-Selective)

Non-selective cross-linking of **aryl azides** (phenyl azide) occurs by exposure of a photoreactive group to a short wavelength UV light. These cross-linkers are particularly useful for cross-linking protein:protein interactions in vivo. A protein is tagged with the photoreactive group and then incubated with a sample. When exposed to UV light, the photoreactive group binds to other proteins that are near the tagged protein.

Fluorescent labeling ?
See page B60

Spacers and other crosslinking tips

Spacer lengh

The lengh of the arm should for considered for the stereoscopic availability during the conjugation step, and then the availability of the conjugated biomolecules for their ligands (receptors, substrates…, avidin for a biotin conjugate). A longer spacer is often thought to improve the biological activity of conjugates.

Spacer nature

The chemical nature of a spacer results in specific features that may be critical in some applications:

- The aryl-structure of GMBS was found less immunogenic than the aromatic spacer of MBS.
- A linear spacer allows a certain flexibility, hence often better availability of biomolecules, while constrained structures can either favor or impeach the right orientation of the 2 biomolecules within the conjugate for a given ligand interaction. This is critical in protein structure studies.

***Cleavable Cross-linkers**

Some cross-linker are designed to be cleavable by chemical methods, using reducing agents, base, periodate or hydroxylamine. This is useful to release one conjugated molecule (a label, a drug...) at a defined site, or in definite conditions. The condition of cleavability should be considered depending on your application, as well as modifications resulting in cleaved fragments that may be desired or detrimental.

Cross-linking and spacer features
The spacer features are important to consider getting optimal conjugates.

Membrane permeability / Water-solubility
Cross-linking (and labeling) reagents have different hydrophobic patterns that are important in biological applications. Polar properties, and subsequent hydrophilicity, are conferred typically by sulfonyl groups of certain derivatives (sulfo-NHS), or by the spacer nature (PEO). For example, lipophilic reagents cross the biological membranes and react (label) both outside and inside biomolecules.
At the opposite, polar reagents should be used if only outside exposed proteins should be labeled on cells. Additionally, polar reagents can be added directly in aqueous buffer, eliminating the need of organic solvent that may be undesired or toxic (DMSO).

PEO/PEG spacers
PolyEthyleneGlycol structure (PolyEthylOxy: **PEO**) is useful to obtain spacers with improved features compared to conventional spacers (i.e. alkyls based), or to obtain specific properties (hydrophilicity, flexibility, adjustable length...).

PEG/PEO technology benefits :

- Increases water-solubility
- Minimizes aggregation of conjugates or conjugates/ligands complexes
- No immunogenicity
- Increases bio-stability
- Reduces non-specific bindings on surfaces

New insight
A new method of preparation of complexes of proteins with PEO : a novel type of dendritic structures.
Non-covalent complexes have been obtained between Polyethylene Glycol (PEG) and proteins (alpha-chymotrypsin (ChT), lysozyme, bovine serum albumine) under high pressure. The complex fully retains its secondary structure, and elicits unchanged kinetic constants for enzymatic hydrolysis.
Topchieva et al, Bioconjug Chem. 2000 Jan-Feb;11(1):22-9: Non-covalent adducts of poly(ethylene glycols) with proteins.

Technical tip

The chief advantage of the PEO technology is to confer **superior water-solubility.** It eliminates or reduces the need to use organic solvent such as DMSO. Compared with Sulfo group introduction strategy (i.e. in Sulfo-SMCC), not only the solubilization is eased, but also the **hydrophilic properties are transferred to resulting modified molecules !**

Applications span in chemistry and biochemistry, notably with peptides and proteins, for bioassays to therapeutics and other biotechs. In example PEO spacers increase or confer solubility to peptides and conjugates, especially for otherwise intractable sequence. They separate peptide or oligonucleotides chain from reporter groups such as fluorescent label or biotin or enzymes while maintaining hydrophilic pattern. Additionally, PEO spacers improve the biological activity of bioconjugates (reduced immunogenicity, proteolytic degradation, which result in limited shelf life in diagnostics and short half-life in body in therapeutic applications). PEO spacers were a successful approach to improve the pharmaco-kinetics profile of a linked drug, leading to novel prodrugs, as well as to create hydrogels. PEO have also benefits to modify surfaces (lower background, higher signal...).

Purity, low polydispersity and low diol contents are key quality parameters. Our PEO linkers are prepared from highly purified PEG to ensure a homogeneous product free from contaminating PEG oligomers.

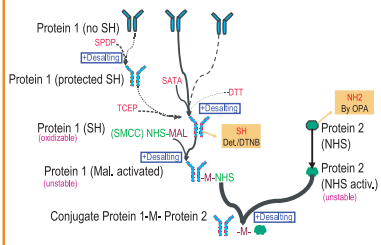
Find our PEO containing linkers in the complete list in page B.15, or detailed presentations of several PEO cross-linkers (amine reactive : page B.20, sulfhydryl reactive : page B.27) and biotins (page B.41).

Oriented Coupling strategies

Maleimide/succinimidyl chemistry **has become** a standard chemistry for protein-to-protein oriented conjugation.

Despite very good performances in coupling, the technique suffers of several limitations. Because it needs free sulfhydryl presence in one molecule to be coupled, it requires (at least for molecules devoid of Cys) a genetic engineering for introduction of Cys residues, or a biochemical conversion of other groups (amines) into sulfhydryls. The biochemical reduction of already present disulfide bridges will lead to non-native state coupled molecules. Because of sulfhydryls susceptibility to oxidation by air, a reduction by DTT before conjugation is usually performed, that requires an additional desalting step. Succinimidyl, but also maleimide, should react in timed delay because of hydrolysis competition, hampering the final yield. As Cys residues are often involved in the biological activity, the maleimide strategy leads then to unstable or inactive conjugates. Finally, intramolecular cross-linking may occur (NH2 and SH bearing molecules), cross-linking is quite polymorphic, and coupling ratio are not easy to control.

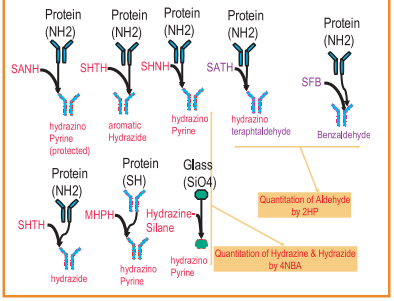
Conjugation Strategie/NHS-MAL



Hydrazone technology provides solutions to each of these points :

- Proteins or other molecules that lack Cys residues or which Cys residues are involved in secondary structure or function, can be easily coupled.
- Biochemical modifications are distinct in the 2 biomolecules, and avoid intramolecular cross-linking.
- Biochemical modifications are stable, hence can be better quantified to adjust concentration ratio for the coupling step. Modified proteins can even be stored and different couplings can be performed with the same batch for greater flexibility with excellent reproducibility.
- Other modifying agents allow coupling schemes to thiols (with MHPH), Silanols (with Hydrazine silane)

Conjugation Strategie/Hydrazone



Crosslinking Kits

Interchim provides a ready-to-use kit to conjugate easily and efficiently 2 purified proteins in controlled way (oriented coupling).

For other conjugations strategies, including the popular maleimide/sucinimidyl one (see the technical tip), please order separate components. Example of key reagents :

Description	Cat.#	Qty
Sulfo-SMCC	**UP17412A**	100 mg
Desalting columns	**UP84874A**	20 columns
DTNB	**UP01566H**	1 g
TCEP	**UP242214**	1 g

HydraLink™ Controlled Amine™ Conjugation Kits

Complete kits for the conjugation and oriented immobilization of amine-containing biomolecules.
Here is a great way to get started with easy and performing bioconjugation chemistry! Simply modify each molecule and mix to yield the desired compound! You get oriented and active conjugates with high yield, which will make you forgot conventional chemistry with aldehyde or SMCC.

Description	Cat.#	Qty
HydraLink™ Controlled Conjugation Kit 2-SHTH	**BL1521**	1 kit
HydraLink™ Controlled Conjugation Kit 1-SANH	**BL1501**	1 kit

The conjugation includes 2 simple steps using the Hydralink™ technology:
1-modification of amines from biomolecule1 in hydrazine (-NH-NH2) or hydrazide by reaction with SANH or SHTH, and modification of amines from biomolecule2 in aldehydes by reaction with SFB.
2-conjugation of modified molecules to form a stable hydrazone bond (-NH-NH-)
3-desalting

The Hydrazone chemistry is so simple, flexible, selective, efficient and reproducible ! Benefits of the chemistry :

- Biomolecules can be activated independently
- Activated biomolecules are stable for months
- Better control of coupling ratio (quantitate modifications before coupling)
- No reduction or deprotection step is required.
- Excellent yields
- Highly selective for heteroconjugation (oriented and controlled conjugation)
- Very stable
- Conjugates that retain inherent biological activity of its components

Applications : flexible technique for a variety of molecules

- Suits for proteins and any amine containing or derivatized molecules and supports : proteins, peptides or oligonucleotides, cDNA, carbohydrates, oxidized glycoproteins, fluorophores, beads, glass, silica... have also been successfully coupled.
- Suitable for surface modification and conjugation (immobilization)
- Suitable for solid phase synthesis (oligonucleotides, peptides)

TecLinKit

This kit allows converting amines to hydrazine, and Tc chelation.
Please inquire for any information.

Description	Cat.#	Qty
TecLinKit	**BL1541**	1 kit

Hydrazone linkers : see page B.31

Technical tip

Heterobifunctional cross-linkers (see page B20) contain 2 different chemical reactive groups. They allow targeting a defined reactive group on one molecule (i.e. SH or CHO) that is chosen for particular reasons, as localization on the peptidic chain, absence on other molecules, insertion of a terminal Cys residue... It is taken to good account to design oriented conjugates of 2 different molecules:

- Study of protein structure, and ligand/receptors complexes
- Reticulation of big biomolecules (stabilization, fixation for IHC,...)
- Immobilization to supports (microplates, sheets, beads,...)
- Antibody conjugates (immunoreagents, immunotoxins,...)

