EDITION 2013

Iris

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DIAGNOSTIC TOOLS

Substrates - Inhibitors - Linkers - Immunological Tools - Dyes

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CONTENT

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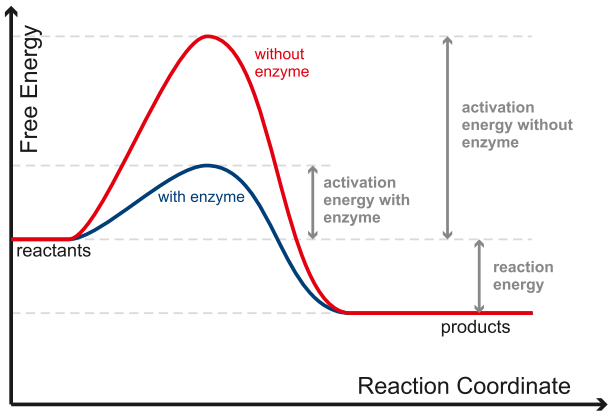
1. Introduction to Enzyme Substrates

1.1. Principle of Enzyme Action

Enzymes catalyze chemical reactions by lowering their activation energy without changing the overall reaction energy itself. The corresponding enzyme substrate is recognized with high specificity. After formation of an enzyme-substrate complex, the substrate is transformed to one or several products, which are finally released from the active pocket.

Substrates that generate a detectable change in any physical property upon this transition can be used to identify or quantify enzymatic activity. The signals easiest to detect are changes in absorption (color), fluorescence or light emission. Iris Biotech can supply you with a multitude of different chromo-, fluoro- and luminogenic enzyme substrates.

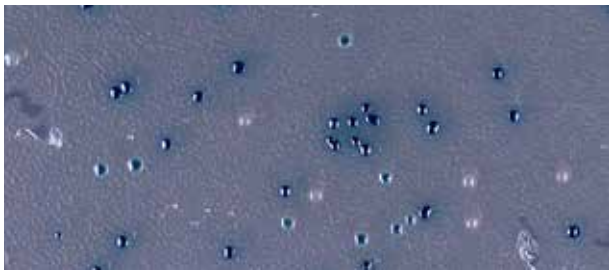


1.2. Application areas

Molecular Biology

Chromogenic substrates are an invaluable tool for rapid screening of high numbers of clones and samples. A classic example is the blue/white screen for successful cloning of genes in recombinant vectors using X-Gal (GBB1321, see chapter 2.3.9.) [1].

Modern applications are staining of transgenic cells (Immunostaining) or identification of reporter gene expression.



Microbiology

Certain enzymatic activities are characteristic in particular for microorganisms. A broad field of applications is therefore identification, discrimination or quantification of microbial content or contamination of food, drinking water or any other sample of interest. For example, chromogenic variants of β-D-glucuronic acid (chapter 2.3.17.) are used to detect and count *E. coli* in drinking water or urinary infections, as 95% of common *E. coli* exhibit β-D-Glucuronidase activity [2].

Biochemistry and Diagnostics

Fluorogenic and chromogenic molecules are the most frequently used substrates in testing and characterizing enzyme activities. Enzyme levels in body fluids are indicative of health condition. Corresponding enzyme assays represent an important tool in clinical diagnostics.

Immunoassays are used to detect a wide variety of metabolites associated with health condition. Changes in color and absorbance can visually be detected or easily be measured by UV/VIS-spectroscopy which is available in almost every lab, whereas fluorescence emission allows much more sensitive detection [3].

References:

- [1] Horwitz, J.P. *et al.*, Substrates for Cytochemical Demonstration of Enzyme Activity. I. Some Substituted 3-Indolyl-β-D-glycopyranosides. *J. Med. Chem.* 1964; **7(4)**: 574-5.
- [2] Brenner K.P. *et al.*, New medium for the simultaneous detection of total coliforms and Escherichia coli in water. *Appl. Environ. Microbiol.* 1993; **59**: 3534-44.
- [3] Mayes J.S. *et al.*, Differential assay for lysosomal alpha-galactosidases in human tissues and its application to Fabry's disease. *Clin. Chim. Acta.* 1981; **112**: 247-51.

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1.3. Using the Right Fluorophore/Chromophore

Different chromo-/fluorophores are available for a set of different applications and equipment in each laboratory. For continuous analysis in spectroscopic instruments typically homogeneous solutions are required. For localizing enzymatic activity within cells or staining of bacterial colonies, substrates that produce insoluble, weakly diffusing chromo-/fluorophores are preferred.

Some products need additional chemical treatment or certain pH conditions for visualization. Many phenolic chromophores, for example, are only visible as phenolates in alkaline solution. Therefore, these substrates are incompatible with monitoring enzymatic processes in living cells. Ideally, labels should be selected, whose detection is not influenced by absorption or fluorescence of any other substance present in the assay.

1.4. Reporter Enzymes

In modern Biotechnology and Diagnostics so called "reporter enzymes" are frequently used to visualize the presence of molecules of interest such as proteins,peptides, oligonucleotides and metabolites. The two reporter enzymes most frequently used for this purpose are Horseradish Peroxidase (HRP) and Alkaline Phosphatase (AP). Substrates for these enzymes will be presented in chapters 2.1. and 2.2.

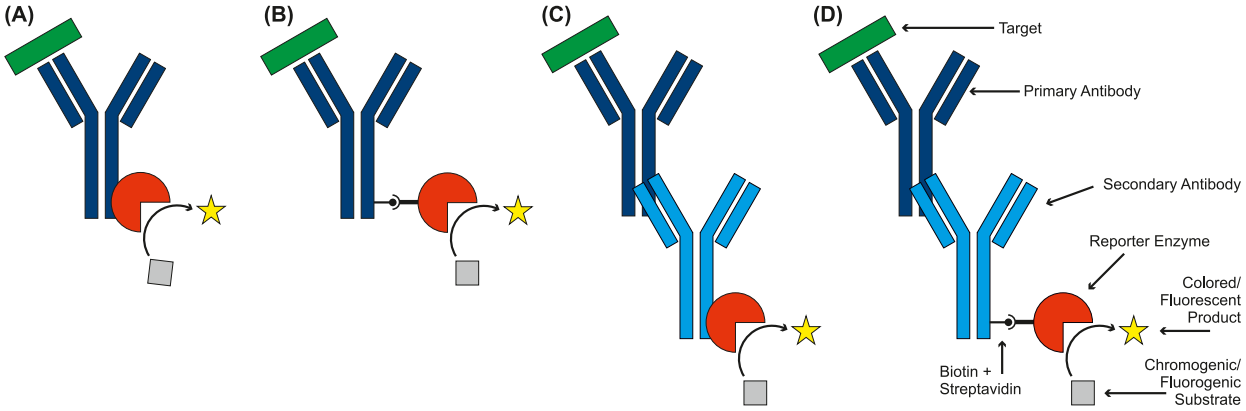
Furthermore these enzymes can be expressed from reporter genes that are introduced into genomic DNA to study the expression of genomic regions.

1.4.1. Enzyme Immunoassays / Immunostaining

The most common application of reporter enzymes is in enzyme immunoassays (EIAs). The desired target is identified by a primary antibody that is somehow connected to the reporter enzyme, which then converts a substrate to a colored or fluorescent product (Immunostaining).

Immunostaining is used in Immunohistochemistry and -cytochemistry, flow cytometry, Western blotting and enzyme-linked immunosorbent assay (ELISA).

The connection between the primary antibody and the reporter enzyme can be established in different ways:



(A) Direct labeling of the primary antibody with the reporter enzyme.

(B) Labeling of the primary antibody with a small molecule that interacts with a high affinity binding partner that is linked to the reporter enzyme. Typically biotin and streptavidin are used as high affinity binding partners.

(C) The primary antibody is detected by a more general species-specific secondary antibody labeled with the reporter enzyme.

(D) The secondary antibody is labeled with a small molecule that interacts with a high affinity binding partner that is linked to the reporter enzyme.

1.4.2. Detection of Nucleic Acids

Similar to Immunostaining, where the primary target is identified by an antibody, reporter enzymes can be used for the **detection of nucleic acids**. Here the DNA or RNA of interest is identified by binding to a hybridization probe. Either this probe is directly attached to the enzyme, or the probe is labeled with a ligand (e.g. digoxigenin or biotin) for which a high affinity binding protein (Anti-digoxigenin antibody or streptavidin) is attached to the reporter enzyme. DNA and RNA fragments are typically identified by Southern- and Northern blotting. Alternatively it is also possible to stain tissues where a gene of interest is expressed by showing the presence of the corresponding mRNA.

In some of the cases described above, reporter enzymes are not necessary, because the binding probe can be monitored by an attached fluorophore, chromophore or radionuclide. Yet, reporter enzymes have the advantage of amplifying the signal, as one single reporter enzyme can produce a high number of fluorescent or colored molecules and therefore enable much more sensitive detection.

1.4.3. Reporter Genes

Another application of reporter enzymes is the use of reporter genes. These reporter genes are attached to a regulatory sequence of another gene of interest in phages, viruses, cell cultures, plants or animals. Certain genes are chosen as reporters because the characteristics they confer on organisms expressing them can easily be identified and measured. Reporter genes are often used as an indication of whether a certain gene has been taken up by or expressed in the cell, tissue or organism.

Among the best known reporter genes are:

- *phoA* coding for Alkaline Phosphatase (AP)
- *lacZ* coding for β-Galactosidase (β-Gal)
- *gusA/uidA* coding for β-Glucuronidase (GUS)
- *luc* coding for luciferase

Expression of the reporter gene can then be detected easily by measuring the generated enzyme activity with chromogenic, fluorogenic or luminogenic enzyme substrates.

Iris Biotech offers test substrates for the listed reporter enzymes and many others.

Desired product not in this catalog? Do not hesitate to inquire via info@iris-biotech.de!

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2. Substrates for Reporter Enzymes

2.1. Peroxidase Substrates

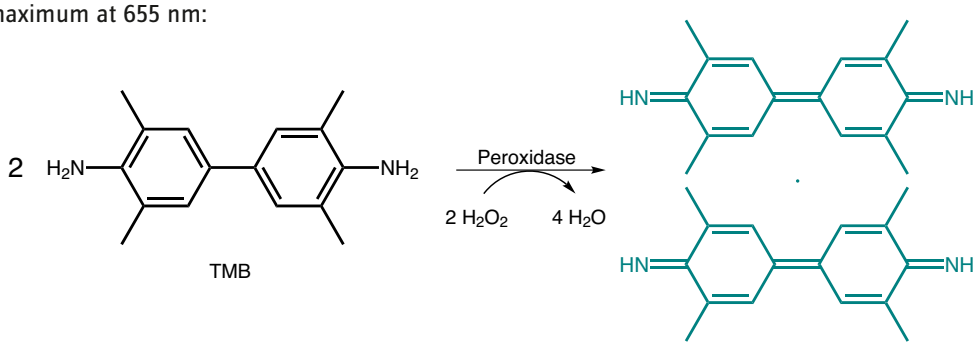
Peroxidase is the most commonly used enzyme in Enzyme Immunoassays (EIA). The most prominent among these peroxidases is Horseradish Peroxidase (HRP). In hydrogen peroxide – peroxidase assays it transfers electrons from an oxidative chromogenic substrate to H_2O_2 and thereby converts this test substrate to a detectable colored dye.

In classical immunostaining assays like ELISA, the amount of generated oxidized dye is a measure for the local concentration of HRP and therefore also for the presence of the desired target of the primary antibody or the nucleic acid hybridization probe.

Furthermore, HRP can be applied to detect the concentration of different other small substances in a probe. Numerous different specific oxidases have been identified to work in such systems. Most oxidases that convert a substance of interest generate hydrogen peroxide, and the amount of produced H_2O_2 therefore is proportional to the concentration of the substance to be measured. H_2O_2 then can be determined by HRP and a chromogenic substrate.

2.1.1. Substrates for Peroxidase Detection

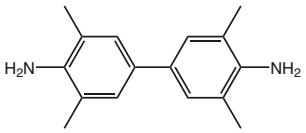
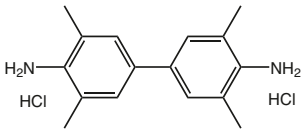
3,3',5,5'-Tetramethylbenzidine (TMB) is a chromogenic substrate for peroxidase detection and is commonly used on EIA plates or blotting membranes. In presence of H_2O_2 and peroxidase it is oxidized and forms a bluish-green dimer with an absorption maximum at 655 nm:



If desired, addition of 1-2 M sulfuric acid to the oxidized dye turns its color from blue to yellow and doubles its absorbance.

TMB replaces the formerly used benzidine, which can be metabolized into highly carcinogenic o-hydroxybenzidines or o,o'-dihydroxybenzidines. As in TMB these ortho positions are occupied by methyl groups, it cannot be metabolized like benzidine and it is therefore much less harmful.

TMB is available as poorly water soluble free base and as hydrochloride salt which is readily soluble in water (1% (w/v)).

		Article No.	Quantity	Price
LS-3250 TMB 3,3',5,5'-Tetramethylbenzidine, free base CAS-NO: 54827-17-7 FORMULA: $C_{16}H_{20}N_2$ MOLECULAR WEIGHT: 240,34 g/mole		LS-3250.0010	10 g	€ 175,00
		LS-3250.0100	100 g	€ 350,00
		LS-3250.0500	500 g	€ 1200,00
		LS-3250.1000	1 kg	€ 1850,00
LS-3255 TMB*2HCl 3,3',5,5'-Tetramethylbenzidine, dihydrochloride hydrate CAS-NO: 207738-08-7 FORMULA: $C_{16}H_{20}N_2$*2HCl MOLECULAR WEIGHT: 240,34*72,90 g/mole		LS-3255.0005	5 g	€ 175,00
		LS-3255.0010	10 g	€ 250,00
		LS-3255.0050	50 g	€ 650,00
		LS-3255.0100	100 g	€ 875,00
		LS-3255.0250	250 g	€ 1550,00
		LS-3255.0500	500 g	€ 2950,00

References:

- Holland V.R. *et al.*, A Safer Substitute for Benzidine in the Detection of Blood. *Tetrahedron* 1974; **30**: 3299-3302.
- Martin T.L. *et al.*, The light side of horseradish peroxidase histochemistry. *J. Histochem. Cytochem.* 1984; **32 (7)**: 793.
- Pujol F.H. *et al.*, A Double Sandwich Monoclonal Enzyme Immunoassay for Detection of Hepatitis B Surface Antigen. *J. Immunoassay* 1993; **14**: 21-31.

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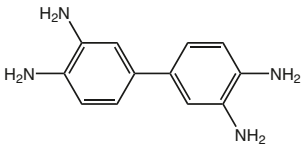
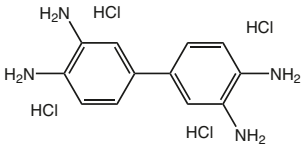
3,3'-Diaminobenzidine (DAB) is one of the most commonly used horseradish peroxidase substrates for application in immunoblotting and immunohistological staining. It produces an insoluble, brown precipitate upon oxidation, which can easily be observed visually.

		Article No.	Quantity	Price
LS-3260 DAB 3,3'-Diaminobenzidine CAS-NO: 91-95-2 FORMULA: $C_{12}H_{14}N_4$ MOLECULAR WEIGHT: 214,27 g/mole		LS-3260.0010	10 g	€ 150,00
		LS-3260.0025	25 g	€ 225,00
		LS-3260.0050	50 g	€ 275,00
		LS-3260.0100	100 g	€ 325,00
		LS-3260.0250	250 g	€ 550,00
LS-3265 DAB*4HCl 3,3'-Diaminobenzidine tetrahydrochloride CAS-NO: 7411-49-6 FORMULA: $C_{12}H_{14}N_4$*4HCl MOLECULAR WEIGHT: 214,27*145,81 g/mole		LS-3265.0025	25 g	€ 325,00

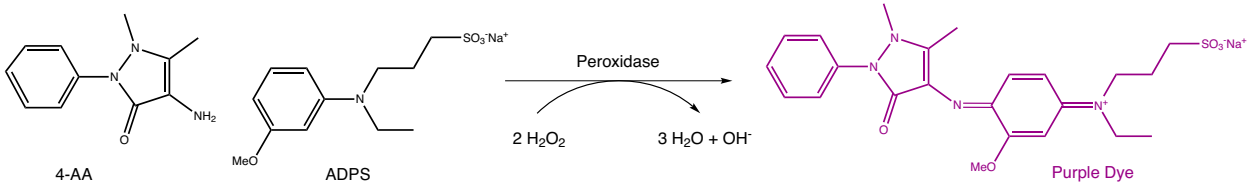
Reference:

- Herzog V., Fahimi H.D., A new sensitive colorimetric assay for peroxidase using 3,3'-diaminobenzidine as hydrogen donor. *Anal. Biochem.* 1973; **55** (2): 554-62.

2.1.2. Substrates for H_2O_2 Detection – Novel Trinder's Reagents

P. Trinder established a diagnostic blood glucose test in the 1960s using an oxidase/peroxidase test system: In a first step, hydrogen peroxide is produced by oxidization of glucose to gluconic acid, catalyzed by glucose oxidase. In the second step, this H_2O_2 is reduced by horseradish peroxidase while phenol is oxidized and finally reacts with 4-aminoantipyrine to form a quinonimine dye. The intensity of the color is directly proportional to the starting glucose concentration.

Today, the classical Trinder's reagent is no longer in use as there are "**Novel Trinder's reagents**" (NTRs) with superior properties. They are aniline analogs with propylsulfonic acid or hydroxypropylsulfonic acid attached to the amino group which confer water solubility and stability to the substrates. Through an oxidative coupling to 4-aminoantipyrine (4-AA) they form stable colored dyes with absorption maxima ranging from 540 to 630 nm. These NTRs show sufficient stability to enable applications both in solution and in test strip detection systems.