Homobifunctional cross-linkers (see page B25) contain 2 identical chemical reactive groups. Besides dimeric conjugates (but also some tri- and oligomers)intramolecular linkings are formed (reticulation), or different molecules. Hence, homobifunctional cross-linkers are dedicated mostly to coupling same molecules together or to immobilization, for production and special studies :

- Immobilization of ligands to supports (plates, gels, beads)
- Production of polymers at big scale (antigens...)
- Reticulation of big molecules / complexes, and membranes
- Design of multimers
- Study of natural polymers...

Photoreactive cross-linkers (see page B30) have the particularity that chemical reactivity is induced by illumination. They are original tools useful when cross-linking should occur in a defined site (organ, cell, compartment) or in a defined time, or when classic reactivities are not working properly. The reaction is not specific, working with almost all molecules containing hydrogen. Main applications are :

- Physiological studies (receptor/ligand study in cell or in-vivo)
- Conjugation of difficult molecules (steroids...)

Most of our cross-linkers are listed in the table page B15, with main characteristics which allow you to select by reactivity, spacer type or length... Important cross-linkers are also presented in detail by categories :

- Heterobifunctional [Mal-NHS (B20), HAL-NHS (B23), SH/Carbonyl (B24)]
- Homobifunctional [NHS-NHS (B25), MAL-MAL (B26), cleavable (B26)]
- Photoreactive [(B39)],
- Hydrazone chemistry [(B31)]

In the following table, products are listed in alphabetic order of usual name, without taking in account prefixes as 'Sulfo', 'C6', 'numbers', 't-Boc', 'Fmoc'.

Please look at page B.19 for table legend.

See also kits for Immobilization of ligands onto matrices : AmiRGel

Crosslinking

Product Name	C.A.S.	M.W.	Functional group(s) Group 1	Group 2	Group 3	Type	Spacer Lenght	Cleavability	Iodinatable	Water Solubility	Description
ABH	UP87750A	177.16	PhA	HYD		Arom	11.9 Ang.	No	Yes	No	B30
AMAS (MAL-CH2COO-NHS)	92161B	252.18	NHS	MAL		Linear	4.4 Ang.	No	No	No	
AMSA	07939A	174.18	/NH2	SH§		Alkyl	4 Atoms	HydroxylA.	No		
ANB-NOS	522191	305.2	NPhA	NHS		Linear	7.7 Ang.	No	No	No	
APDP	UP852670	446.55	HPhA	PThio		Linear	21 Ang.	Thiols	Yes	No	B30
APG	UP28071A	193.16	PhG(arg specif.)	PhA		Arom	9.3 Ang.	No	No	Yes	B28
ASBA	UP66329A	249.27	HPhA	NH2		Alkyl	16.3 Ang.	No	Yes	No	B30
BASED	67018A	474.52	HPhA	HPA		Linear	21.3 Ang.	Thiols	Yes	No	B28
BMB (Bis-MaleimidoButane)	L7731A	248.24	MAL	MAL		Alkyl	10.9 Ang.	No	No	No	
BMDB	L7732A	280.23	MAL	MAL		Linear	10.2 Ang.	Periodate	No	No	
BMH	41613A	276.29	MAL	MAL		Alkyl	16.1 Ang.	No	No	No	
BMME	BJ004A	236.18	MAL	MAL		Linear	3 Atoms	No	no		
BMME (MAL-CH2OCH2-MAL)	BJ004A	236.18	MAL	MAL		Linear	3 Atoms	No	No		
BMOE	L7730A	210.19	MAL	MAL		Alkyl	8 Ang.	No	No	No	B27
BMP(2)	BJ003A	268.23	MAL	MAL		Arom	4 atoms	No	Yes		oPDM
BMP(4)	BJ002A	268.23	MAL	MAL		Arom	4 Atoms	No	Yes		pPDM
BMPA	UP43064A	169.13	MAL	COOH		Alkyl	5.9 Ang.	No	No	Yes	
BMPH (MAL-sc-Hydrazide)	L7725A	297.19	MAL	HYD		Alkyl	8.1 Ang.	No	No	Yes	B24
BMPS	L7726A	266.21	NHS	MAL		Alkyl	6.9 Ang.	No	No	No	
BNPS-Skatole	UP20955A	363.2	Clivage(Try)			-				Yes	B35
t-Boc-amido-PEO3-amido-Br	AK7871	441.36	/NH2	NH2§		PEO	19.3 Ang.	No	No	Yes	
t-Boc-amido-PEO3-NH2	AK7881	320.43	NH2	NH2§		PEO	16.9 Ang.	No	No	Yes	
N-t-Boc-amido-PEO4-COOH	BI0601	365.42	NH2§	COOH		PEO		No	No	Yes	
t-Boc-amido-PEO4-OH	BH8851	293.36	NH2§	OH		PEO	14.3 Ang.	No	No	High	
6-Boc-HNA	BL9750	243.18	COOH	HYDin§		Hydrazone		No			
6-Boc-HNA-O-NHS	BL9770	350.3	NHS	HYDin§		Hydrazone		No			
Boc-HTA	BL9810	280.3	COOH	HYD§		Hydrazone		No			
Boc-HTA-O-NHS	BL9820	377.4	NHS	HYD§		Hydrazone		No			
t-Boc-lc-NHS	BI1451	328.36	NHS	NH2§		Alkyl	7.7 Ang.	No	No	No	
BSHD	BI0221	540.61	NHS	NHS		Alkyl	16 Atoms	HydroxylA.			
BSOCOES	UP28069A	436.35	NHS	NHS		Linear	13 Ang.	Base	No	No	B25
Sulfo-BSOCOES	UP26531A	640.44	NHS	NHS		Linear	13 Ang.	Base	No	Yes	
BSSeb	UPG9912A	396.39	NHS	NHS		Arom	10 Atoms	No	No		
N-CBZ-amido-PEO12-COOH	BI0651	751.86	NH2§	COOH		PEO	46.5 Ang.	No	No	Low	
CBZ-amido-PEO3-NH2	BH9841	354.44	NH2	NH2§		PEO	16.9 Ang.	No	No	High	
N-CBZ-amido-PEO4-COOH	BI0621	399.44	NH2§	COOH		PEO	19.2 Ang.	No	No	High	
N-CBZ-amido-PEO8-COOH	BI0651	575.65	NH2§	COOH		PEO	32.2 Ang.	No	No	Low	
CH3-O-PEO4-Tosylate	BH9120	362.44	Tosylate	OH§		PEO	15.4 Ang.	No	No	Yes	
COOH-PEO4-O-Benzyl	BH9071	333.34	COOH	OH§		PEO	18 Ang.	No	No	High	
COOH-PEO4-O-CH3	BH9101	236.26	COOH	OH§		PEO	15.6 Ang.	No	No	High	
COOH-PEO8-COOH	BH8831	426.46	COOH	COOH		PEO	28.8 Ang.	No	No	High	
COOH-PEO6-COOH	BH8821	338.35	COOH	COOH		PEO	21.7 Ang.	No	No	Yes	
DCC	01202A	206.33	Carbodiimide	Carbodiimide		N/A	0 Ang.	No	No	Yes	
DMA	UP09962A	245.15	ImidoEster	ImidoEster		Alkyl	8.6 Ang.	No	No	Yes	
DMP	UP362009	259.18	ImidoEster	ImidoEster		Alkyl	9.2 Ang.	No	No	Yes	
DMS	UP06633A	273.21	ImidoEster	ImidoEster		Alkyl	11 Ang.	No	No	Yes	
DPDPB	UP09833A	482.71	PThio	PThio		Linear	19.9 Ang.	Thiols	No	No	B27
DSB	BJ0061	327.25	NHS	NHS		Alkyl	14.7 Ang.	No	No		
DSD	BI0231	424.45	NHS	NHS		Arom	12 Atoms	No			
DSG	298591	326.26	NHS	NHS		Alkyl	7.7 Ang.	No	No	No	
DSP	UP18971A	404.42	NHS	NHS		Linear	12 Ang.	Thiols	No	No	B26
Sulfo-DSP (DTSSP)	UP43432A	608.51	NHS(s)	NHS(s)		Linear	12 Ang.	Thiols	No	Yes	B26
DSS	UP28065A	368.35	NHS	NHS		Alkyl	11.4 Ang.	No	No	No	B25
Sulfo-DSS (BS3)	UP54940A	572.43	NHS(s)	NHS(s)		Alkyl	11.4 Ang.	No	No	Yes	B25
DST	UP280681	344.23	NHS	NHS		Linear	6.4 Ang.	Periodate	No	No	B26
Sulfo-DST	UP24864A	548.34	NHS(s)	NHS(s)		Linear	6.4 Ang.	Periodate	No	Yes	B26
DTBP	UP997960	309.28	ImidoEster	ImidoEster		Linear	11.9 Ang.	Thiols	No	Yes	
DTME	L7734A	312.37	MAL	MAL		Linear	13.3 Ang.	Thiols	No	No	
DTNB	UP01566	396.35	/SH		ChromoLabel			Yes		Yes	B39
DTPA	UP639727	300.4	PhA			Linear	10 Atoms	Thiols	Yes		B28
DTT	UP284250	154.25	/SS			-		-		Yes	B35
EDC (EDAC)	UP52005B	191.71	Carbodiimide	Carbodiimide		N/A	0 Ang.	No	No	Yes	
EGS	UP28067A	456.37	NHS	NHS		Linear	16.1 Ang.	HydroxylA.	No	No	B26
Sulfo-EGS	UP24455A	660.45	NHS(s)	NHS(s)		Linear	16.1 Ang.	HydroxylA.	No	Yes	B26
EMCA	L7728A	211.21	MAL	COOH		Alkyl	9.4 Ang.	No	No	Yes	
EMCH	90038A	339.27	MAL	HYD		Alkyl	11.8 Ang.	No	No	No	B20
EMCS	UP19548B	308.29	NHS	MAL		Alkyl	9.4 Ang.	No	No	No	
LC-EMCS	BI1221	421.45	NHS	MAL		Alkyl	16.8 Ang.	No	No	No	
Sulfo-EMCS	UPL7729A	410.34	NHS(s)	MAL		Alkyl	9.4 Ang.	No	No	Yes	
FeBABE	UP994760	589.14	/SH	Clivage		-		No		Yes	B35