Absorption maximum wavelength for different NTR-4-AA coupled dyes:

NTR	ADPS	TODB	TOPS	TOOS	ALPS	HDAOS	DAOS	MAOS	MADB
λ_{max} (nm)	540	550	550	555	561	583	593	630	630

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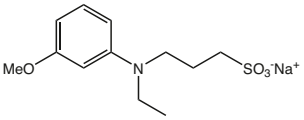
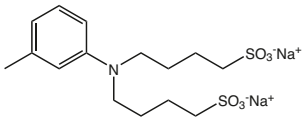
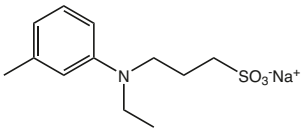
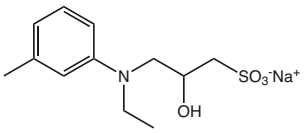
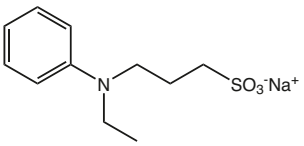
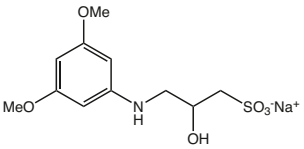
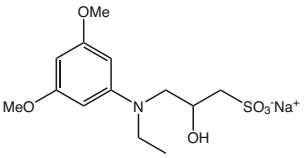
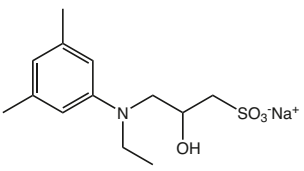
		Article No.	Quantity	Price
LS-3270 ADPS N-Ethyl-N-(3-sulfopropyl)-3-methoxyaniline sodium salt CAS-NO: 82611-88-9 FORMULA: $C_{12}H_{18}NNaO_4S$ MOLECULAR WEIGHT: 295,33 g/mole		LS-3270.0005	5 g	€ 175,00
		LS-3270.0025	25 g	€ 350,00
		LS-3270.0050	50 g	€ 575,00
		LS-3270.0100	100 g	€ 1000,00
LS-3300 TODB N,N-Bis(4-sulfobutyl)-3-methylaniline, disodium salt CAS-NO: 127544-88-1 FORMULA: $C_{15}H_{23}NNa_2O_6S_2$ MOLECULAR WEIGHT: 423,46 g/mole		LS-3300.0001	1 g	€ 175,00
		LS-3300.0005	5 g	€ 400,00
		LS-3300.0010	10 g	€ 650,00
LS-3310 TOPS N-Ethyl-N-(3-sulfopropyl)-3-methylaniline sodium salt CAS-NO: 40567-80-4 FORMULA: $C_{12}H_{18}NNaO_3S$ MOLECULAR WEIGHT: 279,33 g/mole		LS-3310.0001	1 g	€ 200,00
		LS-3310.0005	5 g	€ 500,00
LS-3305 TOOS N-Ethyl-N-(2-hydroxy-3-sulfopropyl)-3-methylaniline sodium salt dihydrate CAS-NO: 82692-93-1 FORMULA: $C_{12}H_{18}NNaO_4S*2H_2O$ MOLECULAR WEIGHT: 295,33*36,04 g/mole		LS-3305.0050	50 g	€ 275,00
		LS-3305.0100	100 g	€ 490,00
		LS-3305.0250	250 g	€ 700,00
LS-3275 ALPS N-Ethyl-N-(3-sulfopropyl)aniline sodium salt CAS-NO: 82611-85-6 FORMULA: $C_{11}H_{16}NNaO_3S$ MOLECULAR WEIGHT: 265,31 g/mole		LS-3275.0005	5 g	€ 275,00
		LS-3275.0010	10 g	€ 475,00
		LS-3275.0025	25 g	€ 1000,00
		LS-3275.0050	50 g	€ 1600,00
		LS-3275.0100	100 g	€ 2500,00
LS-3285 HDAOS N-(2-hydroxy-3-sulfopropyl)-3,5-dimethoxyaniline sodium salt CAS-NO: 82692-88-4 FORMULA: $C_{11}H_{16}NNaO_6S$ MOLECULAR WEIGHT: 313,30 g/mole		LS-3285.0005	5 g	€ 175,00
		LS-3285.0025	25 g	€ 350,00
		LS-3285.0050	50 g	€ 575,00
		LS-3285.0100	100 g	€ 1000,00
LS-3280 DAOS N-Ethyl-N-(2-hydroxy-3-sulfopropyl)-3,5-dimethoxyaniline sodium salt CAS-NO: 83777-30-4 FORMULA: $C_{13}H_{20}NNaO_6S$ MOLECULAR WEIGHT: 341,36 g/mole		LS-3280.0005	5 g	€ 175,00
		LS-3280.0025	25 g	€ 350,00
		LS-3280.0050	50 g	€ 575,00
		LS-3280.0100	100 g	€ 1000,00
LS-3295 MAOS N-Ethyl-N-(2-hydroxy-3-sulfopropyl)-3,5-dimethylaniline sodium salt monohydrate CAS-NO: 82692-97-5 FORMULA: $C_{13}H_{20}NNaO_4S*H_2O$ MOLECULAR WEIGHT: 309,36*18,02 g/mole		LS-3295.0001	1 g	€ 225,00
		LS-3295.0005	5 g	€ 575,00
		LS-3295.0010	10 g	€ 825,00

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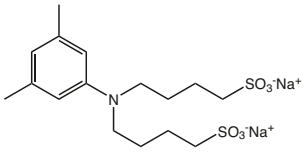
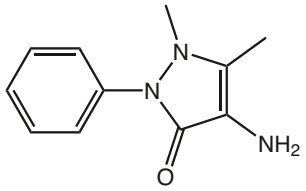
		Article No.	Quantity	Price
LS-3290 MADB		LS-3290.0001	1 g	€ 175,00
		LS-3290.0005	5 g	€ 275,00
		LS-3290.0010	10 g	€ 425,00
		LS-3290.0025	25 g	€ 875,00
N,N-Bis(4-sulfobutyl)-3,5-dimethylaniline, disodium salt CAS-NO: 209518-16-1 FORMULA: $C_{16}H_{25}NNa_2O_6S_2$ MOLECULAR WEIGHT: 437,48 g/mole				
LS-3315 4-Aminoantipyrine		LS-3315.0500	500 g	€ 175,00
		LS-3315.1000	1 kg	€ 250,00
		LS-3315.2000	2 kg	€ 375,00
4-Amino-2,3-dimethyl-1-phenyl-3-pyrazoline-5-one CAS-NO: 83-07-8 FORMULA: $C_{11}H_{13}N_3O$ MOLECULAR WEIGHT: 203,24 g/mole				

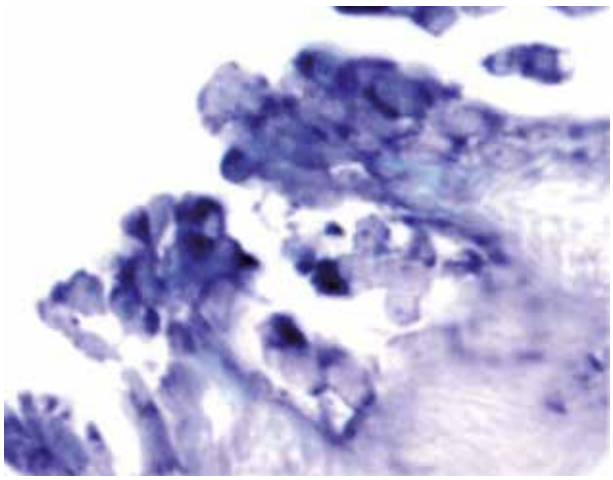
References:

- Trinder P., Determination of blood glucose using an oxidase/peroxidase system with a non-carcinogenic chromogen. *J. Clin. Path.* 1969; **22(2)**: 158-161.
- Tamaoku K. et al., New Water Soluble Hydrogen-Donors for the Enzymatic Photometric Determination of Hydrogen Peroxide. *Chem. Pharm. Bull.* 1982; **30**: 2492-7.
- Madsen B.C. *et al.*, Flow Injection and Photometric Determination of Hydrogen Peroxide in Rainwater with N-Ethyl-N-(sulfopropyl)aniline sodium salt. *Anal. Chem.* 1984; **56**: 2849-50.

2.2. Alkaline Phosphatase Substrates

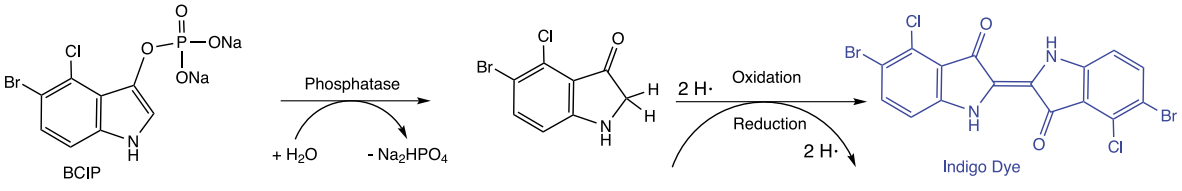
Besides Horseradish Peroxidase, Alkaline Phosphatase (AP) is one of the most frequently applied reporter enzymes. It is used to identify proteins in Western blot or tissue staining and DNA and RNA in Southern blot, Northern blot and in *situ*-hybridization.

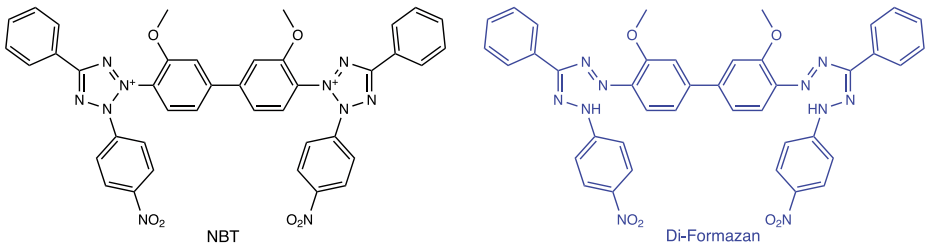
Additionally, its gene *phoA* (derived from *E.coli*) is often applied as a reporter to study genetic regulation.



mRNA in situ-hybridization in mammalian epithelial cells visualized by NBT/BCIP staining.

AP is a hydrolase that removes phosphate groups from a large number of molecules such as proteins, nucleotides or alkaloids. A very sensitive colorimetric detection of AP activity can be achieved by a combined use of the AP substrate 5-bromo-4-chloro-3-indolyl phosphate (BCIP, X-Phos) and the oxidizing reagent nitro blue tetrazolium chloride (NBT), which leads to a deep blue precipitate upon reaction:





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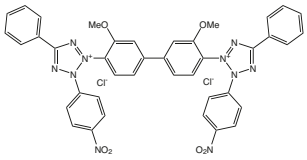
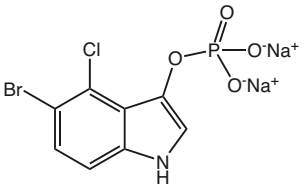
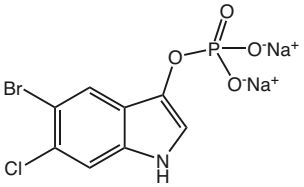
Recently, Trinh and coworkers showed that the widely used NBT/BCIP chromogenic stain is also a fluorophore. Fluorescence methods offer the advantage of being able to determine RNA expression in **three dimensions** when combined with optical sectioning techniques such as confocal laser scanning microscopy (Trinh *et al.*, 2007).

X-Phos can also be used without NBT. Then the final oxidation occurs by the aid of oxygen. Alternatively to X-Phos Iris Biotech can provide Magenta-Phos which leads to a purple to magenta dye.

Frequently, the combination of BCIP/NBT is purchased as a premixed "ready-to-use" solution, which is in the range of 1 Euro per ml. Yet, the solutions can be prepared easily by oneself from our reagents resulting in an expense of only 2-3 Cent per ml:

- **X-Phos-stock solution:** Dissolve 0.5 mg of X-Phos in 10 mL DMF and store up to one year at 4°C.
- **NBT-stock solution:** Dissolve 0.5 mg NBT in 10 mL of 70% DMF / 30% water and store up to one year at 4°C.
- **Substrate solution:** Add 66 µL NBT-stock solution and 33 µL X-Phos-stock solution to 10 mL of your sample buffer (typically 0-50 mM $MgCl_2$, 100 mM NaCl, 100 mM Tris/HCl or diethanolamine buffer pH 9,5), mix well and use within 1 h. The final concentrations are 0.33 mg/mL NBT and 0.165 mg/mL X-Phos.

		Article No.	Quantity	Price
LS-3240 NBT 3,3'-(3,3'-dimethoxybiphenyl-4,4'-diyl)bis(2-(4-nitrophenyl)-5-phenyl-2H-tetrazol-3-ium) chloride CAS-NO: 298-83-9 FORMULA: $C_{40}H_{30}Cl_2N_{10}O_6$ MOLECULAR WEIGHT: 817,64 g/mole		LS-3240.0025 LS-3240.0100	2,5 g 10 g	€ 150,00 € 250,00
LS-3245 X-Phos 5-Bromo-4-chloro-3-indoxyl phosphate, disodium salt sesquihydrate CAS-NO: 102185-33-1 FORMULA: $C_8H_4BrClNNa_2O_4P*1,5H_2O$ MOLECULAR WEIGHT: 370,43*27,02 g/mole		LS-3245.0005 LS-3245.0010 LS-3245.0025 LS-3245.0050	5 g 10 g 25 g 50 g	€ 275,00 € 475,00 € 1050,00 € 1750,00
LS-3235 Magenta-Phos 5-Bromo-6-chloro-3-indoxyl phosphate, disodium salt monohydrate CAS-NO: 404366-59-2 FORMULA: $C_8H_4BrClNNa_2O_4P*H_2O$ MOLECULAR WEIGHT: 370,43*18,01 g/mole		LS-3235.0001 LS-3235.0005 LS-3235.0025	1 g 5 g 25 g	€ 150,00 € 250,00 € 550,00

References:

- McGadey J., A tetrazolium method for non-specific alkaline phosphatase. *Histochemie* 1970; **23**: 180-184.
- Blake M.S. *et al.*, A rapid, sensitive method for detection of alkaline phosphatase-conjugated antibody on Western blots. *Anal. Biochem.* 1984; **136(1)**: 175-9.
- Trinh le A, *et al.*, Fluorescent in situ hybridization employing the conventional NBT/BCIP chromogenic stain. *BioTechniques* 2007; **42**(6): 756-9.

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2.3. Glycosidase Substrates

Due to the high number of different natural carbohydrates there are numerous enzymes hydrolyzing different glycosidic bonds.

Additionally to the different carbohydrates as basis for enzyme substrates there are many different chromo-/fluorogenic dyes available connected to the carbohydrate moiety. Upon cleavage by the specific glycosidase the chromo-/fluorophore is released and can be detected. Those free dyes can be soluble and insoluble.

For continuous analysis in spectroscopic instruments typically homogeneous solutions are required. For determining enzymatic activity within cells or staining of bacterial colonies, substrates that produce insoluble, weakly diffusing chromo-/fluorophores are required.

To minimize the background signal, a label should be selected, whose detection is not influenced by absorption or fluorescence of any other substance present in the assay. Iris Biotech offers glycosidase substrates with the following labels:

Abbreviation	Chromophor / Fluorophor	Color / Fluorescence	Solubility
4-MU	4-Methylumbelliferyl-	blue fluorescence	soluble
8-Hydroxyquinoline	8-Hydroxyquinoline	brown	insoluble
Br-Nap	6-Bromo-2-naphthyl-	fluorescence or azo-dye by coupling to hexazonium p-rosaniline	weakly soluble
Chloro	4-Chloro-3-indoxyl-	blue	insoluble
CPR	Chlorophenol Red	yellow to violet	soluble
Iodo	5-Iodo-3-indoxyl-	purple	insoluble
Lapis™	5-Bromo-3-indoxyl-	blue	insoluble
Magenta™	5-Bromo-6-chloro-3-indoxyl-	purple to magenta	insoluble
Nap	2-Naphthyl-	fluzorescence or azo-dye by coupling to hexazonium p-rosaniline	weakly soluble
oNP	2-Nitrophenyl-	colorless/yellow	soluble
pAPh	4-Aminophenyl-	colorless	soluble
pNP	4-Nitrophenyl-	colorless/yellow	soluble
Ph	Phenyl-	indirect assay (aminoantipyrine)	soluble
Phenolphthalein	Phenolphthalein	red-violet	soluble
Res	Resorufin	red fluorescence	soluble in base
Salmon™	6-Chloro-3-indoxyl-	rose to salmon	insoluble
X	5-Bromo-4-chloro-3-indoxyl-	blue to mint-green	insoluble
Y	3-Indoxyl-	blue	insoluble

6-Bromo-2-naphthol / 2-naphthol are released from Br-Nap- / Nap-carrying substrates upon hydrolysis. By simultaneous coupling with a suitable staining reagent, such as hexazonium p-rosaniline, the corresponding reddish-brown azo-dyes are formed. Naphthols can also be detected directly by fluorescence analysis.

References:

- Gossrau R., Histochemical and biochemical investigation of alpha-glucosidases by means of 2-naphthyl-alpha-D-glucoside. *Histochemistry* 1976; **49**: 193-211.
- Gutschmidt S., *et al.*, A quantitative histochemical technique for the characterisation of alpha-glucosidases in the brush-border membrane of rat jejunum. *Histochemistry* 1979; **63**: 81-101.

Nitrophenol can be detected best deprotonated in base as Nitrophenolate around 405 nm with a molar absorptivity that is two orders of magnitude higher than that of Nitrophenol.

Resorufin is a red fluorescent dye which is completely insoluble under acidic and neutral conditions. However, it readily dissolves in base upon formation of the corresponding phenolate.

The next pages show more than 100 glycosidase substrates.

If you cannot find the desired combination between carbohydrate and dye or

if you need larger quantities: Inquire via info@iris-biotech.de!

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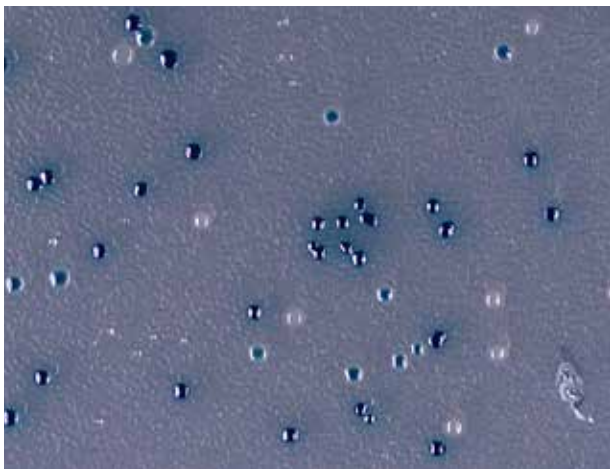
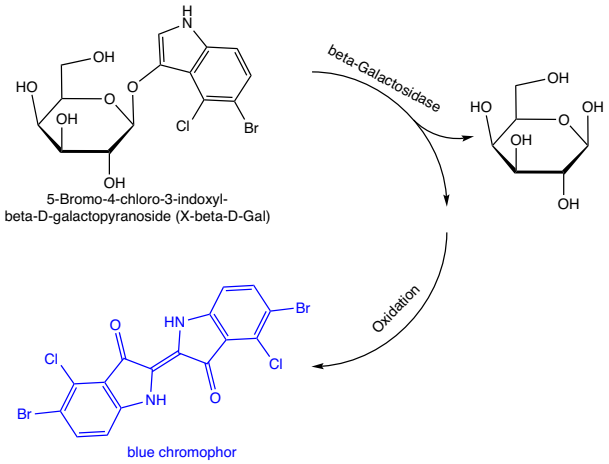
Probably the most prominent example for the application of chromogenic glycosidase substrates is the use of X-Gal (5-bromo-4-chloro-3-indoxyl-beta-D-galactopyranoside; GBB1321, see chapter 2.3.9.) in blue/white screening.

lacZ, the gene for β-D-galactosidase, is a widely used reporter gene. For the identification of clones producing active β-D-galactosidase, a substrate that is hydrolyzed by this enzyme needs to be used. X-Gal yields a colored, non-diffusing precipitate.