Product Name	C.A.S.	M.W.	Functional group(s) Group 1	Group 2	Group 3	Type	Spacer Lenght	Cleavability	Iodinatable	Water Solubility	Description
N-Fmoc-amido-PEO12-COOH	BI0641	839.96	NH2§	COOH		PEO	46.5 Ang.	No	No	Yes	
N-Fmoc-amido-PEO4-COOH	BI0591	487.54	NH2§	COOH		PEO	19.2 Ang.	No	No	Yes	
N-Fmoc-amido-PEO8-COOH	BI0631	663.75	NH2§	COOH		PEO	32.2 Ang.	No	No	Yes	
6-Fmoc-HNA	BL9740	375.2	COOH	HYDin§		Hydrazone		No			
6-Fmoc-HNA-O-NHS	BL9760	472.2	NHS	HYDin§		Hydrazone		No			
GMBS	UP49608A	280.24	NHS	MAL		Alkyl	10.2 Ang.	No	No	No	B20
Sulfo-GMBS	UP96999A	382.28	NHS(s)	MAL		Alkyl	10.2 Ang.	No	No	Yes	B21
HABA	UP05361D	242.24	/Biotin		ChromoLabel	-				Yes	B39
HBVS	UPL7733A	266.38	VS	VS		Alkyl	14.7 Ang.	No	No	No	B27
HNA (6-Hydrazinonicotinic A.)	BL9790	153.1	COOH	HYDin		Hydrazone		No			
C6-HNAA	BL9780	306.4	COOH	HYDin		Hydrazone		No			
2HP	O19022	182.1	/CHO		ChromoLabel	-				Yes	B33
HPG	UP36862A	168.15	HPG(Arg sp.)			Arom	5 Atoms	No	Yes	Yes	B32
Sulfo-HSAB	UP05006B	362.25	PhA	NHS(s)		Linear	9 Ang.	No	No	Yes	B29
Hydrazine-silane	BL9420	396.4	Silane	HYDin		Arom		No	Yes		B32
IABP ((Iodoacetyl)benzophenone)	BI1351	365.17	BP	HAL		Arom	8 Atoms	No	No	No	
IminoThiolate (Traut's reagent)	UP42425A	137.63	/NH2	SH		N/A	4 Atoms		No	Yes	B36
Immobilized-X : see name of non-immobilized product											
KMUA	L7723C	281.35	MAL	COOH		Alkyl	15.7 Ang.	No	No	No	
KMUH	UPL7722B	295.38	NHS	MAL		Alkyl	19 Ang.	No	No	No	B24
Sulfo-KMUS	UPL7712A	480.47	NHS(s)	MAL		Alkyl	19.5 Ang.	No	No	Yes	
LC-X See name of non LC version product											
MAL-4	BU247A	684.71	MAL MAL	MAL MAL		Tetra	6 Atoms	No	No		B33
MAL-cap-NPSA	BI1241	434.35	MAL	NPSA		Alkyl	6 Atoms	No	No	Yes	
MAL-PEO2-COOH	AZ4170	326.32	MAL	COOH		PEO	17.5 Ang.	No	No	Yes	
MAL-PEO4-NHS	AL6580	513.5	NHS	MAL		PEO	24.8 Ang.	No	No	Yes	B20
MAL-PEO8-NHS	BH9851	689.71	NHS	MAL		PEO	39.2 Ang.	No	No	Yes	B20
MAL-PEO12-NHS	BH9861	865.92	NHS	MAL		PEO	53.3 Ang.	No	No	Yes	B20
MAL-PEO24-NHS	BM3011	1394.55	NHS	MAL		PEO	95.2 Ang.	No	No	Yes	B20
MAL-PEO2-MAL(BM[PEO]3)	L7735A	308.29	MAL	MAL		PEO	14.7 Ang.	No	No	Yes	B27
MAL-PEO3-MAL (BM[PEO]4)	L7736A	352.34	MAL	MAL		PEO	17.8 Ang.	No	No	Yes	B27
MAL-PFP	BA0791	335.19	PFP	MAL		Alkyl	6.9 Ang.	No	No		
MAL-sc-PEO4-sc-MAL	AZ4180	510.55	MAL	MAL		PEO	30 Ang.	No	No	Yes	
MBA (MaleimidoButyric Acid)	BI1271	183.2	MAL	COOH		Alkyl	2 Atoms	No	No	No	
MBP ((Maleimido)benzophenone)	BI1331	277.28	BP	MAL		Arom	6 Atoms	No	No	No	
MBS	UP21608A	314.26	NHS	MAL		Arom	9.9 Ang.	No	No	No	B20
Sulfo-MBS	UP52444A	416.3	NHS(s)	MAL		Arom	9.9 Ang.	No	No	Yes	B21
MBS(2)	BI129A	314.26	NHS	MAL		Arom	10 Ang.	No	No	No	
MCM	UP69910A	261.8	MAL	HYD		Alkyl	6 Atoms	No	No		B24
MDSI	BU246A	455.34	NHS	NHS	MAL	Tri	2 Atoms	No	Yes		
2-MEA	BI1191	254.17	MAL	NH2		Alkyl	2 Atoms	No	No	Yes	
MHPH	BL9400	240.65	MAL	HYDp		Hydrazone		No			B32
MMP	BJ005A	278.22	MAL	MAL		Linear	5 Atoms	No	no		
Mono-N-t-Boc-EDA	BI0703	160.21	NH2	NH2§			6 Ang.	No	No		
MPBH	UP09835A	309.75	MAL	HYD		Arom	17.9 Ang.	No	No	Yes	
MPS-EDA	BI0691	325.24	MAL	NH2		Linear	10.7 Ang.	No	No	High	
MSA	L7741A	257.24	NHS	COOH§		Alkyl	7.2 Ang.	No	No	No	
MTSEA	UP99618	236.15	MTS			Alkyl		No	No	Yes	B38
MTSES	U03500	236.18	MTS			Alkyl		No	No	Yes	B38
MTSET	U03510	278.24	MTS			Alkyl		No	No	Yes	B38
4NBA	BL9650	151.1	/HYDin		ChromoLabel	-				Yes	B33
NH2-PEO12-COOH	BH9551	617.74	NH2	COOH		PEO	46.5 Ang.	No	No	Yes	
NH2-PEO12-COO-t-Butyl	BH9541	673.83	NH2§	COOH		PEO	46.5 Ang.	No	No	Yes	
NH2-PEO4-COOH	AN1280	265.3	NH2	COOH		PEO	18 Ang.	No	No	High	
NH2-PEO4-COO-t-Butyl	AN1290	321.41	NH2	COOH§		PEO	18.0 Ang.	No	No	High	
NH2-PEO4-OH	BH8841	193.24	NH2	OH		PEO	14.3Ang.	No	No	High	
NH2-PEO8-COOH	BH9531	441.52	NH2	COOH		PEO	32.2 Ang.	No	No	High	
NH2-PEO8-COO-t-Butyl	BH9521	497.62	NH2	COOH§		PEO	32.2 Ang.	No	No	Yes	
NH2-PEO2-COO-tButyl	BH9511	233.31	NH2	COOH§		PEO	10.9 Ang.	No	No	High	
NHS	UP04594	115.09	NHS			-				No	B36
SulfoNHS-Acetate	UP69380A	259.2	NHS			-				Yes	B36
Sulfo-NHS	UP54422	217.13	NHS(s)		ChromoLabel	-				Yes	B36
NHS-4	BU248A	812.7	NHS NHS	NHS NHS		Tetra	6 Atoms	No	No		B33
NHS-ASA	UP42252B	276.21	HPhA	NHS		Linear	8 Ang.	No	Yes	No	B28
Sulfo-NHS-LC-ASA	22372A	491.41	HPhA	NHS(s)		Alkyl	18 Ang.	No	Yes	Yes	
NHS-BA (bromoacetate)	UPG9908A	236,00	NHS	HAL		Alkyl		No	No	No	B23
NHS-IA (iodoacetate)	UPG9907A	283,00	NHS	HAL		Alkyl		No	No	No	B23
NHS-PEO12-O-CH3	BH9501	685.75	NHS	OH§		PEO	44 Ang.	No	No	High	
NHS-PEO4-O-CH3	BH9061	333.34	NHS	OH§		PEO	15.6 Ang.	No	No	Yes	
NHS-PEO8-O-CH3	BH9131	509.54	NHS	OH§		PEO	29.8 Ang.	No	No	Yes	
NHS-PEO6-NHS	BH8811	532.5	NHS	NHS		PEO	21.7 Ang.	No	No	Yes	B25

Crosslinking

Product Name	Cat.#	M.W.	Functional group(s) Group 1	Group 2	Group 3	Type	Spacer Lenght	Cleavability	Iodinatable	Water Solubility	Description
OH-PEO4-t-butyl ester	BI0611	322.39	COOH§	OH		PEO	18 Ang.	No	No	Yes	
OH-PEO11-O-CH3	BH9110	516.62	OH	OH§		PEO	40.3 Ang.	No	No	High	
OH-PEO12-OH	BH9471	546.66	OH	OH		PEO	42.8 Ang.	No	No	High	
OPA	UP02727A	134.1	/SH		FluoLabel	-				Yes	B39
Papain	14542B	21000	proteolytic			-				Yes	B38
Immobilized Papain	414645	-	proteolytic			-				Yes	B38
PDA (Pyridine dithioethylamine)	BI1321	186.3	MAL	NH2		Alkyl	3 Atoms	Thiols	No	no	
PDPH	UP99648A	229.32	PThio	HYD		Linear	9.1 Ang.	Thiols	No	Yes	B24
Pepsin	FM2178	34700	proteolytic			-				yes	B38
Immobilized Pepsin	499785	-	proteolytic			-				yes	B38
PMPI (MPITC)	UP88307A	214.18	MAL	IC		Alkyl	8.7 Ang.	No	No	No	B24
Sulfo-SADP	51624A	454.44	PhA	NHS(s)		Linear	13.9 Ang.	Thiols	No	Yes	
Sulfo-SAED	38193A	621.6	AMC	NHS(s)	FluoLabel	Linear	23.6 Ang.	Thiols	No	No	
Sulfo-SAH	UPG9975A	491.4	NH(s)	HPhA		Alkyl	8 Atoms	No	Yes		B29
SAND	75035A	570.51	NPhA	NHS(s)		Linear	18.5 Ang.	Thiols	No	Yes	
SANH	BL9270	290.27	NHS	HYDin		Arom	6.7 Ang.	No		Yes	B31
Sulfo-SANPAH	UP09649B	492.4	NPhA	NHS(s)		Alkyl	18.2 Ang.	No	No	Yes	B29
Sulfo-SAPB	UP34514A	403.2	NPhA	NHS(s)		Alkyl	4 Atoms	No	No	Low	B29
Sulfo-SASD	UP40901A	541.51	HPhA	NHS(s)		Linear	18.9 Ang.	Thiols	Yes	Yes	B29
SATA	UP84235B	231.22	NHS	SH§		Alkyl	2.8 Ang.	No	No	No	B36
SATH	BL9390	317.4	NHS	HYDt		Arom		No			B32
SATP	M1175A	245.26	NHS	SH§		Alkyl	4.1 Ang.	No	No	No	
2SBA	A42050	208.2	/HYDo			-				Yes	B33
SBA (NHS BromoAcetate)	BI1301	236.02	NHS	HAL		Alkyl	1.5 Ang.	No	No	No	
SBAP	L7737A	307.11	NHS	HAL		Alkyl	6.2Ang.	No	No	No	
SBTC	BU244A	501.36	NHS	NHS	NHS	Tri	3 Atoms	No	Yes		
SCBP	BI136A	323.3	BP	NHS		Arom	6 Atoms	No	No	No	
SDMB	BU245A	409.31	NHS	MAL	MAL	Tri	2 Atoms	No	Yes		
Sulfo-SDTB	UP35300A	605,00	NHS			-				Yes	B40
Sulfo-SFAD	900391	597.48	PFAA	NHS(s)		Linear	14.6 Ang.	Thiols	No	Yes	
SFB (Succinimidyl 4-formylbenzoate)	M11771	247.21	NHS	BAld		Arom	5.8 Ang.	No	Yes	No	B32
C6-SANH	BL9330	403.4	NHS	HYDin		Arom	14.4 Ang.	No			B31
C6-SFB	BL9410	336.35	NHS	BAld		Arom	13.5 Ang.	No	Yes		B32
Sulfo-SFB	BI1311	326.26	NHS	BAld		Alkyl	5.8 Ang.	No	No	Yes	
SHNH	BL9360	286.7	NHS	HYDp		Arom		No			B32
SH-PEO4-COOH	AN1300	282.35	COOH	SH		PEO	18.3 Ang.	No	No	High	
SH-PEO4-COO-t-Butyl	AN1320	338.46	COOH§	SH		PEO	18.3 Ang.	No	No	High	
SHTH	BL9370	313.7	NHS	HYD		Arom	7.9 Ang.	No			B32
SIA	92177A	283.02	NHS	HAL		Alkyl	1.5 Ang.	No	No	No	
SIAB	UPG9906B	402.15	NHS	HAL		Arom	10.6 Ang.	No	No	No	B23
Sulfo-SIAB	UP75036A	504.19	NHS(s)	HAL		Arom	10.6 Ang.	No	No	Yes	B23
SIAX (NHS-Ic-IA)	BI1461	396.18	NHS	HAL		Alkyl	7.7 Ang.	No	No	No	
SMCC	UP342534	334.33	NHS	MAL		CycloHex	11.6 Ang.	No	No	No	B21
LC-SMCC	L7739B	447.48	NHS	MAL		Alkyl	16.1 Ang.	No	No	No	
Sulfo-SMCC	UP17412A	436.38	NHS	MAL		CycloHex	11.6 Ang.	No	No	Yes	B22
SMCC-Hydrazide	BI1281	365.31	MAL	HYD		CycloHex	6 Atoms	No	No	No	
SMPB	UP28072A	356.34	NHS	MAL		Arom	14.5 Ang.	No	No	No	B21
Sulfo-SMPB	UP52757A	458.38	NHS	MAL		Arom	14.5 Ang.	No	No	Yes	B22
SMPH	L7740B	379.3	NHS	MAL		Alkyl	14.3 Ang.	No	No	No	
LC-SMPH	BI1251	492.52	NHS	MAL		Alkyl	18.8 Ang.	No	No	No	
SPDP	UP79042A	312.37	NHS	PThio		Alkyl	6.8 Ang.	Thiols	No	No	B22
LC-SPDP	UP88622B	425.53	NHS	PThio		Alkyl	15.6 Ang.	Thiols	No	No	B22
Sulfo-LC-SPDP	UP88621A	527.57	NHS(s)	PThio		Alkyl	15.6 Ang.	Thiols	No	Yes	B22
SPDP-Hydrazide	BI1381	229.32	MAL	HYD		Linear	4 Atoms	No	No	No	
STHA	BI1441	287.27	NHS	HYD§		Linear	2 Atoms	No	Yes	No	
STHB	BI1431	349.34	NHS	HYD§		Arom	4 Atoms	No	Yes	No	
Sulfo-X See name of non sulfonated product											
SVSB	L7738A	309.3	NHS	VS		Arom	8.3 Ang.	No	No	No	
TCEP	UP242214	286.65	/SS			-		-		Yes	B35
TFCS	L7727B	324.26	NHS	NH2§		Alkyl	7.7 Ang.	No	No	No	
THPP	Q7468A	197.15	HMP	HMP	HMP+COOH	Tri	3 Ang.	No	No	Yes	
TMEA	86685A	386.36	MAL	MAL	MAL	Tri	10.3 Ang.	No	No		B33
TSAT	L7962A	482.36	NHS	NHS	NHS	Tri	4.2 Ang.	No	No		B33
TSAT-LC	BU243A	482.36	NHS	NHS	NHS	Tri	13.2 Ang.	No	No		B33

Legend for Spacers (type/length/cleavability) :

The length is reported in Angstroms or in number of atoms
The cleavability is reporter as 'Yes' or the condition of cleavability.

The type of spacer is reported as follows :

N/A : no spacer (EDC)
PEO : PolyEthylOxy (PolyEthylGlycol) based (may include a Ethyl or Proprionate linker) ; see technical tip page B13.
Alkyl : Linear Carbon chain may be connected to a functional group by an ester bond (-CO-O-: fatty acid), an amide bond (-CO-N-), a keto (-CO-) or other bonds.
Linear : other non-aliphatic linear chains (include hetero-atoms forming bonds as amide, ether, ester, disulfide, sulfonyl...)
Tri : 3 connected spacers (trifunctional crosslinker)
Tetra : 4 connected spacers (tetrafunctional crosslinker)
CycloHex : contains a ring chain, the cyclohexane (i.e. in SMCC) ; more constrained spacer than aliphatic chains
Arom : Aromatic chain (contains a benzene ring) ; confers constrained configuration to spacer

Legend for Functional groups :

The functional groups are abreviated as follows, on colored background :
- orange for amine main reactivity,
- green for sulfhydryl main reactivity,
- brown for OH or SH groups,
- grey for photoreactive and other reactivities).

A '§' symbol follows when there is a protective group. A '/' symbol mean other reactivity toward indicated group.

AMC : AzidoMethylCoumarin
BAld.: Benzaldehyde
BP : BenzoPhenone
CHO : Aldehyde
ChromoLabel : Label detected by its light absorbance property
COOH : carboxy group (§ means for protection group as t-But, Methyl)
FluoLabel : Marker detected by its fluorescence property
HAL : Acyl Halide or arylHalide (**HALar**)
HMP : TriMethylPhosphine
HPhA : HydroPhenylAzide
HYD : Hydrazide and related groups as Hydrazine (**HYDin**), hydrazidoterephthalamide (**HYDt**), hydrazinopyridine (**HYDp**)
MAL : Maleimide
MTS : MethaneThioSulfonate
NH2 : amine group (§ means for protection group as t-Boc, CBZ (benzocarbocy), Fmoc)
NHS : N-HydroxySuccinimide (Succinimidyl)
NPhA : Nitro Phenyl Azide
NPSA : 2-nitro-4-sulfo-phenyl ester
OH : Hydroxy group (§ means for protection group as Methyl or Benzyl)
PFAA : PerFluoroArylAzide
PFP : polyFluoroPhenyl
PhA. : Phenyl Azide
PhG : Phenyl Glyoxal
PThio : Pyridyl Thio / Disulfides
SH : Sylfhydryl group (§ means for protection group as Ethyl, -COCH3)
VS : Vinyl Sulfone

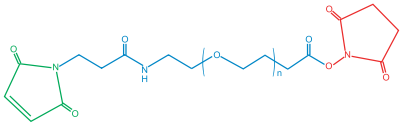
Heterobifunctional cross-linkers SH/Maleimide - NHS/NH2

MAL-PEO-NHS

These new cross-linkers replace advantageously SMCC, MBS, EMCS and related cross-linkers. Additionally, the spacer is adjustable in length.

- Increases water-solubility
- Minimizes aggregation of conjugates or conjugates/ligands complexes
- No immunogenicity
- Increases bio-stability
- Reduces non-specific bindings on surfaces

See detailed advantages in the technical tip "PEO spacers" page B13.