Cells to be screened are grown on culture media containing chromogenic X-beta-D-Gal (GBB1321) and the inducer IPTG (Isopropyl-beta-D-thiogalactopyranoside; GBB1343). Colonies of clones that produce β-D-galactosidase activity appear blue/turquoise and can easily be identified by visual inspection. X-Gal staining is also used in higher organisms, e.g. to study the age- and tissue-specific expression of genes of interest.



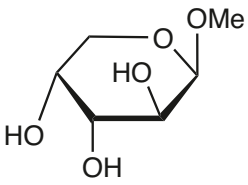
In cell lysates galactosidase activity can be determined by fluorescence of soluble 4-methylumbelliferone from 4-MU-beta-D-Gal (GBB1283) or light absorption of p-nitrophenolate from pNP-beta-D-Gal (GBB1298).

1-O-Methyl-glycosides are often weak substrates, but effective inducers of the according glycosidases.

2.3.1. β-D-Arabinosidase Substrate

		Article No.	Quantity	Price
GBB1144	**Methyl-beta-D-arabinopyranoside**	GBB1144.0005	5 g	€ 250,00

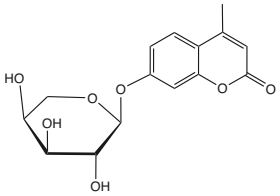
Methyl-beta-D-arabinopyranoside
CAS-NO: 5328-63-2
FORMULA: $C_6H_{12}O_6$
MOLECULAR WEIGHT: 164,16 g/mole



2.3.2. α-L-Arabinosidase Substrates

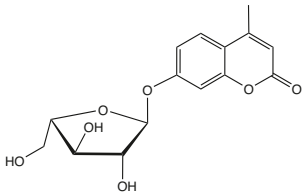
		Article No.	Quantity	Price
GBB1279	**4-MU-alpha-L-Ara(p)**	GBB1279.1000	1 g	€ 200,00
		GBB1279.5000	5 g	€ 510,00

4-Methylumbelliferyl-alpha-L-arabinopyranoside
CAS-NO: 69414-26-2
FORMULA: $C_{15}H_{16}O_7$
MOLECULAR WEIGHT: 308,29 g/mole



GBB1278	**4-MU-alpha-L-Ara(f)**	GBB1278.0025	25 mg	€ 175,00
		GBB1278.0050	50 mg	€ 225,00
		GBB1278.0100	100 mg	€ 350,00
		GBB1278.0200	200 mg	€ 550,00

4-Methylumbelliferyl-alpha-L-arabinofuranoside, 98%
CAS-NO: 77471-44-4
FORMULA: $C_{15}H_{16}O_7$
MOLECULAR WEIGHT: 308,29 g/mole



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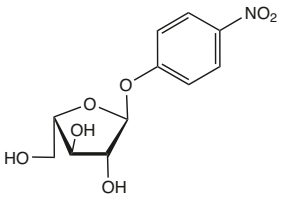
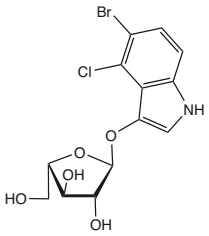
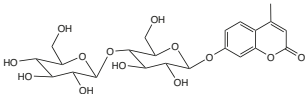
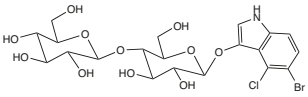
		Article No.	Quantity	Price
GBB1295	**PNP-alpha-L-Ara**	GBB1295.0100	100 mg	€ 200,00
4-Nitrophenyl-alpha-L-arabinofuranoside, 99%		GBB1295.0500	500 mg	€ 600,00
CAS-NO: 6892-58-6		GBB1295.1000	1 g	€ 1150,00
FORMULA: $C_{11}H_{13}NO_7$		GBB1295.2000	2 g	€ 1950,00
MOLECULAR WEIGHT: 271,2 g/mole				
GBB1317	**X-alpha-L-Ara**	GBB1317.0010	10 mg	€ 145,00
5-Bromo-4-chloro-3-indoxyl-alpha-L-arabinofuranoside		GBB1317.0025	25 mg	€ 275,00
FORMULA: $C_{13}H_{13}BrClNO_5$		GBB1317.0050	50 mg	€ 380,00
MOLECULAR WEIGHT: 378,61 g/mole		GBB1317.0100	100 mg	€ 650,00

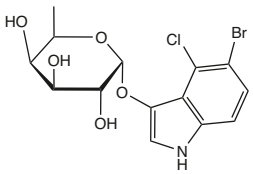
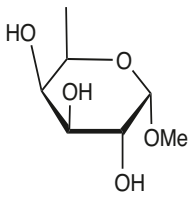
References:

- Renner M.J., Breznak J.A., Purification and properties of ArfI, an alpha-L-arabinofuranosidase from Cytophaga xylanolytica. *Appl. Environ. Microbiol.* 1998; **64**: 43-52.
- Selwood T., Sinnott M.L., One-proton catalysis by the alpha-L-arabinofuranosidase III of Monilinia fructigena. *Biochem. J.* 1988; **254**: 899-90.

2.3.3. β-D-Cellobiosidase Substrates

		Article No.	Quantity	Price
GBB1281	**4-MU-beta-D-Cel**	GBB1281.0500	500 mg	€ 175,00
4-Methylumbelliferyl-beta-D-cellobioside, 98%				
CAS-NO: 72626-61-0				
FORMULA: $C_{22}H_{28}O_{13}$				
MOLECULAR WEIGHT: 500,46 g/mole				
GBB1319	**X-beta-D-Cel**	GBB1319.1000	1 g	€ 250,00
5-Bromo-4-chloro-3-indoxyl-beta-D-cellobioside, 99%		GBB1319.5000	5 g	€ 590,00
CAS-NO: 177966-52-8		GBB1319.9025	25 g	€ 2180,00
FORMULA: $C_{20}H_{25}BrClNO_{11}$				
MOLECULAR WEIGHT: 570,78 g/mole				

2.3.4. α-D-Fucosidase Substrates

		Article No.	Quantity	Price
GBB1310	**X-alpha-D-Fuc**	GBB1310.0050	50 mg	€ 175,00
5-Bromo-4-chloro-3-indoxyl-alpha-D-fucopyranoside		GBB1310.0100	100 mg	€ 250,00
FORMULA: $C_{14}H_{15}BrClNO_5$		GBB1310.0250	250 mg	€ 425,00
MOLECULAR WEIGHT: 392,64 g/mole		GBB1310.0500	500 mg	€ 575,00
GBB1176	**1-OMe-alpha-D-Fuc**	GBB1176.0500	500 mg	€ 185,00
Methyl-6-deoxy-alpha-D-galactopyranoside		GBB1176.0001	1 g	€ 275,00
CAS-NO: 1128-40-1		GBB1176.0005	5 g	€ 900,00
FORMULA: $C_7H_{14}O_5$				
MOLECULAR WEIGHT: 178,19 g/mole				

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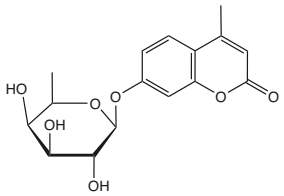
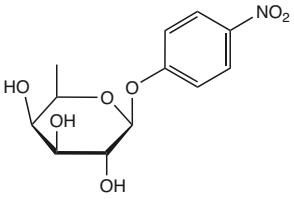
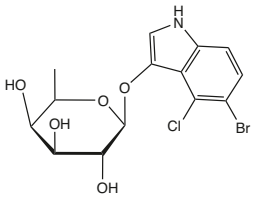
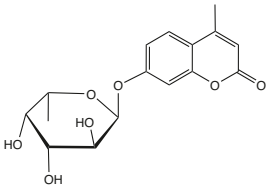
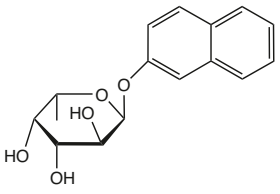
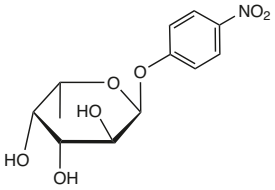
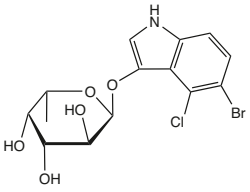
2.3.5. β-D-Fucosidase Substrates

		Article No.	Quantity	Price
GBB1282 4-MU-beta-D-Fuc 4-Methylumbelliferyl-beta-D-fucopyranoside, 99% CAS-NO: 55487-93-9 FORMULA: $C_{16}H_{18}O_7$ MOLECULAR WEIGHT: 322,32 g/mole		GBB1282.0100 GBB1282.1000	100 mg 1 g	€ 250,00 € 1050,00
GBB1297 PNP-beta-D-Fuc 4-Nitrophenyl-beta-D-fucopyranoside, 99% CAS-NO: 1226-39-7 FORMULA: $C_{12}H_{15}NO_7$ MOLECULAR WEIGHT: 285,26 g/mole		GBB1297.0250 GBB1297.1000 GBB1297.2500 GBB1297.5000 GBB1297.9010	250 mg 1 g 2,5 g 5 g 10 g	€ 200,00 € 225,00 € 300,00 € 440,00 € 750,00
GBB1320 X-beta-D-Fuc 5-Bromo-4-chloro-3-indoxyl-beta-D-fucopyranoside, 99% CAS-NO: 17016-46-5 FORMULA: $C_{14}H_{15}BrClNO_5$ MOLECULAR WEIGHT: 392,64 g/mole		GBB1320.0050 GBB1320.0100 GBB1320.0250 GBB1320.1000	50 mg 100 mg 250 mg 1 g	€ 200,00 € 275,00 € 460,00 € 1360,00

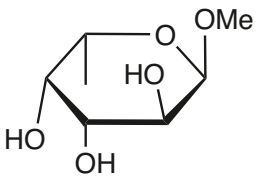
References:

- Levvy G.A., McAllan A., Mammalian fucosidases. 3. beta-D-Fucosidase activity and its relation to beta-D-galactosidase. *Biochem. J.* 1963; **87**: 361-7.
- Levvy G.A., McAllan A., beta-D-Fucosidase in the Limpet, Patella vulgata. *Biochem J.* 1963; **87**: 206-9.

2.3.6. α-L-Fucosidase Substrates

		Article No.	Quantity	Price
GBB1280 4-MU-alpha-L-Fuc 4-Methylumbelliferyl-alpha-L-fucopyranoside CAS-NO: 54322-38-2 FORMULA: $C_{16}H_{18}O_7$ MOLECULAR WEIGHT: 322,32 g/mole		GBB1280.0025	25 mg	€ 225,00
GBB1262 2-Nap-alpha-L-Fuc 2-Naphthyl-alpha-L-fucopyranoside CAS-NO: 63503-05-9 FORMULA: $C_{16}H_{18}O_5$ MOLECULAR WEIGHT: 290,32 g/mole		GBB1262.0100 GBB1262.0250 GBB1262.0500	100 mg 250 mg 500 mg	€ 175,00 € 275,00 € 475,00
GBB1296 PNP-alpha-L-Fuc 4-Nitrophenyl-alpha-L-fucopyranoside, 98% CAS-NO: 10231-84-2 FORMULA: $C_{12}H_{15}NO_7$ MOLECULAR WEIGHT: 285,26 g/mole		GBB1296.1000 GBB1296.5000 GBB1296.9025	1 g 5 g 25 g	€ 250,00 € 640,00 € 2660,00
GBB1318 X-alpha-L-Fuc 5-Bromo-4-chloro-3-indoxyl-alpha-L-fucopyranoside, 98% CAS-NO: 171869-92-4 FORMULA: $C_{14}H_{15}BrClNO_5$ MOLECULAR WEIGHT: 392,64 g/mole		GBB1318.0025 GBB1318.0050 GBB1318.0100 GBB1318.0250	25 mg 50 mg 100 mg 250 mg	€ 190,00 € 225,00 € 250,00 € 410,00

Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
GBB1178	**1-OMe-alpha-L-Fuc**	GBB1178.0001	1 g	€ 175,00
Methyl-6-deoxy-alpha-L-galactopyranoside CAS-NO: 14687-15-1 FORMULA: $C_7H_{14}O_5$ MOLECULAR WEIGHT: 178,19 g/mole		GBB1178.0002	2 g	€ 275,00

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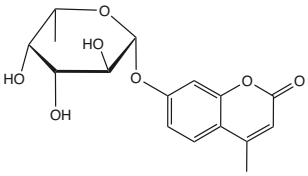
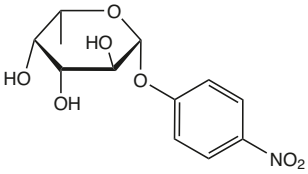
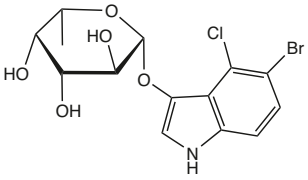
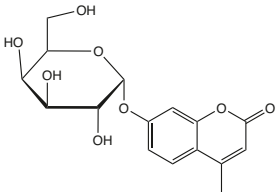
2.3.7. β-L-Fucosidase Substrates

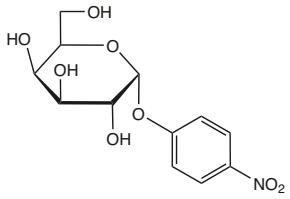
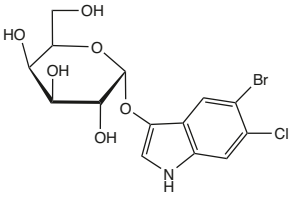
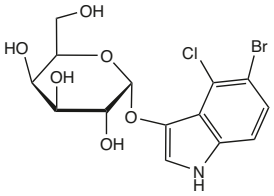
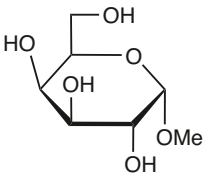
		Article No.	Quantity	Price
GBB1287	**4-MU-beta-L-Fuc**	GBB1287.0100	100 mg	€ 175,00
4-Methylumbelliferyl-beta-L-fucopyranoside, 99% CAS-NO: 72601-82-2 FORMULA: $C_{16}H_{18}O_7$ MOLECULAR WEIGHT: 322,32 g/mole		GBB1287.0250	250 mg	€ 275,00
GBB1303	**PNP-beta-L-Fuc**	GBB1303.0250	250 mg	€ 150,00
4-Nitrophenyl-beta-L-fucopyranoside, 99% CAS-NO: 22153-71-5 FORMULA: $C_{12}H_{15}NO_7$ MOLECULAR WEIGHT: 285,26 g/mole		GBB1303.0500	500 mg	€ 225,00
		GBB1303.1000	1 g	€ 325,00
		GBB1303.2500	2,5 g	€ 600,00
GBB1325	**X-beta-L-Fuc**	GBB1325.0010	10 mg	€ 175,00
5-Bromo-4-chloro-3-indoxyl-beta-L-fucopyranoside, 99% CAS-NO: 125328-84-9 FORMULA: $C_{14}H_{15}BrClNO_5$ MOLECULAR WEIGHT: 392,64 g/mole		GBB1325.0025	25 mg	€ 290,00
		GBB1325.0050	50 mg	€ 470,00
		GBB1325.0100	100 mg	€ 800,00

2.3.8. α-D-Galactosidase Substrates

α-D-Galactosidase substrates are frequently used for species differentiation within the family *Enterobacteriaceae* and differentiation of *Bifidobacteria* species from *Lactobacillus* species. Sometimes they are also utilized for the localization of the enzyme in plants and for the detection of hydrolases in tissues and membranes.

		Article No.	Quantity	Price
GBB1275	**4-MU-alpha-D-Gal**	GBB1275.0250	250 mg	€ 175,00
4-Methylumbelliferyl-alpha-D-galactopyranoside, 99% CAS-NO: 38597-12-5 FORMULA: $C_{16}H_{18}O_8$ MOLECULAR WEIGHT: 338,32 g/mole		GBB1275.0500	500 mg	€ 250,00
		GBB1275.1000	1 g	€ 350,00
		GBB1275.5000	5 g	€ 1250,00
		GBB1275.9001	10 g	€ 2200,00

Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
GBB1290 PNP-alpha-D-Gal 4-Nitrophenyl-alpha-D-galactopyranoside CAS-NO: 7493-95-0 FORMULA: $C_{12}H_{15}NO_8$ MOLECULAR WEIGHT: 301,26 g/mole		GBB1290.0010	10 g	€ 275,00
GBB1328 Magenta-alpha-D-Gal 5-Bromo-6-chloro-3-indoxyl-alpha-D-galactopyranoside CAS-NO: 198402-60-7 FORMULA: $C_{14}H_{15}BrClNO_6$ MOLECULAR WEIGHT: 408,64 g/mole		GBB1328.0500 GBB1328.1000	500 mg 1 g	€ 570,00 € 900,00
GBB1311 X-alpha-D-Gal 5-Bromo-4-chloro-3-indoxyl-alpha-D-galactopyranoside CAS-NO: 107021-38-5 FORMULA: $C_{14}H_{15}BrClNO_6$ MOLECULAR WEIGHT: 408,64 g/mole		GBB1311.0250 GBB1311.1000	250 mg 1 g	€ 175,00 € 225,00
GBB1119 1-OMe-alpha-D-Gal 1-O-Methyl-alpha-D-galactopyranoside, 98% CAS-NO: 3396-99-4 FORMULA: $C_7H_{14}O_6$ MOLECULAR WEIGHT: 194,19 g/mole		GBB1119.0025 GBB1119.0100 GBB1119.0250 GBB1119.0500 GBB1119.1000	25 g 100 g 250 g 500 g 1 kg	€ 200,00 € 290,00 € 580,00 € 1010,00 € 1720,00

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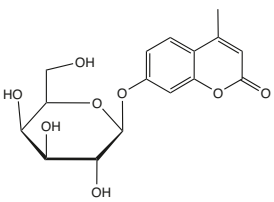
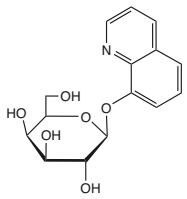
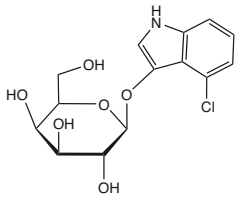
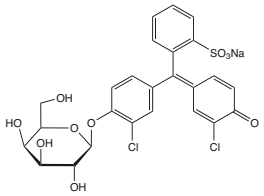
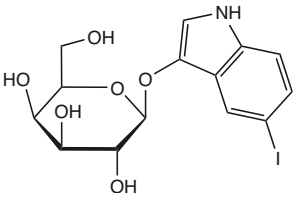
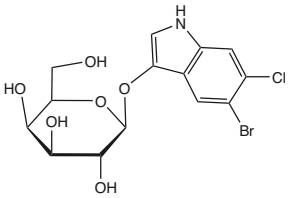
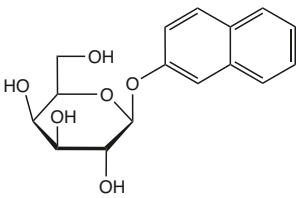
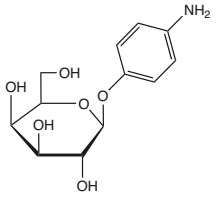
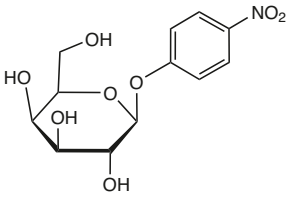
2.3.9. β-D-Galactosidase Substrates

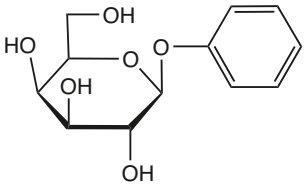
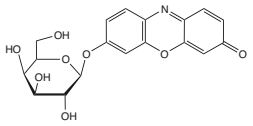
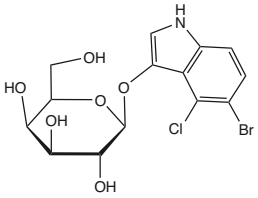
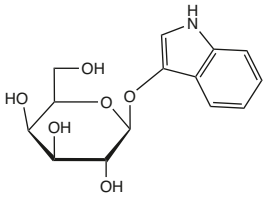
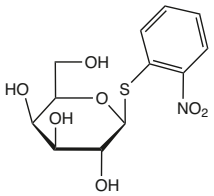
These substrates are frequently used for the detection of coliforms due to their characteristic beta-galactosidase activity.