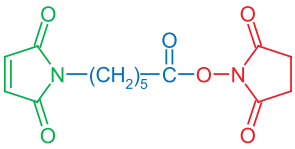


Description	Spacer length	MW	Cat.#	Qty
MAL-PEO$_4$-NHS	24.8 Å (22 atoms)	513.5	**AL6580**	100 mg
MAL-PEO$_8$-NHS	39.2 Å (34 atoms)	689.71	**BH9851**	100 mg
MAL-PEO$_{12}$-NHS	53.3 Å (46 atoms)	865.92	**BH9861**	100 mg
MAL-PEO$_{24}$-NHS	95.2 Å (80 atoms)	1394.55	**BM3011**	100 mg

Other standard cross-linkers (alphabetic order) :

EMCS

N-(ε-MaleimidoCaproyloxy)Succinimide ester
MW : 308.3



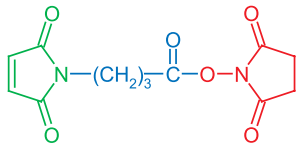
- Reacts with sulfhydryls (with maleimide) at pH 6.5-7.5 and amines (with NHS) at pH 7-9
- 9.4 spacer

See also sulfo EMCS (UPL7729)

Description	Cat.#	Qty
EMCS	**UP19548A**	100 mg
	UP19548B	50 mg

GMBS

m-MaleimidoButyryloxySuccinimide ester
MW : 280.3
Better than MBS in several immuno-applications



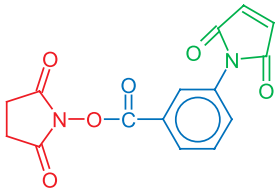
- Cross-links amine-bearing (via NHS) and sulfhydryl-bearing proteins (via maleimide)
- 6.8 Å flexible spacer, non cleavable
- Maleimide more stable
- Spacer less immunogenic than MBS and SMCC, for more antigen-specific antibodies

Applications : Immuno-conjugates : immunocarriers, delivery conjugates, enzyme-antibodies

Description	Cat.#	Qty
GMBS	**UP49608A**	100 mg
	UP49608B	50 mg

MBS

m-maleimidoBenzoyl-N-hydroxySuccinimidyl ester
MW : 314.2
A classic SH- and NH2 cross-linker



- Cross-links amine-bearing (via NHS) and sulfhydryl-bearing proteins (via maleimide)
- 9.9Å, rigid spacer, non cleavable

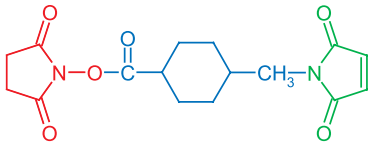
Applications : Immuno-conjugates, Peptide-carriers (see GMBS that may be preferred)

See also sulfo MBS (UP52444)

Description	Cat.#	Qty
MBS	**UP21608A**	100 mg
	UP21608B	50 mg

SMCC

Succinimidyl-4-(N-Maleimidomethyl)Cyclohexane-1-Carboxylate
MW : 334.3
The most popular NH2- and SH- cross-linker



- Reacts with sulfhydryls (with maleimide) and amines (with NHS)
- Maleimide stabilized by the cyclohexane ring
- 11.6 A spacer (9 atoms)

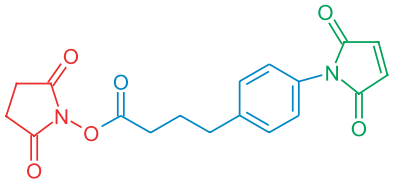
Applications : Widely used to make Immuno-conjugates

Description	Cat.#	Qty
SMCC	**UP34253B**	100 mg
	UP34253A	50 mg

See also sulfoSMCC (UP17412)

SMPB

Succinimidyl-4-(p-MaleimidoPhenyl)-Butyrate
MW : 356.3
Alternative to MBS, with extended spacer

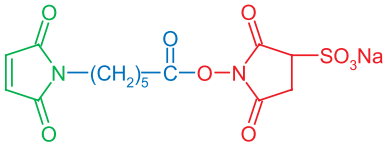


- Features of the MBS (UP21208)
- Extended spacer
- Conjugates more stable in serum than SPDP(Pi36)

Description	Cat.#	Qty
SMPB	**UP28072A**	100 mg
	UP28072B	50 mg

Sulfo-EMCS

N-(ε-MaleimidoCaproyloxy)Sulfo-Succinimide ester
MW : 410.3
Water-soluble analog of EMCS

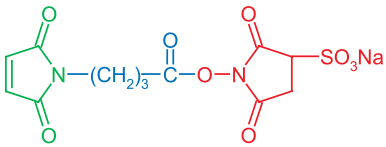


- Features of the EMCS (UP19548)
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes / label inside cells

Description	Cat.#	Qty
Sulfo-EMCS	**UPL7729A**	100 mg
	UPL7729B	50 mg

Sulfo-GMBS

m-MaleimidoButyryloxy-SulfoSuccinimide ester
MW : 362.2
Water-soluble analog of GMBS



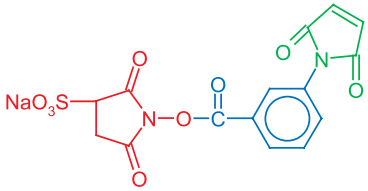
- Features of the GMBS (UP49608)
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes

Description	Cat.#	Qty
Sulfo-GMBS	**UP96999A**	100 mg
	UP96999B	50 mg

Sulfo-MBS

m-MaleimidoBenzoyl-N-hydroxySulfoSuccinimidyl ester
MW : 416.2

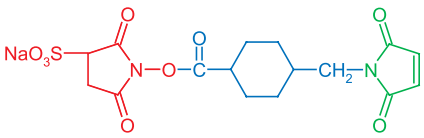
Water-soluble analog of MBS (UP21608)



- Features of MBS
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes

Applications : Cell membrane studies in vivo targeting

Description	Cat.#	Qty
Sulfo-MBS	**UP52444A**	100 mg
	UP52444B	50 mg



Sulfo-SMCC

SulfoSuccinimidyl-4-(N-Maleimidomethyl)Cyclohexane-1-Carboxylate
MW : 436.4

- Features of the SMCC (UP34253)
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes / label inside cells

Applications Coupling of the hinge of (Fab')2
Water-soluble analog of SMCC

Description	Cat.#	Qty
Sulfo-SMCC	**UP17412A**	100 mg
	UP17412B	50 mg

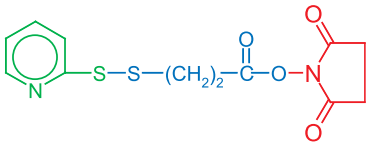
Sulfo-SMPB

SulfoSuccinimidyl-4-(p-maleimidophenyl)-butyrate
MW : 458.4
Water-soluble analog of SMPB

- Features of the SMPB (UP28072)
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes

Description	Cat.#	Qty
Sulfo-SMPB	**UP52757A**	100 mg
	UP52757B	50 mg

Heterobifunctional cross-linkers SH/Pyridythiol - NHS/NH_2



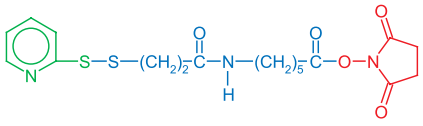
SPDP

N-Succinimidyl-3-(2-Pyridylthio)Propionate
MW : 312.4 - CAS [68181-17-9]
Alternative to SMCC, & cleavable ! Popular

- Reacts with sulfhydryls (with pyridylthiol) and amines (with NHS)
- Released pyridine-2-thione allows to follow the reaction
- 6.8 Å spacer, thiol-cleavable, linear
- Used as a thiolation agent too

Applications : Immuno-conjugates : enzyme-antibodies
Delivery systems : toxin-antibodies Wang (1997), drug carriers, immunization carriers

Description	Cat.#	Qty
SPDP	**UP79042A**	100 mg
	UP79042B	50 mg

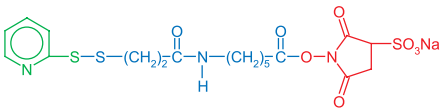


NHS-lc-SPDP

N-Succinimidyl-6-(3'-(2-pyridyldithio)-propionamido)-hexanoate
MW : 425.5
Alternative of SMCC with extended and cleavable spacer

- Features of the SPDP
- Extended linear 15.7 Å spacer

Description	Cat.#	Qty
NHS-lc-SPDP	**UP88622A**	100 mg
	UP88622B	50 mg



Sulfo-NHS-lc-SPDP

SulfoSuccinimidyl-6-(3'-(2-pyridyldithio)propionamido)hexanoate
MW : 527.6
Water-soluble analog of NHS-lc-SPDP

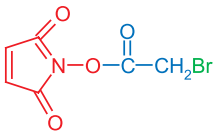
- Features of the NHS-lc-SPDP
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes

Description	Cat.#	Qty
Sulfo-NHS-lc-SPDP	**UP88621A**	100 mg
	UP88621B	50 mg

Heterobifunctional cross-linkers SH/Halogens - NHS/NH_2

NHS-BA (Bromoacetate)

N-hydroxySuccinimidyl-bromoacetate
MW : 236.0
Alternative to SMCC

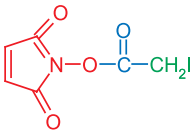


- Reacts with sulfhydryls (with bromoacetate) and amines (with succinimidyl)

Description	Cat.#	Qty
NHS-BA	**UPG9908A**	1 g

NHS-IA (Iodoacetate)

N-hydroxySuccinimidyl-iodoacetate
MW : 283

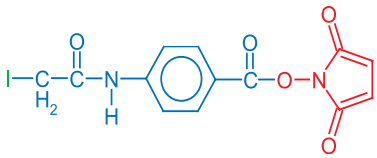


- Reacts with sulfhydryls (with bromoacetate) and amines (with NHS)

Description	Cat.#	Qty
NHS-IA	**UPG9907B**	1 x 1 g
	UPG9907A	1 x 500 mg

SIAB

Succinimidyl-4-iodoacetyl-AminoBenzoate
MW : 402.2



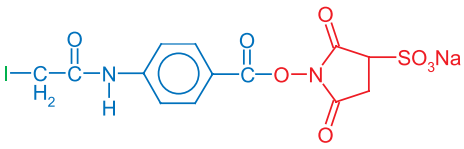
- Reacts with sulfhydryls (through iodoacetate) and amines (through NHS)
- Maleimide stabilized by the cyclohexane ring
- Iodinatable
- 10.6 Å spacer