		Article No.	Quantity	Price
GBB1283 4-MU-beta-D-Gal 4-Methylumbelliferyl-beta-D-galactopyranoside CAS-NO: 6160-78-7 FORMULA: $C_{16}H_{18}O_8$ MOLECULAR WEIGHT: 338,32 g/mole		GBB1283.0005 GBB1283.0025	5 g 25 g	€ 200,00 € 280,00

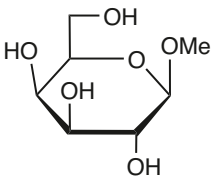
Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
GBB1336 **8-Hydroxyquinoline-beta-D-Gal** 8-Hydroxyquinoline-beta-D-galactopyranoside, 8-Hydroxy-1-azanaphthalene-beta-D-galactoside CAS-NO: 113079-84-8 FORMULA: $C_{15}H_{17}NO_6$ MOLECULAR WEIGHT: 307,3 g/mole		GBB1336.0500 GBB1336.0001	500 mg 1 g	€ 175,00 € 200,00
GBB1273 **4-Cl-3-indoxyl-beta-D-Gal** 4-Chloro-3-indoxyl-beta-D-galactopyranoside CAS-NO: 135313-63-2 FORMULA: $C_{14}H_{16}ClNO_6$ MOLECULAR WEIGHT: 329,74 g/mole		GBB1273.0250 GBB1273.1000 GBB1273.2500	250 mg 1 g 2,5 g	€ 150,00 € 225,00 € 350,00
GBB1339 **CPRG-Na** Chlorophenol red-beta-D-galactopyranoside sodium salt CAS-NO: 99792-50-4 FORMULA: $C_{25}H_{21}Cl_2O_{10}SNa$ MOLECULAR WEIGHT: 607,4 g/mole		GBB1339.0250 GBB1339.0500	250 mg 500 mg	€ 350,00 € 525,00
GBB1332 **Iodo-beta-D-Gal** 5-Iodo-3-indoxyl-beta-D-galactopyranoside, 99% CAS-NO: 36473-36-6 FORMULA: $C_{14}H_{16}INO_6$ MOLECULAR WEIGHT: 421,19 g/mole		GBB1332.0100 GBB1332.1000 GBB1332.5000	100 mg 1 g 5 g	€ 175,00 € 370,00 € 1380,00
GBB1329 **Magenta-beta-D-Gal** Red beta-D-Gal, 5-Bromo-6-chloro-3-indoxyl-beta-D-galactopyranoside, 99% CAS-NO: 93863-88-8 FORMULA: $C_{14}H_{15}BrClNO_6$ MOLECULAR WEIGHT: 408,64 g/mole		GBB1329.1000 GBB1329.5000 GBB1329.9025 GBB1329.9100	1 g 5 g 25 g 100 g	€ 175,00 € 250,00 € 710,00 € 2190,00
GBB1263 **2-Nap-beta-D-Gal** 2-Naphthyl-beta-D-galactopyranoside, 99% CAS-NO: 33993-25-8 FORMULA: $C_{16}H_{18}O_6$ MOLECULAR WEIGHT: 306,32 g/mole		GBB1263.0001 GBB1263.0005	1 g 5 g	€ 200,00 € 300,00
GBB1272 **PAPh-beta-D-Gal** 4-Aminophenyl-beta-D-galactopyranoside CAS-NO: 5094-33-7 FORMULA: $C_{12}H_{17}NO_6$ MOLECULAR WEIGHT: 271,27 g/mole		GBB1272.0250 GBB1272.0001 GBB1272.2500	250 mg 1 g 2,5 g	€ 175,00 € 225,00 € 500,00
GBB1298 **PNP-beta-D-Gal** CAS-NO: 3150-24-1 FORMULA: $C_{12}H_{15}NO_8$ MOLECULAR WEIGHT: 301,26 g/mole		GBB1298.0010 GBB1298.0025 GBB1298.0050 GBB1298.0100 GBB1298.0250	10 g 25 g 50 g 100 g 250 g	€ 175,00 € 250,00 € 375,00 € 850,00 € 1750,00

Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
GBB1228 1-Ph-beta-D-Gal Phenyl-beta-D-galactopyranoside CAS-NO: 2818-58-8 FORMULA: $C_{12}H_{16}O_6$ MOLECULAR WEIGHT: 256,25 g/mole		GBB1228.0005 GBB1228.0010 GBB1228.0025	5 g 10 g 25 g	€ 175,00 € 240,00 € 450,00
GBB1358 Res-beta-D-Gal Resorufin-beta-D-galactopyranoside, 98% CAS-NO: 95079-19-9 FORMULA: $C_{18}H_{17}NO_8$ MOLECULAR WEIGHT: 375,34 g/mole		GBB1358.0025 GBB1358.0100	25 mg 100 mg	€ 175,00 € 375,00
GBB1321 X-beta-D-Gal 5-Bromo-4-chloro-3-indoxyl-beta-D-galactopyranoside, 99% CAS-NO: 7240-90-6 FORMULA: $C_{14}H_{15}BrClNO_6$ MOLECULAR WEIGHT: 408,64 g/mole		GBB1321.2500	2,5 g	€ 145,00
GBB1267 Y-beta-D-Gal 3-Indoxyl-beta-D-galactopyranoside, 98% CAS-NO: 126787-65-3 FORMULA: $C_{14}H_{17}NO_6$ MOLECULAR WEIGHT: 295,29 g/mole		GBB1267.1000 GBB1267.2500 GBB1267.5000	1 g 2,5 g 5 g	€ 200,00 € 250,00 € 290,00
GBB1264 ONP-1-S-beta-D-Gal 2-Nitrophenyl-1-thio-beta-D-galactopyranoside, 99% CAS-NO: 1158-17-4 FORMULA: $C_{12}H_{15}NO_7S$ MOLECULAR WEIGHT: 317,32 g/mole		GBB1264.0001	1 g	€ 250,00

2-Nitrophenyl 1-thio-β-D-galactopyranoside is an enzyme substrate typically used in the election of *lac*⁻ mutants.

		Article No.	Quantity	Price
GBB1120 1-OMe-beta-D-Gal 1-O-Methyl-beta-D-galactopyranoside, 98% CAS-NO: 1824-94-8 FORMULA: $C_7H_{14}O_6$ MOLECULAR WEIGHT: 194,19 g/mole		GBB1120.0005 GBB1120.0025	5 g 25 g	€ 125,00 € 175,00

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Prices are in EUR, net, exw Germany

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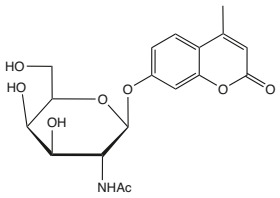
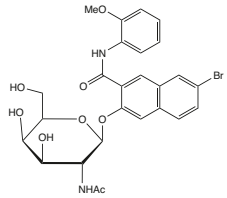
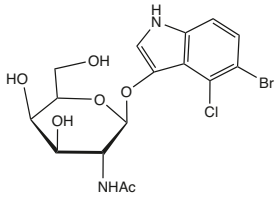
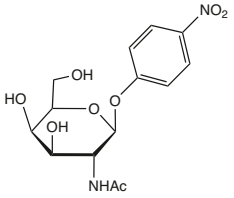
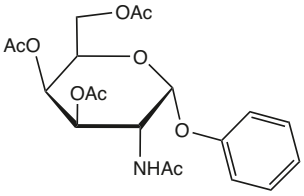
2.3.10. N-Acetyl-β-D-Galactosaminidase Substrates

N-Acetyl-β-D-Galactosaminidase activity is frequently used for the detection of *Candida albicans*.

		Article No.	Quantity	Price
GBB1288 **4-MU-beta-D-GalNAc** 4-Methylumbelliferyl-N-acetyl-beta-D-galactosaminide, 4-Methylumbelliferyl 2-acetamido-2-deoxy-beta-D-Galactopyranoside, 98% CAS-NO: 36476-29-6 FORMULA: $C_{18}H_{21}NO_8$ MOLECULAR WEIGHT: 379,37 g/mole		GBB1288.1000 GBB1288.5000	1 g 5 g	€ 200,00 € 330,00
GBB1349 **Naphthol AS-BI beta-D-GalNAc** Naphthol AS-BI N-acetyl-beta-D-galactosaminide CAS-NO: 3395-37-7 FORMULA: $C_{26}H_{27}BrN_2O_8$ MOLECULAR WEIGHT: 575,42 g/mole		GBB1349.0100 GBB1349.0250 GBB1349.0500 GBB1349.0001	100 mg 250 mg 500 mg 1 g	€ 250,00 € 350,00 € 525,00 € 750,00
GBB1308 **X-beta-D-GalNAc** 5-Bromo-4-chloro-3-indoxyl-2-acetamido-2-deoxy-beta-D-galactopyranoside CAS-NO: 129572-48-1 FORMULA: $C_{16}H_{18}BrClN_2O_6$ MOLECULAR WEIGHT: 449,69 g/mole		GBB1308.0100 GBB1308.0250 GBB1308.0500	100 mg 250 mg 500 mg	€ 175,00 € 200,00 € 225,00
GBB1305 **PNP-beta-D-GalNAc** 4-Nitrophenyl-N-acetyl-beta-D-galactosaminide, 4-Nitrophenyl-N-acetyl-beta-D-galactosamine, 98% CAS-NO: 14948-96-0 FORMULA: $C_{14}H_{18}N_2O_8$ MOLECULAR WEIGHT: 342,31 g/mole		GBB1305.0001 GBB1305.0005 GBB1305.0010	1 g 5 g 10 g	€ 200,00 € 300,00 € 470,00
GBB1227 **Phenyl-3,4,6-tri-O-Ac-alpha-D-GalNAc** Phenyl-2-acetamido-3,4,6-tri-O-acetyl-2-deoxy-alpha-D-galactopyranoside FORMULA: $C_{20}H_{25}NO_9$ MOLECULAR WEIGHT: 423,42 g/mole		GBB1227.0001 GBB1227.0002 GBB1227.0005	1 g 2 g 5 g	€ 350,00 € 600,00 € 1100,00

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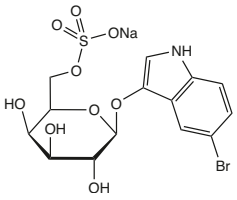
Prices are in EUR, net, exw Germany

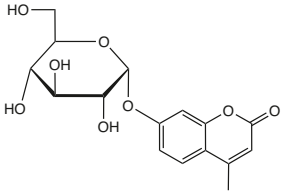
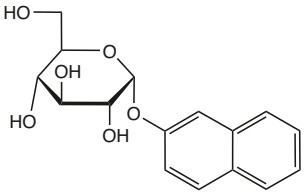
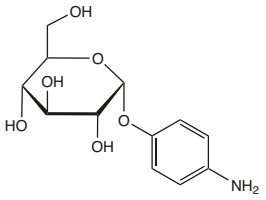
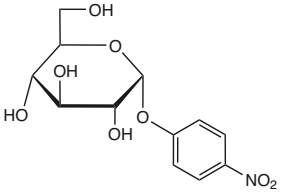
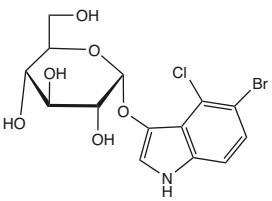
2.3.11. β-D-Galactose-6-Sulfate Sulfatase Substrate

Determination of galactose-6-sulfate sulfatase activity can be used for diagnosis of Morquio disease type A. Patients with Morquio syndrome display a deficiency of galactose 6-sulfate sulfatase and N-acetylgalactosamine 6-sulfate sulfatase activity.

		Article No.	Quantity	Price
GBB1307	**Lapis-beta-D-Gal-6-Sulfate*Na**	GBB1307.0025	25 mg	€ 240,00
5-Bromo-3-indoxyl-beta-D-galactopyranoside-6-sulfate sodium salt FORMULA: $C_{14}H_{15}BrNO_9SNa$ MOLECULAR WEIGHT: 476,24 g/mole		GBB1307.0100	100 mg	€ 680,00

2.3.12. α-D-Glucosidase Substrates

Alpha-D-glucosidase substrates have been used in studies of Pompe´s disease (glycogen storage disease), for differentiation and enumeration of *Enterobacter sakazakii* based on alpha-glucosidase activity, for the detection of glucansucrases, as ligand immobilized on agarose for affinity precipitation of concanavalin A and for studies of the crystal structure of the complexes of concanavalin A.

		Article No.	Quantity	Price
GBB1276	**4-MU-alpha-D-Glc**	GBB1276.0250	250 mg	€ 175,00
4-Methylumbelliferyl-alpha-D-glucopyranoside, 99% CAS-NO: 17833-43-1 FORMULA: $C_{16}H_{18}O_8$ MOLECULAR WEIGHT: 338,32 g/mole		GBB1276.1000	1 g	€ 200,00
GBB1261	**2-Nap-alpha-D-Glc**	GBB1261.0001	1 g	€ 275,00
2-Naphthyl-alpha-D-glucopyranoside, 98% CAS-NO: 25320-79-0 FORMULA: $C_{16}H_{18}O_6$ MOLECULAR WEIGHT: 306,32 g/mole		GBB1261.0005	5 g	€ 600,00
GBB1271	**pAPh-alpha-D-Glc**	GBB1271.1000	1 g	€ 225,00
4-Aminophenyl-alpha-D-glucopyranoside CAS-NO: 31302-52-0 FORMULA: $C_{12}H_{17}NO_6$ MOLECULAR WEIGHT: 271,27 g/mole				
GBB1291	**PNP-alpha-D-Glc**	GBB1291.0005	5 g	€ 200,00
4-Nitrophenyl-alpha-D-glucopyranoside, 99% CAS-NO: 3767-28-0 FORMULA: $C_{12}H_{15}NO_8$ MOLECULAR WEIGHT: 301,26 g/mole		GBB1291.0010	10 g	€ 225,00
		GBB1291.0025	25 g	€ 300,00
GBB1313	**X-alpha-D-Glc**	GBB1313.0100	100 mg	€ 175,00
5-Bromo-4-chloro-3-indoxyl-alpha-D-glucopyranoside, 99% CAS-NO: 108789-36-2 FORMULA: $C_{14}H_{15}BrClNO_6$ MOLECULAR WEIGHT: 408,64 g/mole		GBB1313.0250	250 mg	€ 225,00
		GBB1313.0500	500 mg	€ 300,00
		GBB1313.0001	1 g	€ 450,00
		GBB1313.0005	5 g	€ 1720,00

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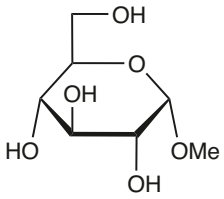
	Article No.	Quantity	Price
GBB1251 1-OMe-alpha-Glu	GBB1251.0250	250 g	€ 150,00
	GBB1251.0500	500 g	€ 200,00

1-O-Methyl-alpha-D-glucopyranoside, 99%
CAS-NO: 97-30-3
FORMULA: $C_7H_{14}O_6$
MOLECULAR WEIGHT: 194,19 g/mole



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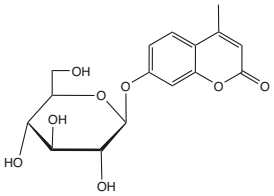
2.3.13. β-D-Glucosidase Substrates

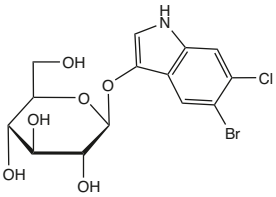
	Article No.	Quantity	Price
GBB1284 4-MU-beta-D-Glc	GBB1284.0001	1 g	€ 150,00
	GBB1284.0005	5 g	€ 230,00
	GBB1284.0010	10 g	€ 250,00

4-Methylumbelliferyl-beta-D-glucopyranoside, 99%
CAS-NO: 18997-57-4
FORMULA: $C_{16}H_{18}O_8$
MOLECULAR WEIGHT: 338,32 g/mole



GBB1330 Magenta-beta-D-Glc	GBB1330.0001	1 g	€ 200,00
	GBB1330.0025	25 g	€ 1280,00
	GBB1330.0100	100 g	€ 4460,00

5-Bromo-6-chloro-3-indoxyl-beta-D-glucopyranoside, 99%
CAS-NO: 93863-89-9
FORMULA: $C_{14}H_{15}BrClNO_6$
MOLECULAR WEIGHT: 408,64 g/mole



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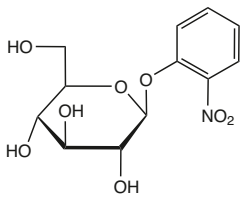
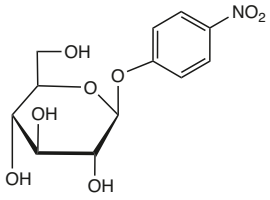
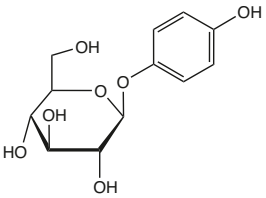
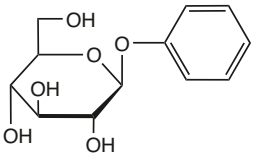
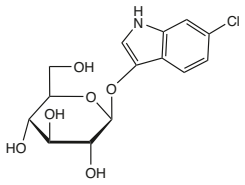
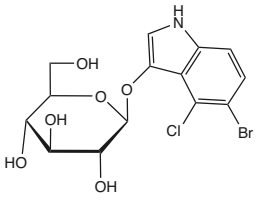
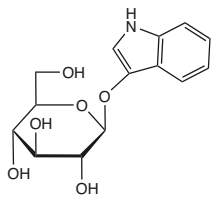
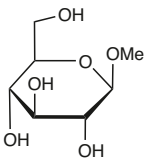
		Article No.	Quantity	Price
GBB1265 ONP-beta-D-Glc 2-Nitrophenyl-beta-D-glucopyranoside, 99% CAS-NO: 2816-24-2 FORMULA: $C_{12}H_{15}NO_8$ MOLECULAR WEIGHT: 301,26 g/mole		GBB1265.0005 GBB1265.0010 GBB1265.0025	5 g 10 g 25 g	€ 200,00 € 350,00 € 650,00
GBB1299 PNP-beta-D-Glc 4-Nitrophenyl-beta-D-glucopyranoside, 99% CAS-NO: 2492-87-7 FORMULA: $C_{12}H_{15}NO_8$ MOLECULAR WEIGHT: 301,26 g/mole		GBB1299.0005 GBB1299.0025	5 g 25 g	€ 200,00 € 290,00
GBB1149 Arbutin 4-Hydroxyphenyl beta-D-glucopyranoside CAS-NO: 497-76-7 FORMULA: $C_{12}H_{16}O_7$ MOLECULAR WEIGHT: 272,25 g/mole		GBB1149.0250 GBB1149.0500	250 g 500 g	€ 200,00 € 325,00
GBB1355 Ph-beta-D-Glc Phenyl-beta-D-glucopyranoside CAS-NO: 1464-44-4 FORMULA: $C_{12}H_{16}O_6$ MOLECULAR WEIGHT: 256,26 g/mole		GBB1355.0005 GBB1355.0010 GBB1355.0025	5 g 10 g 25 g	€ 150,00 € 175,00 € 200,00
GBB1333 Salmon-beta-D-Glc 6-Chloro-3-indoxyl-beta-D-glucopyranoside, Rose glucoside CAS-NO: 159954-28-6 FORMULA: $C_{14}H_{16}ClNO_6$ MOLECULAR WEIGHT: 329,74 g/mole		GBB1333.1000 GBB1333.5000 GBB1333.9025 GBB1333.9100	1 g 5 g 25 g 100 g	€ 150,00 € 350,00 € 1100,00 € 2750,00
GBB1312 X-beta-D-Glc 5-Bromo-4-chloro-3-indoxyl-beta-D-glucopyranoside, 98% CAS-NO: 15548-60-4 FORMULA: $C_{14}H_{15}BrClNO_6$ MOLECULAR WEIGHT: 408,64 g/mole		GBB1312.0001 GBB1312.0005 GBB1312.0010	1 g 5 g 10 g	€ 200,00 € 300,00 € 450,00
GBB1268 Y-beta-D-Glc 3-Indoxyl-beta-D-glucopyranoside, 99% CAS-NO: 487-60-5 FORMULA: $C_{14}H_{17}NO_6$ MOLECULAR WEIGHT: 295,29 g/mole		GBB1268.0001 GBB1268.0005	1 g 5 g	€ 200,00 € 300,00
GBB1224 1-OMe-beta-Glc 1-O-Methyl-beta-D-glucopyranoside hemihydrate CAS-NO: 7000-27-3 FORMULA: $C_7H_{14}O_6*1/2H_2O$ MOLECULAR WEIGHT: 194,18*9,01 g/mole		GBB1224.0010 GBB1224.0025	10 g 25 g	€ 175,00 € 275,00

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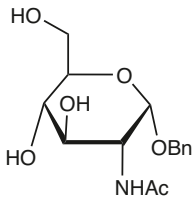
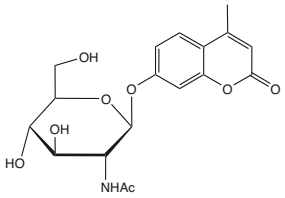
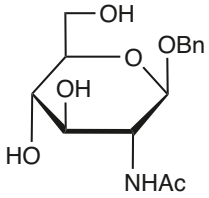
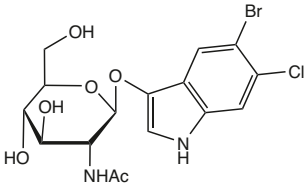
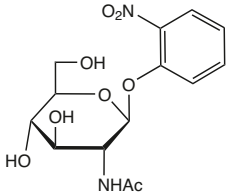
2.3.14. N-Acetyl-α-D-Glucosaminidase Substrate

		Article No.	Quantity	Price
GBB1219	**Benzyl-alpha-D-GlcNAc**	GBB1219.0001	1 g	€ 225,00
Benzyl 2-acetamido-2-deoxy-alpha-D-glucopyranoside CAS-NO: 13343-62-9 FORMULA: $C_{15}H_{21}NO_6$ MOLECULAR WEIGHT: 311,34 g/mole		GBB1219.0005	5 g	€ 700,00

2.3.15. N-Acetyl-β-D-Glucosaminidase Substrates

Several mycological culture media contain N-acetyl-β-D-glucosaminidase substrates. They are used particularly in yeasts and molds or for rapid identification of *Salmonella* species.

		Article No.	Quantity	Price
GBB1289	**4-MU-beta-D-GlcNAc**	GBB1289.1000	1 g	€ 175,00
4-Methylumbelliferyl-N-acetyl-beta-D-glucosaminide, 4-Methylumbelliferyl-N-acetyl-beta-D-glucosamine, 4-Methylumbelliferyl 2-acetamido-2-deoxy-beta-D-Glucopyranoside, 99% CAS-NO: 37067-30-4 FORMULA: $C_{18}H_{21}NO_8$ MOLECULAR WEIGHT: 379,37 g/mole		GBB1289.5000	5 g	€ 650,00
		GBB1289.9001	10 g	€ 1000,00
GBB1242	**Benzyl-beta-D-GlcNAc**	GBB1242.0010	10 g	€ 1250,00
Benzyl 2-acetamido-2-deoxy-beta-D-glucopyranoside CAS-NO: 13343-67-4 FORMULA: $C_{15}H_{21}NO_6$ MOLECULAR WEIGHT: 311,34 g/mole		GBB1242.0025	25 g	€ 2500,00
		GBB1242.0050	50 g	€ 4250,00
GBB1327	**Magenta-beta-D-GlcNAc**	GBB1327.0250	250 mg	€ 250,00
5-Bromo-6-chloro-3-indoxyl-2-acetamido-2-deoxy-beta-D-glucopyranoside, 99% CAS-NO: 5609-91-6 FORMULA: $C_{16}H_{18}BrClN_2O_6$ MOLECULAR WEIGHT: 449.69 g/mole		GBB1327.0500	500 mg	€ 450,00
		GBB1327.1000	1 g	€ 700,00
GBB1266	**ONP-beta-D-GlcNAc**	GBB1266.0250	250 mg	€ 150,00
2-Nitrophenyl-N-acetyl-beta-D-glucosaminide CAS-NO: 13264-92-1 FORMULA: $C_{14}H_{18}N_2O_8$ MOLECULAR WEIGHT: 342,31 g/mole		GBB1266.0001	1 g	€ 225,00
		GBB1266.0005	5 g	€ 450,00

Prices are in EUR, net, exw Germany

	Article No.	Quantity	Price
GBB1306 PNP-beta-D-GlcNAc 4-Nitrophenyl-N-acetyl-beta-D-glucosaminide, 99% CAS-NO: 3459-18-5 FORMULA: $C_{14}H_{18}N_2O_8$ MOLECULAR WEIGHT: 342,31 g/mole	GBB1306.0500	500 mg	€ 150,00
	GBB1306.1000	1 g	€ 175,00
	GBB1306.9010	10 g	€ 450,00
GBB1309 X-beta-D-GlcNAc 5-Bromo-4-chloro-3-indoxyl-2-acetamido-2-deoxy-beta-D-gluco-pyranoside CAS-NO: 4264-82-8 FORMULA: $C_{16}H_{18}BrClN_2O_6$ MOLECULAR WEIGHT: 449,69 g/mole	GBB1309.0001	1 g	€ 200,00
	GBB1309.0005	5 g	€ 320,00
	GBB1309.0010	10 g	€ 520,00

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2.3.16. Glucose-6-Phosphat

Glucose-6-phosphat (Robison-Ester, G6P) is an organic molecule playing a central role in cell metabolism as a so called "activated glucose". It is a substrate for numerous enzymes such as glucose-6-phospate dehydrogenase, glucose-6-phospate mutase or glucose-6-phosphatase. Yet, it is not a fluorogenic or chromogenic substrate for any reporter enzyme.

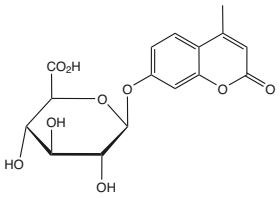
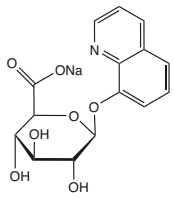
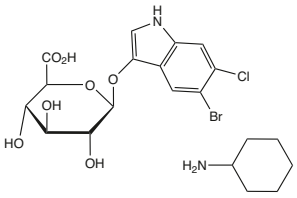
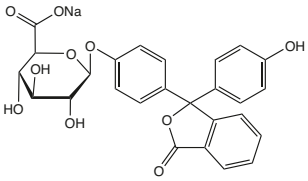
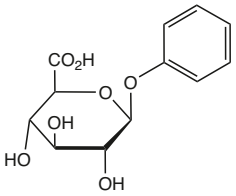
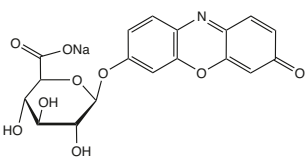
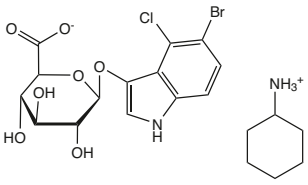
	Article No.	Quantity	Price
GBB1340 Robison ester monosodium salt D-Glucose 6-phosphate, monosodium salt CAS-NO: 54010-71-8 FORMULA: $C_6H_{12}O_9PNa$ MOLECULAR WEIGHT: 282,12 g/mole	GBB1340.0005	5 g	€ 200,00
	GBB1340.0010	10 g	€ 300,00
	GBB1340.0025	25 g	€ 320,00

Prices are in EUR, net, exw Germany

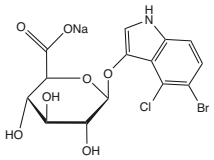
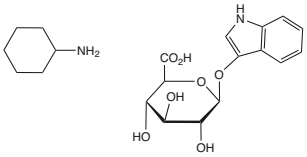
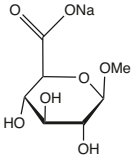
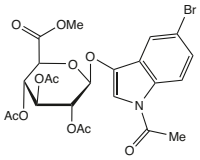
2.3.17. β-D-Glucuronidase Substrates

About 95% of common *E. coli* possess beta-D-glucuronidase activity. Therefore chromogenic culture media are used for detection and enumeration of *E. coli* in food samples such as meat, dairy products, or shellfish and have clinical applications in the assessment of urinary infections. It has gained international acceptance as a highly accurate test for the presence of *E. coli* in drinking water samples. It is also used for the detection of the expression of *gusA* (*E. coli* beta-glucuronidase) gene fusion marker constructs in plants.

4-Methylumbelliferyl beta-D-glucuronide (MUG) is recommended in international normatives (ISO, DIN) as a fluorogenic substrate for detection of *E. coli*.

		Article No.	Quantity	Price
GBB1285	**4-MU-beta-D-GlcUA**	GBB1285.0005	5 g	€ 150,00
4-Methylumbelliferyl-beta-D-glucuronic acid dihydrate, 99%		GBB1285.0010	10 g	€ 225,00
CAS-NO: 6160-80-1		GBB1285.0025	25 g	€ 325,00
FORMULA: $C_{16}H_{16}O_9*2H_2O$				
MOLECULAR WEIGHT: 388,33 g/mole				
GBB1337	**8-Hydroxyquinoline-beta-D-GlcUA*Na**	GBB1337.0005	5 g	€ 360,00
8-Hydroxyquinoline-beta-D-glucuronic acid, sodium salt, 8-Hydroxy-1-azanaphthalene-beta-D-glucuronide, sodium salt, 98%				
CAS-NO: 207728-71-0				
FORMULA: $C_{15}H_{14}NO_7Na$				
MOLECULAR WEIGHT: 343,27 g/mole				
GBB1331	**Magenta-beta-D-GlcUA*CHA**	GBB1331.0500	500 mg	€ 225,00
5-Bromo-6-chloro-3-indoxyl-beta-D-glucuronic acid cyclohexylamin, 99%		GBB1331.1000	1 g	€ 275,00
CAS-NO: 144110-43-0				
FORMULA: $C_{14}H_{13}BrClNO_7*C_6H_{13}N$				
MOLECULAR WEIGHT: 521,8 g/mole				
GBB1354	**Phenolphthalein-beta-D-GlcUA*Na**	GBB1354.0050	50 mg	€ 200,00
Phenolphthalein-beta-D-glucuronic acid, sodium salt		GBB1354.0100	100 mg	€ 375,00
CAS-NO: 6820-54-8		GBB1354.0250	250 mg	€ 750,00
FORMULA: $C_{26}H_{21}O_{10}Na$				
MOLECULAR WEIGHT: 552,47 g/mole				
GBB1356	**Ph-beta-D-GlcUA**	GBB1356.0100	100 mg	€ 200,00
Phenyl-beta-D-glucuronic acid monohydrate, 98%		GBB1356.0500	500 mg	€ 250,00
CAS-NO: 17685-05-1		GBB1356.2500	2,5 g	€ 370,00
FORMULA: $C_{12}H_{14}O_7*H_2O$		GBB1356.5000	5 g	€ 510,00
MOLECULAR WEIGHT: 288,26 g/mole				
GBB1359	**Res-beta-D-GlcUA*Na**	GBB1359.0005	5 mg	€ 440,00
Resorufin-beta-D-glucuronic acid, sodium salt, 90%		GBB1359.0010	10 mg	€ 720,00
CAS-NO: 125440-91-7		GBB1359.0025	25 mg	€ 1670,00
FORMULA: $C_{18}H_{14}NO_9Na$		GBB1359.0250	250 mg	€ 2390,00
MOLECULAR WEIGHT: 411,3 g/mole		GBB1359.0500	500 mg	€ 4250,00
GBB1322	**X-beta-D-GlcUA*DCHA*H_2O**	GBB1322.0250	250 mg	€ 145,00
5-Bromo-4-chloro-3-indoxyl-beta-D-glucuronic acid cyclohexylamin monohydrate, 99%		GBB1322.0500	500 mg	€ 175,00
CAS-NO: 114162-64-0		GBB1322.2500	2,5 g	€ 425,00
FORMULA: $C_{14}H_{13}BrClNO_7*C_6H_{13}N*H_2O$				
MOLECULAR WEIGHT: 422,61*99,17*18,02 g/mole				

Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
GBB1323 **X-beta-D-GlcUA*Na*3H$_2$O** 5-Bromo-4-chloro-3-indoxyl-beta-D-glucuronic acid, sodium salt, 99% CAS-NO: 370100-64-4 FORMULA: $C_{14}H_{12}BrClNO_7Na*3H_2O$ MOLECULAR WEIGHT: 444,6 g/mole		GBB1323.1000	1 g	€ 175,00
		GBB1323.5000	5 g	€ 425,00
		GBB1323.9025	25 g	€ 1250,00
		GBB1323.9100	100 g	€ 3000,00
GBB1269 **Y-beta-D-GlcUA*CHX** 3-Indoxyl-beta-D-glucoronic acid cyclohexylamine salt, 98% CAS-NO: 35804-66-1 FORMULA: $C_{14}H_{17}NO_7*C_6H_{13}N$ MOLECULAR WEIGHT: 408,46 g/mole		GBB1269.0500	500 mg	€ 250,00
		GBB1269.1000	1 g	€ 470,00
GBB1254 **1-OMe-beta-D-GlcUA*Na** 1-O-Methyl-beta-D-glucuronic acid, sodium salt, 99% CAS-NO: 134253-42-2 FORMULA: $C_7H_{11}O_7Na$ MOLECULAR WEIGHT: 230,15 g/mole		GBB1254.0001	1 g	€ 200,00
		GBB1254.0010	10 g	€ 470,00
		GBB1254.0050	50 g	€ 1300,00
		GBB1254.0100	100 g	€ 1970,00
GBB1347 **Lapis-GlcUA-Ac** N-Acetyl-5-bromo-3-indoxyl-2,3,4-tri-O-acetyl-beta-D-glucuronic acid methyl ester FORMULA: $C_{23}H_{24}BrNO_{11}$ MOLECULAR WEIGHT: 570,34 g/mole		GBB1347.0500	500 mg	€ 325,00
		GBB1347.1000	1 g	€ 475,00

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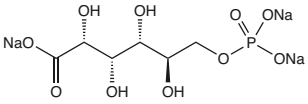
Prices are in EUR, net, exw Germany

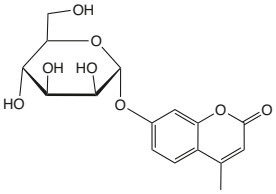
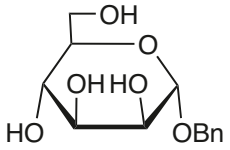
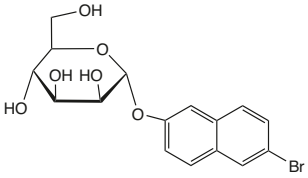
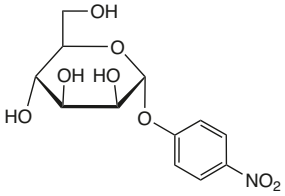
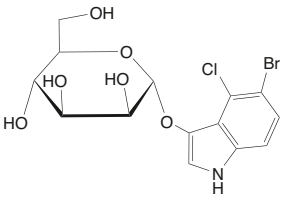
2.3.18. 6-Phosphogluconate

6-Phosphogluconic acid is a substrate for phosphogluconate dehydratase. Yet, it is not a fluorogenic or chromogenic substrate for any reporter enzyme.

		Article No.	Quantity	Price
GBB1335	**6-P-GlcUA-Na3**	GBB1335.2500	2,5 g	€ 340,00
6-Phosphogluconic acid, trisodium salt, Trisodium 6-phospho-D-gluconate, D-Gluconate 6-phosphate trisodium salt, 98%		GBB1335.9010	10 g	€ 970,00
CAS-NO: 53411-70-4		GBB1335.9025	25 g	€ 1930,00
FORMULA: $C_6H_{10}O_{10}PNa_3$		GBB1335.9100	100 g	€ 4630,00
MOLECULAR WEIGHT: 342,08 g/mole				

2.3.19. α-D-Mannosidase Substrates

Alpha-D-mannosidase substrates are used for determination of lectin in very dilute solutions by fluorescence quenching, in studies of the kinetics of saccharide binding to the dimer form of concanavalin A, for studies of the crystal structure of the complexes of concanavalin A and for diagnosis of alpha-mannosidosis by measuring alpha-mannosidase in plasma.