Applications : Immuno-conjugates : toxin-antibodies

Description	Cat.#	Qty
SIAB	**UPG9906A**	100 mg
	UPG9906B	50 mg

Sulfo-SIAB

SulfoSuccinimidyl-4-iodoacetyl-AminoBenzoate
MW : 504.2

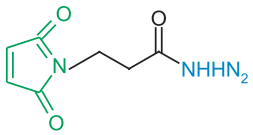


Water-soluble analog of SIAB

- Features of SIAB
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes

Description	Cat.#	Qty
Sulfo-SIAB	**UP75036A**	100 mg
	UP75036B	50 mg

Heterobifunctional cross-linkers SH/ — /Carbonyl

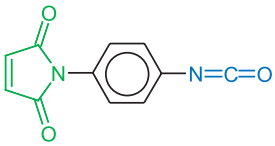


BMPH (NHS-sc-Hydrazide), TFA salt

Sulfhydryl and carbonyl reactive heterobifunctional cross-linking reagent.[1]
Used to prepare thiol reactive, luminescent metal chelates.[2]
Spacer 8.1 Å (3 atoms)

1. Kitagawa T., et.al. (1981) Chem. Pharm. Bull. 29, 1130.
2. Ge P.; Selvin P.R. (2003) Bioconjugate Chem. 14, 870-876.

Description	Cat.#	Qty
BMPH (NHS-sc-Hydrazide), TFA salt	**L7725A**	100 mg



MPITC (PMPI)

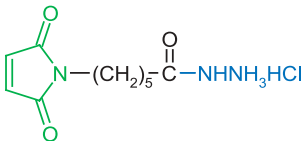
N-[p-Maleimidophenyl]isocyanate
MW : 214.18
A useful sulfhydryl- and hydroxyl-reactive non-cleavable cross-linker

- Maleimide reacts with -SH groups at pH 6.5-7.5, forming stable thioether linkages
- Isocyanate reacts with -OH groups to form a carbamate link at pH 8.5
- 8.7 Å rigid spacer

Ideal for conjugate preparation with OH containing biomolecules
Solves problems when amine/carboxyls is not successful or impossible, steroids, vitamins[(1)].

1. Annunziato, M.E., Patel, U.S., Ranade, M. and Palumbo, P.S. (1993). p-Maleimidophenyl isocyanate: A novel heterobifunctional linker for hydroxyl to thiol coupling. Bioconjugate Chem. 4, 212-218.

Description	Cat.#	Qty
MPITC (PMPI)	**UP88307A**	50 mg

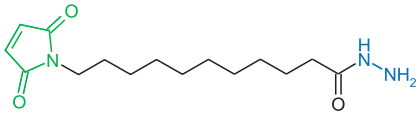


MCH

e-MaleimidoCaproic acid Hydrazide.HCl ester
MW : 261.8
Extended chain version of MPH

- Reacts with sulfhydryls (through maleimide) and carbohydrates (through hydrazide)
- Linear 6-atoms spacer

Description	Cat.#	Qty
MCH(EMCH)	**UPG9910A**	50 mg

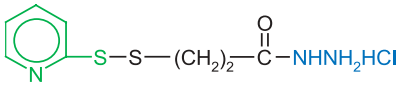


KMUH

N-(k-Maleimido-undecanoic acid)hydrazide
MW : 295.4
Extended chain version of MPH

- Reacts with sulfhydryls (through maleimide) and carbohydrates (through hydrazide)
- 19.0 Å linear and flexible spacer

Description	Cat.#	Qty
KMUH	**UPL7722A**	100 mg
	UPL7722B	50 mg



PDPH

3-(2-pyridyldithio)-propionic acid Hydrazide.HCl
MW : 279.81
Alternative to MPH, and cleavable

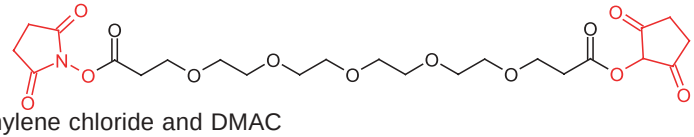
- Reacts with sulfhydryls (through pyridylthiol) and carbohydrates (through hydrazide)
- Linear 7-atoms spacer
- Easily cleavable by reducing agents

Description	Cat.#	Qty
PDPH	**UP99648A**	50 mg

Homobifunctional cross-linkers NH_2/ — /NH_2

NHS-PEO-NHS

MW : 532.50
Spacer : 21.7A length (19 atoms)



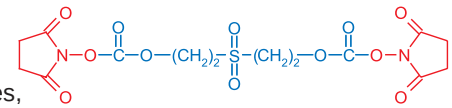
- Water-soluble ; soluble in organic solvents like methylene chloride and DMAC
- Non immunogenic
- Replace advantageously BS3
- Increases water-solubility
- Minimizes aggregation of conjugates or conjugates/ligands complexes
- No immunogenicity
- Increases bio-stability
- Reduces non-specific bindings on surfaces

Description	Cat.#	Qty
NHS-PEO_6-NHS	**BH8811**	100 mg

See detailed advantages page B13.

BSOCOES

Bis(2-(SuccinimidylOxyCarbonylOxy)-Ethyl)Sulfone
MW : 436.4
Base-cleavable analog of DSS
Suits when oxidizing conditions must be avoided (for example with metal chelates, hemes…)



- Reacts with NH_2 via NHS at pH 7-9 forming a stable amide bond
- 13.0Å spacer
- Cleavable by alkaline conditions pH 11.6

Description	Cat.#	Qty
BSOCOES	**UP28069A**	100 mg
	UP28069B	50 mg

DSS

Dissucinimidyl Suberate
MW 368.4
A standard homobifunctional amine reactive crosslinker

- Reacts with NH_2 via NHS at pH 7-9 forming a stable amide bond
- 11.4 Å linear spacer, very flexible, non cleavable

Applications : Receptor-protein studiesImmobilisation of IgG on protein ACox (1990), Petruzelli (1985), Rashidbaigi (1986), Sawyer (1987)

Description	Cat.#	Qty
DSS	**UP28065A**	1 g
	UP28065B	5 x 1 g

Sulfo-DSS(BS3)

Bis(Sulfosuccinimidyl) Suberate ester
MW 572.4

- Water soluble analog of DSS
- Features of the DSS
- Soluble directly in aqueous buffer (no need DMSO)
- Do not cross biological membranes

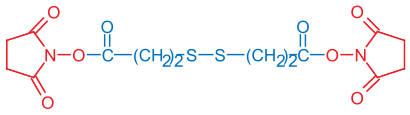
Applications : Cell Crosslinking biomolecules on cells (Jordan 1996). In Out-side membrane receptor-protein studiesBifunctional bioconjugates

Description	Cat.#	Qty
Sulfo-DSS(BS3)	**UP54940A**	100 mg
	UP54940B	50 mg

Cleavable cross-linkers

DSP

Lomant's reagent
Dithio-bis(succinimidyl Propionate)
MW : 404.4
Thiol-cleavable analog of DSS

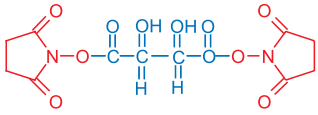


- Reacts with NH_2 via NHS at pH7-9 forming a stable amide bond 12.0Å linear spacer Easily cleavable by reducing agents
- Can be used as a thiolation agent

Description	Cat.#	Qty
DSP	**UP18971A**	1 g

DST

DiSuccinimidyl Tartarate
MW : 344.2
Oxidizer-cleavable homobifonctional cross-linker
Suits when reducing conditions are to be avoided (for an amide bond)

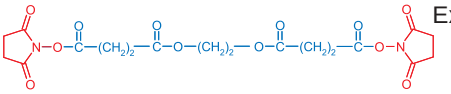


- 6.4Å linear spacer, shorter than DSS
- Cleavable by alkaline conditions pH11.6 (ex: with periodate)

Description	Cat.#	Qty
DST	**UP280681**	1 g

EGS

EthylGlycol bis(SuccinimidylSuccinate)
MW : 456.4
Extended and cleavable spacer analog of DSS

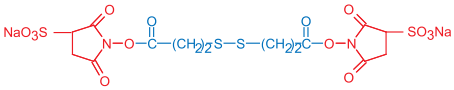


- Reacts with NH2 via NHS at pH7-9 forming a stable amide bond
- 16.1 linear spacer, longer than DSS
- Cleavable by mild alkaline conditions (ex: pH8.5 with hydroxylamine)

Description	Cat.#	Qty
EGS	**UP28067A**	1 g

Sulfo-DSP(DTSSP)

3,3'-Dithiobis(sulfosuccinimidyl Propionate)
MW : 608.5
Water-soluble analog of DSP

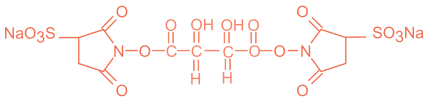


- Features of the DSP (UP18971)
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes

Description	Cat.#	Qty
Sulfo-DSP(DTSSP)	**UP434320**	100 mg
	UP43432B	50 mg

Sulfo-DST

DiSulfoSuccinimidyl Tartarate
MW : 584.3
Water-soluble analog of DST

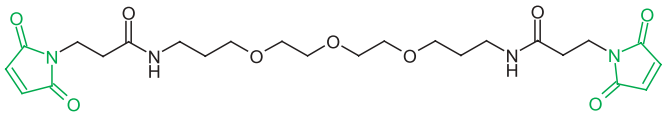


- Features of the DST (UP28068)
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes

Description	Cat.#	Qty
Sulfo-DST	**UP24864A**	100 mg
	UP24864B	50 mg

Homobifunctional cross-linkers SH/ — /SH

MAL-PEO-MAL



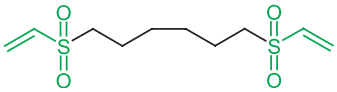
- Water-soluble
- Non-immunogenic

Description	Cat.#	Qty
MAL-PEO_2-MAL MW : 308.29 ; 14.7 A spacer	**L7735A**	100 mg
MAL-PEO_3-MAL MW : 352.34 ; 17.8 A spacer	**L7736A**	100 mg
MAL-sc-PEO_3-sc-MAL MW : 522.55 ; 30 A spacer	**AZ4180**	50 mg

See more feature due to PEO spacer page B13.

HBVS

1,6-Hexane bis-vinylsulfone
MW : 266.38

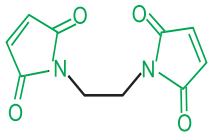


- Spacer arm length : 14.7 Å.
- Hydrolytically stable vinylsulfone which cross-links sulfhydryl groups
- Spacer 14.7 Å
- Unlike maleimides, Michael addition to vinylsulfones does not generate stereoisomers.

Description	Cat.#	Qty
HBVS (1,6-Hexane bis-vinylsulfone)	**UPL7733A**	50 mg

BMOE

1,2-bis-Maleimidoethane
MW : 210.19

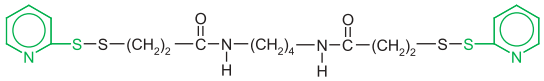


- A shot spacer (9 Å) SH reactive homofunctional crosslinker
- Maleimide reacts with SH et pH 6.5 - 7.5

Description	Cat.#	Qty
BMOE	**L7730A**	100 mg

DPDPB

Lomant's reagent
1,4-Di(3'-(2'-PyridylDithio)-Propionamido)Butane
MW : 482.7



A unique homobifonctional SH reactive cross-linker, cleavable

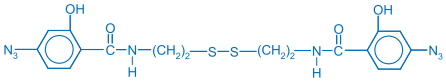
- Reacts with SH via pyridyldithiol forming a disulfide bridge
- 19.9 Å spacer
- Spacer cleavable by reduction

Description	Cat.#	Qty
DPDPB	**UP09833A**	100 mg
	UP09833B	50 mg

Photoreactive cross-linkers

BASED

Bis(β-(4-AzidoSalicylaminoEthyl)Disulfide
MW : 474.5
Non specific photoreactive and cleavable cross-linker



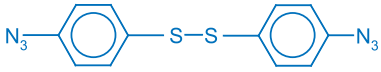
- Reacts non-specifically with 2 biomolecules
- Extended 34.7 Å spacer
- Cleavable by thiol reducing agents

Applications : Non specific conjugation for biomolecules difficult to handle

Description	Cat.#	Qty
BASED	**UP67018A**	100 mg
	UP67018B	50 mg

DTPA

Dithio bis Phenyl Azide
MW : 300.4
Non-specific conjugation with short and cleavable spacer!



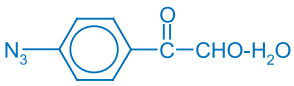
- Features of the BASED
- Short spacer than BASED

Description	Cat.#	Qty
DTPA	**UP63972A**	100 mg

Photoreactive cross-linkers with Amine reactivity

APG

p-AzidoPhenyl Glyoxal, monohydrate
MW : 193.2
Photoreactive and arginine selective

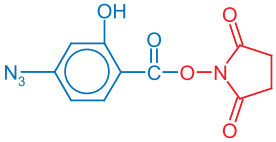


- Phenylglyoxal reacts with arginine residues at pH7-8
- Phenyl azide reacts amines upon light photolysis
- 9.3 Å rigid spacer

Description	Cat.#	Qty
APG	**UP28071A**	100 mg
	UP28071B	50 mg

NHS-ASA

N-HydroxySuccinimidyl-4-azidoSalicylic acid
MW : 276.2



- SulfoNHS ester reacts specifically with amines at pH7-10
- NHS reacts with amines at pH7-9
- Hydroxyphenyl Azide reacts with amines upon photolysis at 265 nm-275 nm
- 8.0 Å rigid spacer

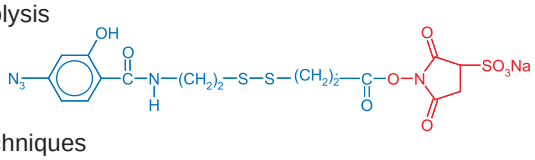
Applications : Ligand interactions studies, especially with radiolabeling techniques

Description	Cat.#	Qty
NHS-ASA	**UP42252B**	100 mg
	UP42252A	50 mg

Sulfo-SASD

Sulfosuccinimidyl-2-(p-AzidoSalicylamido)-ethyl-1,3-dithiopropionate
MW : 541.5

- Photoreactive, iodinatable and cleavable !
- SulfoNHS ester reacts specifically with amines at pH7-10
- Hydroxyphenyl azide reacts with amines upon UV 265-275nm photolysis
- 13.9 Å spacer, cleavable by thiols reducing agents
- Directly soluble in aqueous buffer (no DMSO needed)
- Does not cross biological membranes



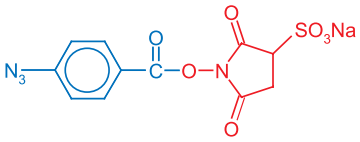
Applications : Ligand interactions studies, especially with radiolabeling techniques

Description	Cat.#	Qty
Sulfo-SASD	**UP40901B**	100 mg
	UP40901A	50 mg

Sulfo-HSAB

N-HydroxySulfo Succinimidyl-4-azido benzoate
MW : 362.2
The water-soluble analog of HSAB

- Feature of the HSAB



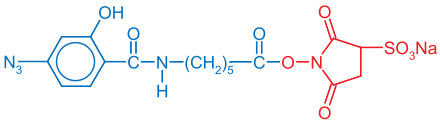
Applications : Membrane receptor studies

Description	Cat.#	Qty
Sulfo-HSAB	**UP05006A**	100 mg
	UP05006B	50 mg

Sulfo-SAH

SulfoSuccinimidyl-(4-azidoSalicylamido)hexanoate
MW : 491.4
Nitro-analog to Sulfo-SANPAH

- SulfoNHS reacts with amines at pH 6.5-9.5
- Iodinatable
- Hydroxyphenyl azide reacts with amines upon photolysis at 265 nm-275 nm
- 8 C-long linear chain spacer

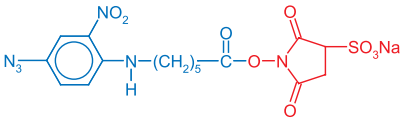


Description	Cat.#	Qty
Sulfo-SAH	**UPG9975A**	100 mg

Sulfo-SANPAH

SulfoSuccinimidyl-6(4'-azido-2'-nitrophenylamino)hexanoate
MW : 492.4
Extended and flexible spacer

- SulfoNHS reacts with amines at pH 6.5-9.5
- Nitrophenyl azide reacts with amines upon photolysis at 320 nm-350 nm
- Low alteration of biomolecules 18.2 nm linear chain spacer

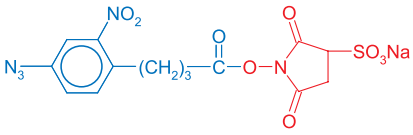


Description	Cat.#	Qty
Sulfo-SANPAH	**UP09649A**	100 mg
	UP09649B	50 mg

Sulfo-SAPB

SulfoSuccinimidyl-4(p-azidophenyl)butyrate
MW : 403.2
Shorter spacer than Sulfo-SANPAH

- SulfoNHS reacts with amines at pH6.5-9.5
- Nitrophenyl azide reacts with amines upon photolysis at 320 nm-350 nm
- 4 C-long linear chain spacer

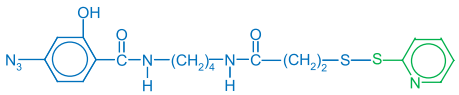


Description	Cat.#	Qty
Sulfo-SAPB	**UP34514A**	100 mg

Photoreactive cross-linkers with Sulfhydryl reactivity

APDP

N-(4-(p-AzidoSalicylamido)butyl)-3-(2'-pyridylthio)-propionamide
MW : 446.6
Photoreactive and SH-oriented conjugation



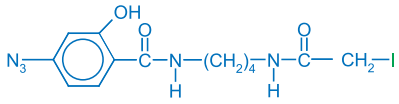
- Pyridylthiol reacts with free SH of proteins
- Hydroxyphenyl azide reacts with amines upon UV photolysis
- 21.0 Å linear spacer
- Water-soluble

Applications : In situ Cys-containing active sites studies

Description	Cat.#	Qty
APDP	**UP85267A**	100 mg
	UP85267B	50 mg

ASIB

1-(p-AzidoSalicylamido0-4-(Iodoacetamido)Butane
MW : 417.3
Photoreactive and amine reactive cross-linker



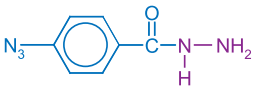
- Iodoacetamide reacts with free sulfhydryls
- Iodinatable
- Hydroxyphenyl Azide reacts with amines upon photolysis

Description	Cat.#	Qty
ASIB	**UP672601**	100 mg

Photoreactive cross-linkers with others reactivity

ABH

p-AzidoBenzoyl Hydrazide
MW : 177.2
Photoreactive, carbohydrate selective cross-linker



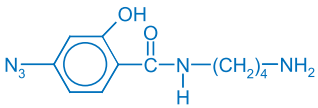
- Hydrazide reacts with cis-diol of carbohydrates or proteins
- Aryl azide reacts upon UV photolysis with other molecules
- 11.9 Å rigid spacer

Applications : Glycosylated proteins studies, immunoglobulin conjugates

Description	Cat.#	Qty
ABH	**UP87750A**	100 mg
	UP87750B	50 mg

ASBA

4-(p-AzidoSalicylamido)butylamine
MW : 249.3
A unique photoreactive cross-linker for carbonyls



- Terminal amine reacts with carbonyls in presence of EDC forming a stable amide bond
- Iodinatable
- Hydroxyphenyl Azide reacts with amines upon photolysis
- Can also be used to modify carbonyls too

Associated product : EDC #UP52005

Description	Cat.#	Qty
ASBA	**UP66329A**	100 mg
	UP66329B	50 mg

Hydrazone chemistry

HydraLink conjugation system is a privileged new method to conjugate and immobilize a variety of biomolecules, including peptides, carbohydrates and nucleic acids. It is covered by US patents 5.206.370. 5.420.285. 5.753.520 and 5.769.778 and EU Patent 0.384.769. The involved reaction is highly selective and mild, derivatized molecules are stable and not susceptible to non-specific binding. Hydrazone link is kinetically and metabolically a stable analog of a cysteine bridge.
It is a superior alternative to step-wise methods, in which difficulties come from the need to separate the modified or conjugated molecules from modifiers excess, unavailable reactive groups requiring tedious activation steps or labor-intensive site-specific engineering methods, from intramolecular undesired cross-linking, and from heterogeneous conjugation at the molecular level.