		Article No.	Quantity	Price
GBB1277	**4-MU-alpha-D-Man**	GBB1277.0250	250 mg	€ 250,00
4-Methylumbelliferyl-alpha-D-mannopyranoside, 98%		GBB1277.1000	1 g	€ 600,00
CAS-NO: 28541-83-5				
FORMULA: $C_{16}H_{18}O_8$				
MOLECULAR WEIGHT: 338,32 g/mole				
GBB1221	**Benzyl alpha-D-Man**	GBB1221.0001	1 g	€ 175,00
Benzyl alpha-D-mannopyranoside		GBB1221.0002	2 g	€ 275,00
CAS-NO: 15548-45-5		GBB1221.0005	5 g	€ 550,00
FORMULA: $C_{13}H_{18}O_6$				
MOLECULAR WEIGHT: 270,28 g/mole				
GBB1256	**Br-Nap-alpha-D-Man**	GBB1256.0250	250 mg	€ 175,00
2-(6-Bromonaphthyl)-alpha-D-mannopyranoside		GBB1256.0001	1 g	€ 440,00
CAS-NO: 28541-84-6				
FORMULA: $C_{16}H_{17}BrO_6$				
MOLECULAR WEIGHT: 385,22 g/mole				
GBB1294	**PNP-alpha-D-Man**	GBB1294.0005	5 g	€ 225,00
4-Nitrophenyl-alpha-D-mannopyranoside, 99%		GBB1294.0010	10 g	€ 275,00
CAS-NO: 10357-27-4		GBB1294.0025	25 g	€ 490,00
FORMULA: $C_{12}H_{15}NO_8$		GBB1294.0100	100 g	€ 1450,00
MOLECULAR WEIGHT: 301,26 g/mole				
GBB1314	**X-alpha-D-Man**	GBB1314.0010	10 mg	€ 175,00
5-Bromo-4-chloro-3-indoxyl-alpha-D-mannopyranoside, 99%		GBB1314.0100	100 mg	€ 300,00
CAS-NO: 125229-64-3		GBB1314.1000	1 g	€ 500,00
FORMULA: $C_{14}H_{15}BrClNO_6$				
MOLECULAR WEIGHT: 408,64 g/mole				

Prices are in EUR, net, exw Germany

References:

- Clegg R.M., *et al.*, Binding of 4-methylumbelliferyl alpha-D-mannopyranoside to dimeric concanavalin A: fluorescence temperature-jump relaxation study. *Biochemistry* 1977; **16**: 167-75.
- Datta P.K., Bera S.C., Determination of lectin in very dilute solution with umbelliferyl sugars by fluorescence quenching. *Anal. Chim. Acta* 1989; **220**: 225.
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- Yoshihisa T., *et al.*, Solubilization and purification of alpha-mannosidase , a marker enzyme of vacuolar membranes in Saccharomyces cerevisiae. *J. Biol. Chem.* 1988; **263**: 5158-63.
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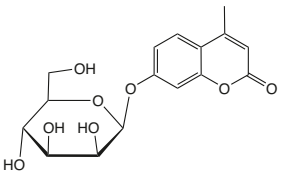
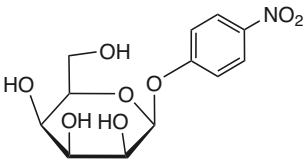
- Conchie J., Hay A.J., Mammalian glycosidases. 4. The intracellular localization of beta-galactosidase, alpha-mannosidase, beta-N-acetylglucosaminidase and alpha-L-fucosidase in mammalian tissues. *Biochem. J.* 1963; **87**: 354-61.
- Hamodrakas S.J., *et al.*, Models of binding of 4'-nitrophenyl alpha-D-mannopyranoside to the lectin concanavalin A. *Int. J. Biol. Macromol.* 1989; **11**: 17-22.
- Jelinek-Kelly S., *et al.*, Characterization of a specific alpha-mannosidase involved in oligosaccharide processing in Saccharomyces cerevisiae. *J. Biol. Chem.* 1985; **260**: 2253-7.
- Kanellopoulos P.N., *et al.*, The crystal structure of the complexes of concanavalin A with 4'-nitrophenyl-alpha-D-mannopyranoside and 4'-nitrophenyl-alpha-D-glucopyranoside. *J. Struct. Biol.* 1996; **116**: 345-55.

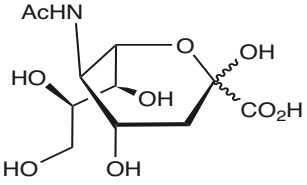
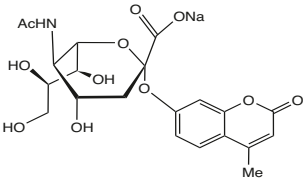
2.3.20. β-D-Mannosidase Substrates

		Article No.	Quantity	Price
GBB1286	**4-MU-beta-D-Man**	GBB1286.0100	100 mg	€ 200,00
4-Methylumbelliferyl-beta-D-mannopyranoside, 99%		GBB1286.0250	250 mg	€ 350,00
CAS-NO: 67909-30-2				
FORMULA: $C_{16}H_{18}O_8$				
MOLECULAR WEIGHT: 338,32 g/mole				
GBB1301	**PNP-beta-D-Man**	GBB1301.0100	100 mg	€ 200,00
4-Nitrophenyl-beta-D-mannopyranoside, 98%		GBB1301.0250	250 mg	€ 225,00
CAS-NO: 35599-02-1		GBB1301.0500	500 mg	€ 275,00
FORMULA: $C_{12}H_{15}NO_8$				
MOLECULAR WEIGHT: 301,26 g/mole				

References:

- Pearce R.D., *et al.*, Caprine beta-D-mannosidosis: characterization of a model lysosomal storage disorder. *Can. J. Vet. Res.* 1990; **54**: 22-9.
- Pearce R.D., *et al.*, Properties and prenatal ontogeny of beta-D-mannosidase in selected goat tissues. *Biochem. J.* 1987; **243**: 603-9.
- Pearce R.D., *et al.*, Properties of partially purified goat kidney beta-D-mannosidase. *Br. Vet. J.* 1990; **146**: 270-80.
- Andreotti G., *et al.*, Purification and characterization of a beta-D-mannosidase from the marine anaspidean Aplysia fasciata. *J. Biotechnol.* 2005; **119**: 26-35.
- Cavanagh K., *et al.*, Measurement of caprine plasma beta-mannosidase with a p-nitrophenyl substrate. *Am. J. Vet. Res.* 1983; **44**: 681-4.

2.3.21. Neuraminidase Substrates

		Article No.	Quantity	Price
GBB1179	**NANA**	GBB1179.0005	5 g	€ 110,00
N-Acetyl-neuraminic acid dihydrate (synthetic), Sialic acid, 98%		GBB1179.0025	25 g	€ 250,00
CAS-NO: 131-48-6		GBB1179.0100	100 g	€ 660,00
FORMULA: $C_{11}H_{19}NO_9$				
MOLECULAR WEIGHT: 309,28 g/mole				
GBB1258	**4-MU-NANA*Na**	GBB1258.0005	5 mg	€ 150,00
2'-(4-Methylumbelliferyl)-alpha-D-N-acetylneuraminic acid, sodium salt, 98%		GBB1258.0025	25 mg	€ 200,00
CAS-NO: 76204-02-9		GBB1258.0100	100 mg	€ 275,00
FORMULA: $C_{21}H_{24}NO_{11}Na$				
MOLECULAR WEIGHT: 489,42 g/mole				

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		Article No.	Quantity	Price
GBB1315	**X-NANA*Na**	GBB1315.0010	10 mg	€ 175,00
5-Bromo-4-chloro-3-indoxyl-alpha-D-N-acetylneuraminic acid, sodium salt		GBB1315.0001	1 mg	€ 190,00
CAS-NO: 160369-85-7		GBB1315.0025	25 mg	€ 200,00
FORMULA: $C_{19}H_{21}BrClN_2O_9Na$		GBB1315.0100	100 mg	€ 330,00
MOLECULAR WEIGHT: 559,74 g/mole		GBB1315.0500	500 mg	€ 1000,00
		GBB1315.1000	1 g	€ 1640,00

References:

- Saito M., *et al.*, Fluorescent cytochemical detection of sialidase activity using 5-bromo-4-chloroindol-3-yl-alpha- D- N-acetylneuraminic acid as the substrate. *Histochem. Cell. Biol.* 2002; **117**: 453-8.
- Nayak D.P., Reichl U., Neuraminidase activity assays for monitoring MDCK cell culture derived influenza virus. *J. Virol. Methods* 2004; **122**: 9-15.
- Potier M., *et al.*, Fluorometric assay of neuraminidase with a sodium (4-methylumbelliferyl-alpha-D-N-acetylneuraminate) substrate. *Anal. Biochem.* 1979; **94**: 287-96.
- Suzuki T., *et al.*, Sialidase activity of influenza A virus in an endocytic pathway enhances viral replication. *J. Virol.* 2005; **79**: 11705-15.
- Wetherall N.T., *et al.*, Evaluation of neuraminidase enzyme assays using different substrates to measure susceptibility of influenza virus clinical isolates to neuraminidase inhibitors: report of the neuraminidase inhibitor susceptibility network. *J. Clin. Microbiol.* 2003; **41**: 742-50.
- Yen H.L., *et al.*, Importance of neuraminidase active-site residues to the neuraminidase inhibitor resistance of influenza viruses. *J. Virol.* 2006; **80**: 8787-95.

2.3.22. α-D-Xylosidase Substrates

		Article No.	Quantity	Price
GBB1316	**X-alpha-D-Xyl**	GBB1316.0500	500 mg	€ 550,00
5-Bromo-4-chloro-3-indoxyl-alpha-D-xylopyranoside, 99%				
FORMULA: $C_{13}H_{13}BrClNO_5$				
MOLECULAR WEIGHT: 378,61 g/mole				
GBB1252	**1-OMe-alpha-D-Xyl**	GBB1252.0005	5 g	€ 175,00
1-O-Methyl-alpha-D-xylopyranoside, 98%		GBB1252.0025	25 g	€ 270,00
CAS-NO: 91-09-8				
FORMULA: $C_6H_{12}O_5$				
MOLECULAR WEIGHT: 164,16 g/mole				

2.3.23. β-D-Xylosidase Substrates

		Article No.	Quantity	Price
GBB1257	**Br-Nap-beta-D-Xyl**	GBB1257.0001	1 g	€ 200,00
2-(6-Bromonaphthyl)-beta-D-xylopyranoside		GBB1257.0005	5 g	€ 650,00
FORMULA: $C_{15}H_{15}BrO_5$		GBB1257.0010	10 g	€ 1100,00
MOLECULAR WEIGHT: 355,19 g/mole				
GBB1302	**PNP-beta-D-Xyl**	GBB1302.0001	1 g	€ 200,00
4-Nitrophenyl-beta-D-xylopyranoside, 99%		GBB1302.0005	5 g	€ 300,00
CAS-NO: 2001-96-9				
FORMULA: $C_{11}H_{13}NO_7$				
MOLECULAR WEIGHT: 271,23 g/mole				

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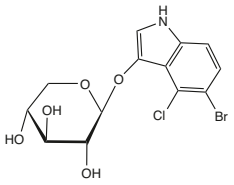
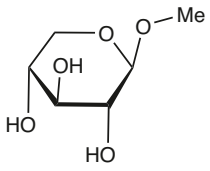
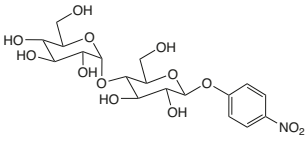
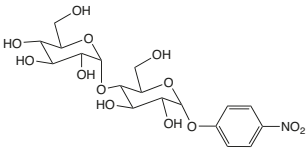
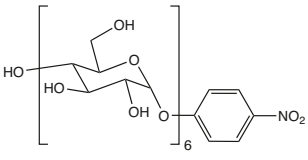
		Article No.	Quantity	Price
GBB1324 **X-beta-D-Xyl**		GBB1324.0500	500 mg	€ 150,00
5-Bromo-4-chloro-3-indoxyl-beta-D-xylopyranoside, 99%		GBB1324.1000	1 g	€ 250,00
CAS-NO: 207606-55-1		GBB1324.2500	2,5 g	€ 475,00
FORMULA: $C_{13}H_{13}BrClNO_5$				
MOLECULAR WEIGHT: 378,61 g/mole				
GBB1255 **1-OMe-beta-D-Xyl**		GBB1255.0010	10 g	€ 175,00
1-O-Methyl-beta-D-xylopyranoside, 98%		GBB1255.0025	25 g	€ 300,00
CAS-NO: 612-05-5		GBB1255.0100	100 g	€ 1000,00
FORMULA: $C_6H_{12}O_5$				
MOLECULAR WEIGHT: 164,16 g/mole				

References:

- Buttner R., Bode R., Purification and characterization of beta-xylosidase activities from the yeast Arxula adeninivorans. *J. Basic Microbiol.* 1992; **32**. 159-66.
- Cleemput G., *et al.*, Purification and Characterization of a [beta]-D-Xylosidase and an Endo-Xylanase from Wheat Flour. *Plant Physiol.* 1997; **113**: 377-86.
- Fisher D., Kent P.W., Rat liver beta-xylosidase, a lysosomal membrane enzyme. *Biochem. J.* 1969; **115**: 50-51.
- Hudson R.C., *et al.*, Purification and properties of an aryl beta-xylosidase from a cellulolytic extreme thermophile expressed in Escherichia coli. *Biochem. J.* 1991; **273**: 645-50.
- Panbangred W., *et al.*, Isolation of two beta-xylosidase genes of Bacillus pumilus and comparison of their gene products. *Eur. J. Biochem.* 1984; **138**: 267-73.
- Xu W.Z., *et al.*, Sequence and properties of beta-xylosidase from Bacillus pumilus IPO. Contradiction of the previous nucleotide sequence. *Eur. J. Biochem.* 1991; **202**: 1197-203.

2.3.24. Oligosaccharide Based Substrates

		Article No.	Quantity	Price
GBB1300 **PNP-beta-D-Mal**		GBB1300.1000	1 g	€ 275,00
4-Nitrophenyl-beta-D-maltopyranoside, 99%		GBB1300.2500	2,5 g	€ 500,00
CAS-NO: 56846-39-0				
FORMULA: $C_{18}H_{25}NO_{13}$				
MOLECULAR WEIGHT: 463,4 g/mole				
GBB1293 **PNP-alpha-D-Mal**		GBB1293.0100	100 mg	€ 175,00
4-Nitrophenyl-alpha-D-maltopyranoside, 98%		GBB1293.0500	500 mg	€ 200,00
CAS-NO: 17400-77-0		GBB1293.1000	1 g	€ 250,00
FORMULA: $C_{18}H_{25}NO_{13}$		GBB1293.5000	5 g	€ 640,00
MOLECULAR WEIGHT: 463,4 g/mole		GBB1293.9025	25 g	€ 2140,00
GBB1292 **PNP-alpha-D-maltohexaoside**		GBB1292.0250	250 mg	€ 200,00
4-Nitrophenyl-alpha-D-maltohexaoside, 97%		GBB1292.0500	500 mg	€ 325,00
CAS-NO: 74173-30-1		GBB1292.1000	1 g	€ 550,00
FORMULA: $C_{42}H_{65}NO_{33}$				
MOLECULAR WEIGHT: 1111,97 g/mole				

GBB1292 is a chromogenic substrate for alpha-amylase.

References:

- Mizuma T., Awazu S., Intestinal Na^+/glucose cotransporter-mediated transport of glucose conjugate formed from disaccharide conjugate. *Biochim. Biophys. Acta.* 1998; **1379**: 1-6.
- Mizuma T., *et al.*, Kinetic characterization of glycosidase activity from disaccharide conjugate to monosaccharide conjugate in Caco-2 cells. *J. Pharm. Pharmacol.* 2005; **57**: 661-4.
- Lorentz K., Evaluation of alpha-amylase assays with 4-nitrophenyl-alpha-oligosaccharides as substrates. *J. Clin. Chem. Clin. Biochem.* 1983; **21**: 463-71.

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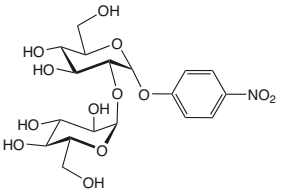
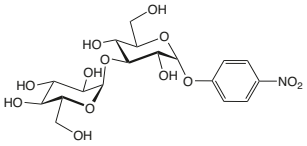
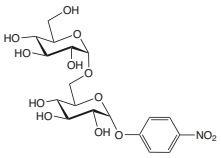
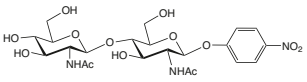
		Article No.	Quantity	Price
GBB1720	**pNP-alpha-Kojobioside**	GBB1720.0500	0,5 mg	€ 375,00
4-Nitrophenyl 2-O-alpha-D-glucopyranosyl-alpha-D-glucopyranoside CAS-NO: 147103-31-9 FORMULA: $C_{18}H_{25}NO_{13}$ MOLECULAR WEIGHT: 463,39 g/mole		GBB1720.0001	1 mg	€ 575,00
		GBB1720.0002	2 mg	€ 950,00
		GBB1720.0005	5 mg	€ 1850,00
		GBB1720.0010	10 mg	€ 3400,00
GBB1740	**pNP-alpha-Nigeroside**	GBB1740.0002	2 mg	€ 175,00
4-Nitrophenyl 3-O-(alpha-D-glucopyranosyl)-alpha-D-glucopyranoside CAS-NO: 136632-95-6 FORMULA: $C_{18}H_{25}NO_{13}$ MOLECULAR WEIGHT: 463,39 g/mole		GBB1740.0005	5 mg	€ 250,00
		GBB1740.0010	10 mg	€ 350,00
		GBB1740.0025	25 mg	€ 700,00
		GBB1740.0050	50 mg	€ 1200,00
GBB1730	**pNP-alpha-Melibioside**	GBB1730.0001	1 mg	€ 135,00
4-Nitrophenyl 6-O-alpha-D-glucopyranosyl-alpha-D-glucopyranoside CAS-NO: 104872-92-6 FORMULA: $C_{18}H_{25}NO_{13}$ MOLECULAR WEIGHT: 463,39 g/mole		GBB1730.0002	2 mg	€ 175,00
		GBB1730.0005	5 mg	€ 250,00
		GBB1730.0010	10 mg	€ 375,00
GBB1750	**pNP-N,N-Diacetyl-beta-D-chitobioside**	GBB1750.0001	1 mg	€ 175,00
4-Nitrophenyl 4-O-beta-D-glucopyranosyl-beta-D-glucopyranoside CAS-NO: 7284-16-4 FORMULA: $C_{22}H_{31}N_3O_{13}$ MOLECULAR WEIGHT: 545,49 g/mole		GBB1750.0002	2 mg	€ 250,00
		GBB1750.0005	5 mg	€ 350,00
		GBB1750.0010	10 mg	€ 575,00
		GBB1750.0025	25 mg	€ 1100,00

Chitinase catalyzes the hydrolytic cleavage of the β(1-4)-glycoside bonds present in biopolymers of N-acetylglucosamine, primarily in chitin.

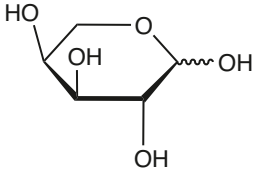
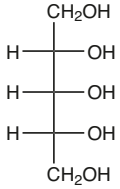
References:

- Duo-Chuan L.I. *et al.*, Purification and partial characterization of two chitinases from the mycoparasitic fungus. *Talaromyces flavus*. *Mycopathologia* 2005; **159**: 223-229.
- Frandberg E., Schnurer J., Evaluation of chromogenic chito-oligosaccharide analogue, p-nitrophenyl-b-D-N,N'-diacetylchitobiose, for the measurments of the chitinolytic activity of bacteria. *J. Appl. Bacteriol.* 1994; **76**: 259-263.