Selection guide

Comparison of conjugation methods :

	Hydrazine/carbonyl	Avidin/Biotin	Maleimide/Thiol
Stability of Activated biomolecules	+++	++	-
High selectivity	+++	+++	+
No reticulation	+++	+	-
No undesirable covalent modification	+++	+++	-
No non-specific binding of conjugate	++	+	++
No need of reductant	+++	+++	-
Covalent (stable) linkage	++	(non cov)	++
Fast reaction kinetics	+++	+++	++
Suitable to a variety of biomolecules & support	+++	+	+
Amenable to solid phase synthesis	+++	++	+
Reproducible/adjustable coupled ratio	+++	++	+
Scalable	+++	-	++
pH range (optimum)	3-(4.7)-7	5-11	4-7.5

The technology is ideal for :

- Protein-to-protein conjugation (see HydraLink Kit #BL1521 page B14)
- Peptides and nucleic immobilization acids onto microarrays, microplates. (page B10)
- Organic synthesis of peptides and nucleic acids (page B96)
- Other biomolecule conjugation

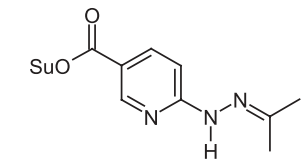
Principle :
The method includes one (or 2 separated) activation step(s) of amine, thiols, or silanols in aldehyde, hydrazine, and/or, hydrazide. The level of activation is fully controllable with chemical groups quantitation reagents (page B33). Then the modified molecules are simply mixed to yield a stable conjugate. The hydrazone bound formed is fully stable, in contrast to the hydrazone formed by more commonly accessible hydrazides (unstable acyl hydrazones).

Hydrazone modifiers/cross-linkers :

SANH

Succinimidyl 4-Hydrazinonicotinate Acetone Hydrazone
MW : 290.2
Used to convert primary amines to hydrazinopyridine moieties where hydrazine protection is required. The protecting group leaves during formation of the hydrazone conjugate.

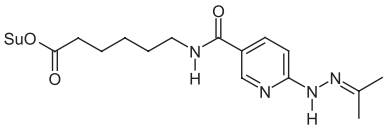
Description	Cat.#	Qty
SANH	**BL9270**	10 mg
	BL9271	25 mg



C6-SANH

C6-Succinimidyl 4-Hydrazinonicotinate Acetone Hydrazone
MW : 403.4
Used to convert primary amines to hydrazinopyridine moieties with an extended six carbon linker where protection of the hydrazine is required. The protecting group leaves during formation of the hydrazone conjugate.

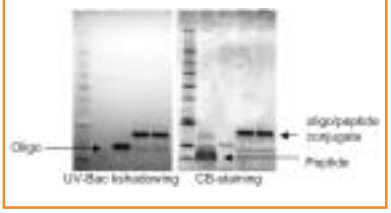
Description	Cat.#	Qty
C6-SANH	**BL9330**	10 mg
	BL9331	25 mg

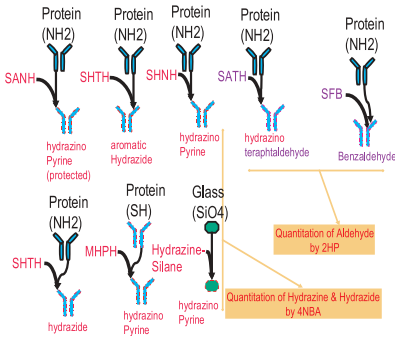


Application

Application 1 :
A detailed presentation of the hydrazone method for proteins, as well as comparison with maleimide/succinimidyl chemistry can be found with our kit # BL1501.

Application 2 :
Oligonucleotide-Protein conjugation
PAGE gel demonstrating a 5'-aldehyde modified oligonucleotide (1 equivalent) which reacted with a 15 mer peptide that was modified by C6-HNA at N-terminus). Simple addition of the hydrazine-modified peptide *(lane1)* to the aldehyde-modified oligonucleotide (lane 1) *(lane2)* directly yielded the peptide/oligonucleotide conjugate (lane 2) *(lane3-4)* without the reducing reagents requirement.



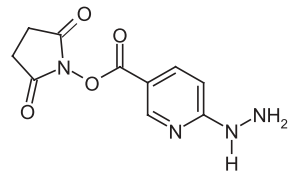


The Hydrazone chemistry is so great !

Su = Succinimidyl = NHS

See HNA protected reagents page B96

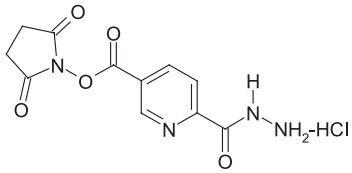
Crosslinking



SHNH

Succinimidyl Hydraziniumnicotinate Hydrochloride
MW : 286.7
Used to convert primary amines to hydrazinopyridine moieties. Also chelates 99mTc.

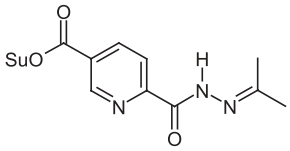
Description	Cat.#	Qty
SHNH	**BL9360**	10 mg
	BL9361	25 mg



SHTH

Succinimidyl 4-Hydrazidoterephthalate.Hydrochloride
MW : 313.7
Used to convert primary amines to aromatic hydrazide moieties.

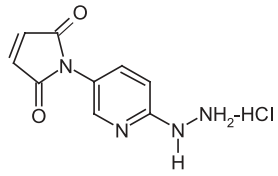
Description	Cat.#	Qty
SHTH	**BL9370**	10 mg
	BL9370	25 mg



SATH

Succinimidyl 4-hydrazidoterephthate acetone hydrazone
MW : 317.4
Used to incorporate 4-hydrazidoterephthalamide moieties on proteins or other amine-containing moieties. This is a custom product ; please call for availability.

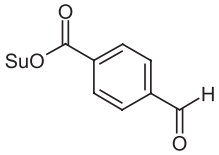
Description	Cat.#	Qty
SATH	**BL9390**	25 mg



MHPH

5-Maleimido-2-hydraziniumpyridine Hydrochloride
MW : 204.2
Used to convert thiol moieties to hydrazinopyridine moieties.

Description	Cat.#	Qty
MHPH	**BL9400**	15 mg



SFB

Succinimidyl 4-formylbenzoate
MW : 247.1
Used to convert primary amines to benzaldehyde moieties.

Description	Cat.#	Qty
SFB	**M11771**	100 mg

C6-SFB

C6-Succinimidyl 4 -formylbenzoate
MW : 360.4
Used to convert primary amines to benzaldehyde moieties with an extended six-carbon linker.

Description	Cat.#	Qty
C6-SFB	**BL9410**	25 mg

Hydrazine-silane

MW : 396.4
Used to incorporate hydrazinopyridine moieties on silica or glass surfaces

Description	Cat.#	Qty
Hydrazine-silane	**BL9420**	25 mg

Associated products : Activation control reagents for Hydrazone chemistry :

4NBA

4-Nitrobenzaldehyde
MW : 151.1
Used to colorimetrically quantitate the level of hydrazine and hydrazide modification.

Description	Cat.#	Qty
4NBA	**BL9650**	100 mg

2HP

2-Hydrazinopyridine dihydrochloride
MW : 182.1
Used to colorimetrically quantitate the level of aldehyde modification.

Description	Cat.#	Qty
2HP	**O19022**	100 mg

2SBA

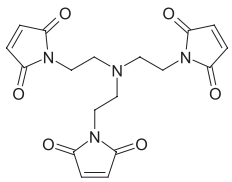
2-Sulfobenzaldehyde
MW : 208.2
Used to quench or cap hydrazone conjugation reactions.

Description	Cat.#	Qty
2SBA	**A42050**	100 mg

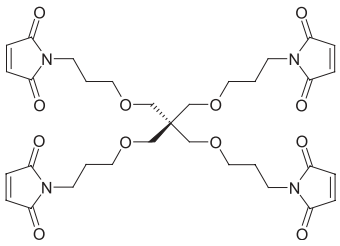
Multi-functional cross-linkers

Multi Maleimide agents

Sulfhydryl reactive tri- and tetra-maleimide reagents for preparing multimeric aggregrates of polypeptides
Applications :
preparation of self-repairing polymers (Wudl, F., et.al. (2002) Science 295, 1698)



Description	Cat.#	Qty
TMEA (Mal-3)	**86685A**	50 mg
tris-(2-Maleimidoethyl)amine - (99+%) - MW : 386.36 - Spacer : 10.3 Å		
TKMA (Mal-4)	**BU247A**	100 mg
tetrakis-(3-Maleimidopropyl)pentaerythritol - MW : 684.70		



Multi NHS agents

Amino reactive tri- and tetra-unctional crosslinking reagents
Applications : preparation of multivalent ligand complexes, dendritic or molecular aggregrates. Can be selectively aminated to generate mixed multimers.

Description	Cat.#	Qty
TSAT (NHS-3)	**L7962A**	250 mg
tris-Succinimidyl aminotriacetate - (99+%) - MW : 482.36 - Spacer : 4.2 Å.		
LC-TSAT (lc-NHS-3)	**BU243A**	50 mg
tris-Succinimidyl (6-aminocaproyl)aminotriacetate - MW : 821.83		
NHS-4	**BU248A**	100 mg
tetrakis-(N-succinimidylcarboxypropyl)pentaerythritol - MW : 812.69