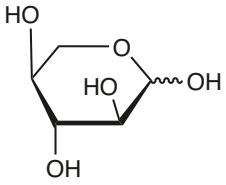
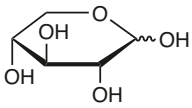
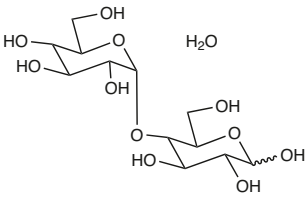
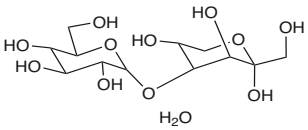
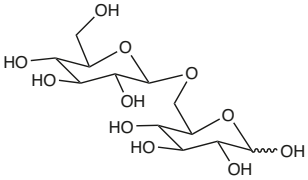
2.3.25. Non-Chromogenic Carbohydrates for Differentiation of Microorganisms

Microorganisms can be differentiated by their different metabolic properties. Therefore the ability or inability to metabolize certain substrates, i.e. to grow on these substrates, can be used for the identification of different species.

L-Arabinose, for example, is the naturally occurring isomer of arabinose and is a constituent of plant polysaccharides. Most bacteria contain an inducible arabinose operon that codes for a series of enzymes and transporters that allows L-arabinose to be used as the sole carbon source in microbial culture.

		Article No.	Quantity	Price
GBB1345	**L-Ara**	GBB1345.0100	100 g	€ 125,00
L-Arabinose, 99% CAS-NO: 87-72-9 FORMULA: $C_5H_{10}O_5$ MOLECULAR WEIGHT: 150,13 g/mole		GBB1345.0250	250 g	€ 200,00
		GBB1345.1000	1 kg	€ 250,00
GBB1690	**Adonitol**	GBB1690.0050	50 g	€ 125,00
(2R,3S,4S)-Pentane-1,2,3,4,5-pentol CAS-NO: 488-81-3 FORMULA: $C_5H_{12}O_5$ MOLECULAR WEIGHT: 152,15 g/mole		GBB1690.0100	100 g	€ 200,00
		GBB1690.0250	250 g	€ 300,00
		GBB1690.0500	500 g	€ 400,00
		GBB1690.1000	1 kg	€ 650,00

Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
GBB1338 L-Xyl alpha,beta-L-Xylose, 99% CAS-NO: 609-06-3 FORMULA: $C_5H_{10}O_5$ MOLECULAR WEIGHT: 150,13 g/mole		GBB1338.0010 GBB1338.0050	10 g 50 g	€ 150,00 € 375,00
GBB1700 D-Xyl alpha,beta-D-Xylose, 99% CAS-NO: 58-86-6 FORMULA: $C_5H_{10}O_5$ MOLECULAR WEIGHT: 150,13 g/mole		GBB1700.0001 GBB1700.0005 GBB1700.0010	1 kg 5 kg 10 kg	€ 150,00 € 250,00 € 400,00
GBB1174 D-Maltose H_2O 4-O-alpha-D-glucopyranosyl-D-glucose CAS-NO: 6363-53-7 FORMULA: $C_{12}H_{22}O_{11}*H_2O$ MOLECULAR WEIGHT: 360,32 g/mole		GBB1174.1000 GBB1174.2000	1 kg 2 kg	€ 175,00 € 225,00
GBB1175 Maltulose H_2O alpha-D-Glucopyranosyl(--->)-D-fructose monohydrate CAS-NO: 17606-72-3 FORMULA: $C_{12}H_{20}O_{10}*H_2O$ MOLECULAR WEIGHT: 342,31*18,01 g/mole		GBB1175.0005 GBB1175.0010	5 g 10 g	€ 200,00 € 325,00
GBB1334 Amygdalose 6-O-beta-D-Glucopyranosyl-D-glucose, beta-D-Gentiobiose, 98% CAS-NO: 554-91-6 FORMULA: $C_{12}H_{22}O_{11}$ MOLECULAR WEIGHT: 342,3 g/mole		GBB1334.2500 GBB1334.0005 GBB1334.0010 GBB1334.0100	2,5 g 5 g 10 g 100 g	€ 225,00 € 250,00 € 320,00 € 2140,00

References:

- Gibson S., Friedman H., L-Arabinose-ornithine-Irgasan medium for differentiating Serratia species. *J. Clin. Microbiol.* 1978; **7**: 279-81.
- Khlebnikov, A., *et al.*, Modulation of gene expression from the arabinose-inducible araBAD promoter. *J. Ind. Microbiol.* 2002; **29**: 34-37.

2.4. Protease (and Esterase) Substrates

Proteases (also called proteinases or peptidases) are enzymes that catalyze the hydrolysis of peptide bonds that link amino acids in (poly-)peptide chains. Proteases are part of the enzyme class of hydrolases, which in general catalyze the reaction of hydrolysis of various bonds with the participation of water. The chemical reactions of hydrolysis of amide (= peptide) bonds and ester bonds are very similar and therefore many proteases also exhibit esterase activity.

While endopeptidases can act at many positions within a polypeptide chain, exopeptidases cleave off terminal amino acids: aminopeptidases cleave off amino acids from the N-terminus of their substrates, carboxypeptidases from the C-terminus.

Many proteases exhibit high specificity, i.e. they act very sequence specific, cutting only after certain amino acids or amino acid sequences. Therefore substrates are required with many different amino acids attached to the chromo-/fluorogenic dye.

Similar as already shown for glycosidases, there are also many different chromo-/fluorogenic dyes available connected to the amino acid moiety. Upon cleavage by the specific peptidase the chromo-/fluorophore is released and can be detected. Those free dyes can be soluble and insoluble.

For continuous analysis in spectroscopic instruments typically homogeneous solutions are required. For determining enzymatic activity within cells or staining of bacterial colonies, substrates that produce insoluble, weakly diffusing chromo-/fluorophores are required.

To minimize the background signal, a label should be selected, whose detection is not influenced by absorption or fluorescence of any other substance present in the assay.

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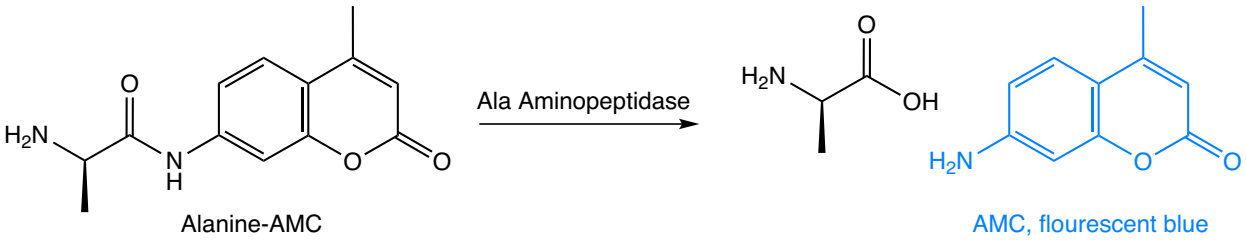
Iris Biotech offers protease substrates with the following labels:

Abbreviation	Chromophor / Fluorophor	Color / Fluorescence	Solubility
2-Abz	2-Aminobenzoic acid	fluorescence	weakly soluble
4-Abz (PABA)	4-Aminobenzoic acid	fluorescence	weakly soluble
ACC / ACA	7-Amido-4-carbamoylmethylcoumarin	fluorescence	soluble
AMC	7-Amido-4-methylcoumarin	fluorescence	soluble
ANBA (= 3CNA)	5-Amino-2-nitrobenzoic acid	yellow	insoluble
CLIPS	4-(7-coumarinyloxy)-2-butanol	fluorescence	soluble
3CNA (= ANBA)	3-Carboxy-4-nitroanilide-	yellow to violet	soluble
pNA	4-Nitroanilide-	yellow	soluble
ONp	4-Nitrophenyl-	yellow	soluble
X	5-Bromo-4-chloro-3-indoxyl-	blue to mint-green	insoluble

Many proteases also exhibit esterase activity. p-Nitrophenol esters (-ONp) of amino acids are an economic alternative as test substrates. The resulting p-nitrophenol can be detected at 415 nm with a rather low molar absorptivity of about 200 M^{-1} cm^{-1} or deprotonated in base as p-nitrophenolate at 405 nm with a molar absorptivity of 18,000 M^{-1} cm^{-1}. ONp esters are available for most biogenic amino acids and are listed among the peptidase substrates in the subsequent chapters.

Fluoro- and chromogenic amino acids can be applied in a wide spectrum of assays: in screening and in characterizing of most aminopeptidases and also many endopeptidases or special enzymes like gamma-glutamyl transferase or citrullin ureidase.

Aminopeptidases can also be used as disease biomarkers: For example, elevated levels of alanine aminopeptidase activity are found in the urine of kidney patients. On reacting with H-L-Ala-AMC (alanine 7-amido-4-methylcoumarin; HAA1174), alanine aminopeptidase produces a blue water soluble fluorophore, whose formation can be followed kinetically:



Reference:

▶ Pásztor, M. *et al.*, Proteolytic enzyme activities in rat peritoneal exudate. *Acta Biol Hung.* 1991; **42(1-3)**: 285-95.

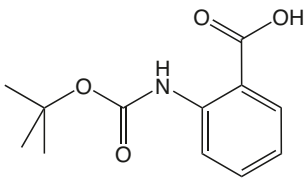
2.4.1. Dyes for Peptide Synthesis

Fmoc-/Boc-protected dyes can be used in solid-phase peptide synthesis to attach a chromo-/ fluorogenic dye to a peptide. The protected dyes can be loaded, for example, onto polystyrene Rink resin and then peptide synthesis can be continued with standard Boc/Bzl or Fmoc/tBu strategies.

Article No.	Quantity	Price
BAA1325.0005	5 g	€ 150,00

BAA1325 Boc-2-Abz-OH

2-(t-Butyloxycarbonylamino)-benzoic acid
CAS-NO: 68790-38-5
FORMULA: $C_{12}H_{15}NO_4$
MOLECULAR WEIGHT: 237,25 g/mole



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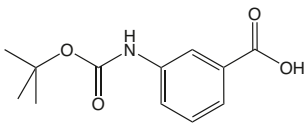
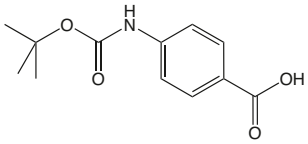
		Article No.	Quantity	Price
BAA1327	**Boc-3-Abz-OH**	BAA1327.0005	5 g	€ 150,00

3-(t-Butyloxycarbonylamino)-benzoic acid
CAS-NO: 111331-82-9
FORMULA: $C_{12}H_{15}NO_4$
MOLECULAR WEIGHT: 237,25 g/mole



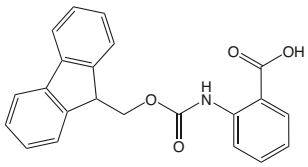
BAA1330	**Boc-4-Abz-OH**	BAA1330.0005	5 g	€ 150,00

4-(t-Butyloxycarbonylamino)-benzoic acid
CAS-NO: 66493-39-8
FORMULA: $C_{12}H_{15}NO_4$
MOLECULAR WEIGHT: 237,25 g/mole



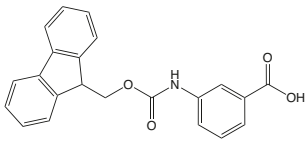
FAA1641	**Fmoc-2-Abz-OH**	FAA1641.0001	1 g	€ 40,00
		FAA1641.0005	5 g	€ 150,00

N-2-(9-Fluorenylmethyloxycarbonyl)amino-benzoic acid
CAS-NO: 150256-42-1
FORMULA: $C_{22}H_{17}NO_4$
MOLECULAR WEIGHT: 359,36 g/mole



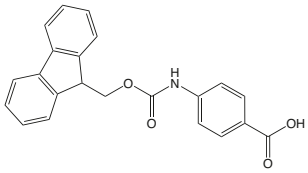
FAA1643	**Fmoc-3-Abz-OH**	FAA1643.0001	1 g	€ 40,00
		FAA1643.0005	5 g	€ 150,00

3-(9-Fluorenylmethyloxycarbonyl)amino-benzoic acid
CAS-NO: 185116-42-1
FORMULA: $C_{22}H_{17}NO_4$
MOLECULAR WEIGHT: 359,36 g/mole



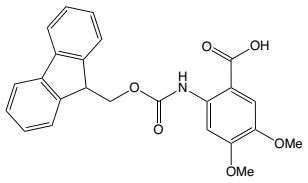
FAA1645	**Fmoc-4-Abz-OH**	FAA1645.0001	1 g	€ 40,00
		FAA1645.0005	5 g	€ 150,00

4-(9-Fluorenylmethyloxycarbonyl)amino-benzoic acid
CAS-NO: 185116-43-2
FORMULA: $C_{22}H_{17}NO_4$
MOLECULAR WEIGHT: 359,36 g/mole



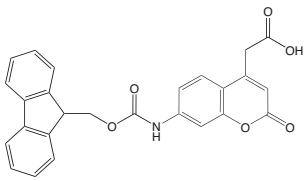
FAA1860	**Fmoc-2Abz(4,5-OMe2)-OH**	FAA1860.0500	500 mg	€ 170,00
		FAA1860.1000	1000 g	€ 210,00

2-N-(9-Fluorenylmethoxycarbonyl)-amino-4,5-dimethoxybenzoic acid
FORMULA: $C_{24}H_{21}NO_6$
MOLECULAR WEIGHT: 419,43 g/mole



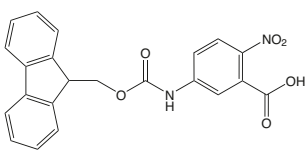
RL-1170	**Fmoc-ACA-OH**	RL-1170.0250	250 mg	€ 125,00
		RL-1170.0001	1 g	€ 500,00
		RL-1170.0005	5 g	€ 2000,00

7-(9-Fluorenylmethyloxycarbonylamino)-coumarin-4-acetic acid
FORMULA: $C_{26}H_{19}NO_6$
MOLECULAR WEIGHT: 441,43 g/mole



FAA6850	**Fmoc-ANBA**	FAA6850.0005	5 g	€ 250,00
		FAA6850.0025	25 g	€ 1000,00

5-(9-Fluorenylmethyloxycarbonylamino)-2-nitrobenzoic acid
CAS-NO: 1301739-86-5
FORMULA: $C_{22}H_{16}N_2O_6$
MOLECULAR WEIGHT: 404,30 g/mole

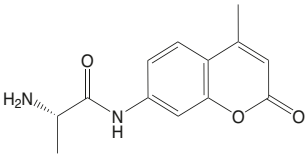
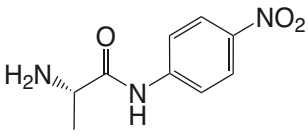
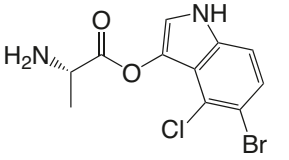
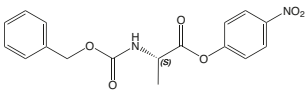
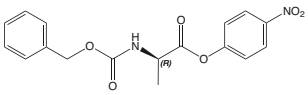


References:

- Fields G. B., Noble R. L., *Approaches to High Throughput Physical Organic Chemistry.* 1990; **35**: 161-214.
- Portal C., Bradley M., *Org. Biomol. Chem.* (Emerging Areas) 2007; **5**: 587-592.

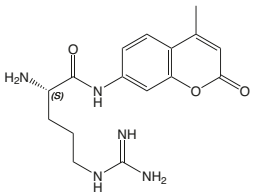
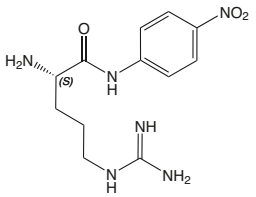
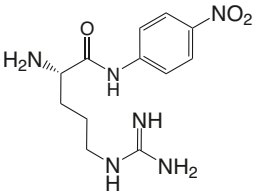
Prices are in EUR, net, exw Germany

2.4.2. Alanine Based Substrates

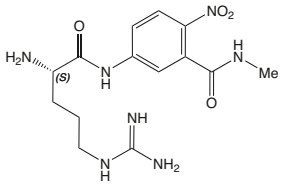
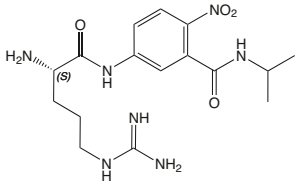
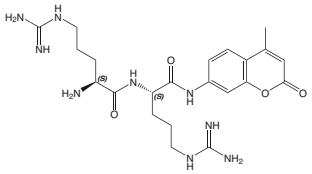
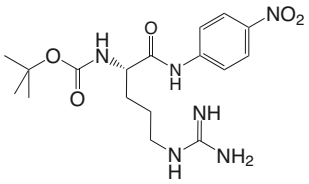
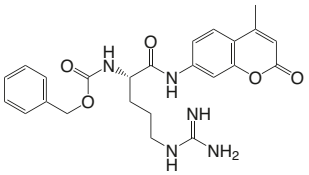
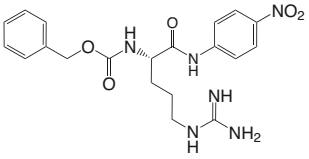
		Article No.	Quantity	Price
HAA1174 H-L-Ala-AMC*TFA L-Alanine 7-amido-4-methylcoumarin trifluoroacetate CAS-NO: 96594-10-4 FORMULA: $C_{13}H_{14}N_2O_3*CF_3CO_2H$ MOLECULAR WEIGHT: 360,29 g/mole		HAA1174.0250	250 mg	€ 175,00
		HAA1174.0500	500 mg	€ 200,00
		HAA1174.1000	1 g	€ 225,00
		HAA1174.5000	5 g	€ 1200,00
HAA1175 H-L-Ala-pNA*HCl L-Alanine-p-nitroanilide hydrochloride CAS-NO: 31796-55-1 FORMULA: $C_9H_{11}N_3O_3*HCl$ MOLECULAR WEIGHT: 209,21*36,45 g/mole		HAA1175.0001	1 g	€ 55,00
		HAA1175.0005	5 g	€ 200,00
		HAA1175.0025	25 g	€ 600,00
HAA7620 H-L-Ala-X*TFA L-Alanine-5-bromo-4-chloro-3-indoxyl ester trifluoroacetate, 98% CAS-NO: 207725-18-6 FORMULA: $C_{11}H_{10}BrClN_2O_2*CF_3CO_2H$ MOLECULAR WEIGHT: 317,57*114,02 g/mole		HAA7620.0025	25 mg	€ 275,00
		HAA7620.0050	50 mg	€ 450,00
ZAA5690 Z-L-Ala-ONp N-alpha-Benzyloxycarbonyl-L-alanine p-nitrophenyl ester CAS-NO: 1168-87-2 FORMULA: $C_{17}H_{16}N_2O_6$ MOLECULAR WEIGHT: 344,31 g/mole		ZAA5690.0025	25 g	€ 45,00
ZAA5680 Z-D-Ala-ONp N-alpha-Benzyloxycarbonyl-D-alanine p-nitrophenyl ester FORMULA: $C_{17}H_{16}N_2O_6$ MOLECULAR WEIGHT: 344,31 g/mole		ZAA5680.0001	1 g	€ 50,00
		ZAA5680.0005	5 g	€ 135,00

2.4.3. Arginine Based Substrates

Arginine based chromogenic/fluorogenic substrates can be used for the quantitative determination of cathepsins, aminopeptidase B, aminopeptidase III, aminopeptidase in common, pepN, pepC, trypsin or papain activity.

		Article No.	Quantity	Price
HAA7630 H-L-Arg-AMC*2HCl L-Arginine 7-amido-4-methylcoumarin dihydrochloride CAS-NO: 113712-08-6 FORMULA: $C_{16}H_{21}N_5O_3*2HCl$ MOLECULAR WEIGHT: 331,37*72,90 g/mole		HAA7630.1000	1 g	€ 250,00
		HAA7630.5000	5 g	€ 950,00
HAA1178 H-L-Arg-pNA*2HCl L-Arginine p-Nitroanilide dihydrochloride CAS-NO: 40127-11-5 FORMULA: $C_{12}H_{18}N_6O_3*2HCl$ MOLECULAR WEIGHT: 367,22 g/mole		HAA1178.0001	1 g	€ 85,00
		HAA1178.0005	5 g	€ 250,00
		HAA1178.0025	25 g	€ 1000,00
HAA1177 H-L-Arg-pNA*2HBr L-Arginine p-Nitroanilide dihydrobromide CAS-NO: 6154-84-3 FORMULA: $C_{12}H_{18}N_6O_3*2HBr$ MOLECULAR WEIGHT: 456,2 g/mole		HAA1177.0001	1 g	€ 85,00
		HAA1177.0005	5 g	€ 250,00
		HAA1177.0025	25 g	€ 900,00

Prices are in EUR, net, exw Germany

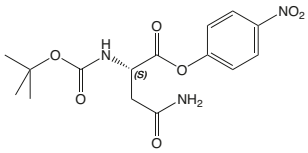
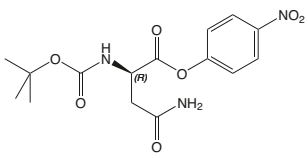
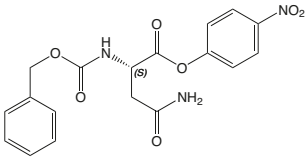
		Article No.	Quantity	Price
HAA1195	**H-L-Arg-ANBA-Me*2HCl**	HAA1195.0001	1 g	€ 300,00
L-Arginine-5-amino-2-nitrobenzoic acid methylamide dihydrochloride FORMULA: $C_{14}H_{21}N_7O_4$*2HCl MOLECULAR WEIGHT: 351,36*72,9 g/mole		HAA1195.0005	5 g	€ 1200,00
HAA1176	**H-L-Arg-ANBAiPr*2HCl**	HAA1176.0001	1 g	€ 300,00
Arginine-5-amino-2-nitrobenzoic acid isopropylamide dihydrochloride CAS-NO: 1272755-10-8 FORMULA: $C_{16}H_{25}N_7O_4$*2HCl MOLECULAR WEIGHT: 379,42*72,9 g/mole		HAA1176.0005	5 g	€ 1200,00
HAA7640	**H-L-Arg-L-Arg-AMC*3HCl**	HAA7640.1000	1 g	€ 300,00
L-Arginyl-L-arginine 7-amido-4-methylcoumarin trihydrochloride CAS-NO: 201847-69-0 FORMULA: $C_{22}H_{33}N_9O_4$*3HCl MOLECULAR WEIGHT: 487,56*109,36 g/mole		HAA7640.2500	2,5 g	€ 600,00
BAA5360	**Boc-L-Arg-pNA*HCl**	BAA5360.0005	5 g	€ 55,00
N-alpha-t-Butyloxycarbonyl-L-arginine p-nitroanilide hydrochloride CAS-NO: 99306-64-6 FORMULA: $C_{17}H_{26}N_6O_5$*HCl MOLECULAR WEIGHT: 394,43*36,45 g/mole		BAA5360.0025	25 g	€ 145,00
ZAA1262	**Z-L-Arg-AMC*HCl**	ZAA1262.0250	250 mg	€ 225,00
N-alpha-Benzyloxycarbonyl-L-arginine 7-amido-4-methylcoumarin hydrochloride, 99% CAS-NO: 70375-22-3 FORMULA: $C_{24}H_{27}N_5O_5$*HCl MOLECULAR WEIGHT: 465,50*36,45 g/mole				
ZAA1040	**Z-L-Arg-pNA*HCl**	ZAA1040.0005	5 g	€ 250,00
N-alpha-Benzyloxycarbonyl-L-arginine-p-nitroanilide hydrochloride CAS-NO: 59188-53-3 FORMULA: $C_{20}H_{24}N_6O_5$*HCl MOLECULAR WEIGHT: 428,44*36,45 g/mole		ZAA1040.0025	25 g	€ 990,00

References:

- Barrett A.J., Fluorimetric assays for cathepsin B and cathepsin H with methylcoumarylamide substrates. *Biochem. J.* 1980; **187**: 909-12.
- Barrett A.J., Kirschke H., Cathepsin B, Cathepsin H, and Cathepsin L. *Methods Enzymol.* 1981; **80**: 535-61.
- Sanz Y., Toldrá F., Purification and Characterization of an Arginine Aminopeptidase from Lactobacillus sakei. *Appl. Env. Microbiol.* 2002; **68**: 1980-7.
- Schwartz W.N., Barrett A.J., Human Cathepsin H. *Biochem. J.* 1980; **191**: 487-97.
- Barrett A.J., *et al.*, Cathepsin B, Cathepsin H, and Cathepsin L. *Methods Enzymol.* 1981; **80**: 535-61.
- Mantle D., *et al.*, Purification and characterization of the major aminopeptidase from human skeletal muscle. *Biochem. J.* 1983; **211**: 567-73.

Prices are in EUR, net, exw Germany

2.4.4. Asparagine Based Substrates

		Article No.	Quantity	Price
BAA5450 **Boc-L-Asn-ONp** N-alpha-t-Butyloxycarbonyl-L-asparagine p-nitrophenyl ester CAS-NO: 4587-33-1 FORMULA: $C_{15}H_{19}N_3O_7$ MOLECULAR WEIGHT: 353,33 g/mole		BAA5450.0005	5 g	€ 65,00
		BAA5450.0025	25 g	€ 225,00
		BAA5450.0100	100 g	€ 650,00
BAA5400 **Boc-D-Asn-ONp** N-alpha-t-Butyloxycarbonyl-D-asparagine p-nitrophenyl ester FORMULA: $C_{15}H_{19}N_3O_7$ MOLECULAR WEIGHT: 353,33 g/mole		BAA5400.0005	5 g	€ 80,00
		BAA5400.0025	25 g	€ 290,00
ZAA1196 **Z-L-Asn-ONp** N-alpha-Benzyloxycarbonyl-L-asparagine p-nitrophenyl ester CAS-NO: 3256-57-3 FORMULA: $C_{18}H_{17}N_3O_7$ MOLECULAR WEIGHT: 387,34 g/mole		ZAA1196.0025	25 g	€ 95,00

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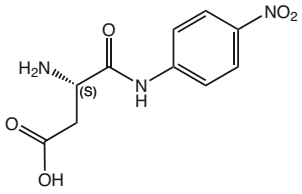
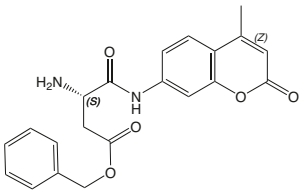
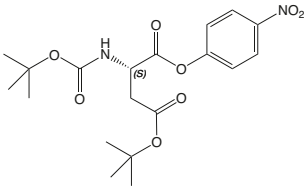
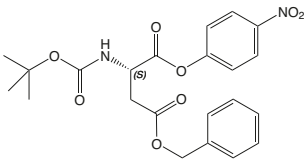
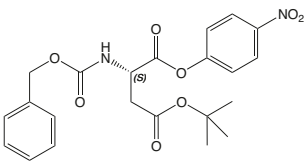
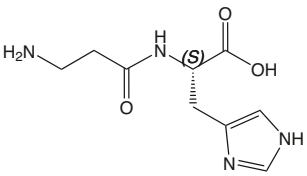
2.4.5. Aspartate Based Substrates

		Article No.	Quantity	Price
HAA2105 H-L-Asp-pNA*HCl L-Aspartic acid alpha-p-nitroanilide hydrochloride CAS-NO: 154564-03-1 FORMULA: $C_{10}H_{11}N_3O_5$*HCl MOLECULAR WEIGHT: 253,21*36,45 g/mole		HAA2105.0001	1 g	€ 350,00
		HAA2105.0005	5 g	€ 1400,00
HAA2030 H-L-Asp(Bzl)-AMC*HCl L-Aspartic acid alpha-(7-amido-4-methylcoumarin) beta-benzyl ester hydrochloride CAS-NO: 219138-15-5 FORMULA: $C_{21}H_{20}N_2O_5$*HCl MOLECULAR WEIGHT: 380,39*36,45 g/mole		HAA2030.0001	1 g	€ 300,00
		HAA2030.0005	5 g	€ 1200,00
BAA5480 Boc-L-Asp(tBu)-ONp N-alpha-t-Butyloxycarbonyl-L-aspartic acid beta-t-butyl ester alpha-p-nitrophenyl ester CAS-NO: 29365-05-7 FORMULA: $C_{19}H_{26}N_2O_8$ MOLECULAR WEIGHT: 410,41 g/mole		BAA5480.0005	5 g	€ 115,00
BAA5460 Boc-L-Asp(Bzl)-ONp N-alpha-t-Butyloxycarbonyl-L-aspartic acid beta-benzyl ester alpha-p-nitrophenyl ester CAS-NO: 26048-69-1 FORMULA: $C_{22}H_{24}N_2O_8$ MOLECULAR WEIGHT: 444,44 g/mole		BAA5460.0005	5 g	€ 45,00
		BAA5460.0025	25 g	€ 100,00
ZAA1198 Z-L-Asp(tBu)-ONp N-alpha-Benzyloxycarbonyl-L-aspartic acid alpha-p-nitrophenyl beta-t-butyl ester CAS-NO: 17543-17-8 FORMULA: $C_{22}H_{24}N_2O_8$ MOLECULAR WEIGHT: 444,42 g/mole		ZAA1198.0005	5 g	€ 100,00

2.4.6. Carnosinase Substrate

		Article No.	Quantity	Price
LS-1213 L-Carnosine beta-Alanyl-L-histidine, 98% CAS-NO: 305-84-0 FORMULA: $C_9H_{14}N_4O_3$ MOLECULAR WEIGHT: 226,23 g/mole		LS-1213.0025	25 g	€ 145,00
		LS-1213.0100	100 g	€ 250,00
		LS-1213.0500	500 g	€ 750,00
		LS-1213.1000	1 kg	€ 1400,00

Carnosin is a substrate for carnosinase. Liberated L-histidine is quantified by reaction with o-phthaldialdehyde (OPA) to produce a fluorescent product, which is directly proportional to serum carnosinase activity. Decreased carnosinase concentrations have been observed in patients with Parkinson disease or multiple sclerosis and in patients after a cerebrovascular accident. It is believed that carnosine has the ability to protect neuronal cells against ischemic injury and oxidative stress as well as to increase their resistance towards functional exhaustion and accumulation of senile features. L-Carosine is a dipeptide found at millimolar concentration in brain, muscle and the lens of the eye. In model systems it is a potent antioxidant that scavenges oxygen free radicals and transition metal ions. It blocks protein-protein and protein-DNA cross-links induced by hypochlorite anions and toxic aldehydes such as acetaldehyde, formaldehyde, and malondialdehyde, the primary product of

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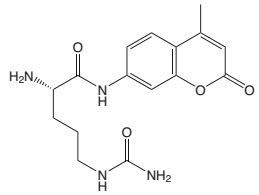
lipid peroxidation. It also inhibits nonenzymatic protein glycation induced by aldose and ketose reducing sugars and inhibits the formation of toxic advanced glycation end products (AGE). These activities make it of interest in studies of aging, atherosclerosis, Alzheimer's disease, and the secondary effects of diabetes (Schoen 2003).

References:

- Schoen P., *et al.*, Serum carnosinase activity in plasma and serum: validation of a method and values in cardiopulmonary bypass surgery. *Clin. Chem.* 2003; **49**: 1930-2.
- Bando K., *et al.*, Fluorometric assay of human serum carnosinase activity in normal children, adults and patients with myopathy. *Ann. Clin. Biochem.* 1984; **21**: 510-4.
- Burgess E.A., *et al.*, Plasma carnosinase deficiency in patients with urea cycle defects. *Clin. Chim. Acta* 1975; **61**: 215-18.
- Guiotto A., *et al.*, Carnosine and carnosine-related antioxidants: a review. *Curr. Med. Chem.* 2005; **12**: 2293-315.
- Murphey W.H., *et al.*, Carnosinase: a fluorometric assay and demonstration of two electrophoretic forms in human tissue extracts. *Clin. Chim. Acta.* 1972; **42**: 309-14.
- Orfanos A.P., *et al.*, A fluorometric micromethod for estimation of carnosinase in dried blood samples. *Clin. Chim. Acta* 1987; **166**: 219-25.

2.4.7. Citrulline Based Substrate

		Article No.	Quantity	Price
HAA7650	**H-L-Cit-AMC*HBr**	HAA7650.0100	100 mg	€ 280,00
L-Citrulline 7-amido-4-methylcoumarin hydrobromide, 99%		HAA7650.1000	1 g	€ 1650,00
CAS-NO: 123314-39-6				
FORMULA: $C_{16}H_{20}N_4O_4$*HBr				
MOLECULAR WEIGHT: 332,35*80,91 g/mole				



Sensitive fluorogenic substrate for citrulline ureidase.

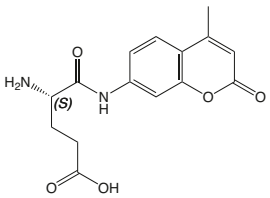
Reference:

- Gray C.J., Sullivan S.M., Synthesis of 7-Amino-4-methylcoumarin (AMC) derivatives and their hydrolysis by plant cysteine proteinases. *J. Chem. Tech. Biotech.* 1989; **46**: 11.

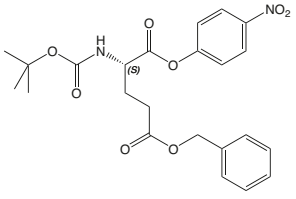
2.4.8. Glutamate Based Substrates

Glutamate based chromogenic/fluorogenic substrates can be used especially for the quantitative determination of aminopeptidase A activity.

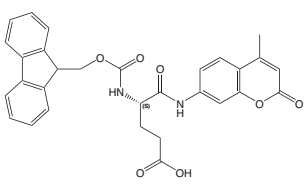
		Article No.	Quantity	Price
HAA7670	**H-L-Glu-AMC**	HAA7670.0100	100 mg	€ 200,00
L-Glutamic acid alpha-(7-amido-4-methylcoumarin), 98%		HAA7670.0500	500 mg	€ 310,00
CAS-NO: 98516-76-8		HAA7670.1000	1 g	€ 560,00
FORMULA: $C_{15}H_{16}N_2O_5$		HAA7670.2500	2,5 g	€ 1300,00
MOLECULAR WEIGHT: 304,31 g/mole				



BAA5690	**Boc-L-Glu(Bzl)-ONp**	BAA5690.0005	5 g	€ 55,00
N-alpha-t-Butyloxycarbonyl-L-glutamic acid alpha-(p-nitrophenyl) gamma-benzyl ester		BAA5690.0025	25 g	€ 150,00
FORMULA: $C_{23}H_{26}N_2O_8$				
MOLECULAR WEIGHT: 458,45 g/mole				



FAA2085	**Fmoc-L-Glu-AMC**	FAA2085.0001	1 g	€ 125,00
N-alpha-(9-Fluorenylmethyloxycarbonyl)-L-glutamic acid alpha-(7-amido-4-methylcoumarin)		FAA2085.0005	5 g	€ 450,00
CAS-NO: 957311-37-4		FAA2085.0025	25 g	€ 1800,00
FORMULA: $C_{30}H_{26}N_2O_7$				
MOLECULAR WEIGHT: 526,54 g/mole				



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		Article No.	Quantity	Price
FAA1925	**Fmoc-L-Glu-pNA**	FAA1925.0001	1 g	€ 90,00
N-alpha-(9-Fluorenylmethyloxycarbonyl)-L-glutamyl p-nitroanilid		FAA1925.0005	5 g	€ 300,00
CAS-NO: 185547-51-7f		FAA1925.0025	25 g	€ 1200,00
FORMULA: $C_{26}H_{23}N_3O_7$				
MOLECULAR WEIGHT: 489,48 g/mole				
ZAA1221	**Z-L-Glu(tBu)-ONp**	ZAA1221.0005	5 g	€ 80,00
N-alpha-Benzyloxycarbonyl-L-glutamic acid alpha-(p-nitrophenyl) gamma-t-butyl ester		ZAA1221.0025	25 g	€ 300,00
CAS-NO: 7670-08-8				
FORMULA: $C_{23}H_{26}N_2O_8$				
MOLECULAR WEIGHT: 458,45 g/mole				

Chromogenic/fluorogenic glutamate based substrates for the determination of **gamma-glutamyl transferase** activity:

		Article No.	Quantity	Price
HAA7660	**H-L-Glu(AMC)-OH**	HAA7660.0050	100 mg	€ 200,00
L-Glutamic acid gamma-(7-amido-4-methylcoumarin), 99%		HAA7660.0250	250 mg	€ 320,00
CAS-NO: 72669-53-5				
FORMULA: $C_{15}H_{16}N_2O_5$				
MOLECULAR WEIGHT: 304,31 g/mole				
HAA7890	**H-L-Glu(3CNA)-OH-NH3**	HAA7890.1000	1 g	€ 275,00
L-Glutamic acid gamma-(3-carboxy-4-nitroanilide) ammonium salt, 99%		HAA7890.5000	5 g	€ 425,00
CAS-NO: 63699-78-5		HAA7890.9025	25 g	€ 750,00
FORMULA: $C_{12}H_{13}N_3O_7{*}NH_3$				
MOLECULAR WEIGHT: 311,25*17,03 g/mole				

References:

- Martin M.N., Slovin J.P., Purified gamma -Glutamyl Transpeptidases from Tomato Exhibit High Affinity for Glutathione and Glutathione S-Conjugates. *Plant Physiol.* 2000; **122**: 1417-26.
- Shaw L.M., *et al.*, Gamma-Glutamyltransferase: kinetic properties and assay conditions when gamma-glutamyl-4-nitroanilide and its 3-carboxy derivative are used as donor substrates. *Clin. Chem.* 1977; **23**: 79-85.

2.4.9. Glutamine Based Substrates

		Article No.	Quantity	Price
BAA5670	**Boc-L-Gln-ONp**	BAA5670.0100	100 g	€ 390,00
CAS-NO: 15387-45-8				
FORMULA: $C_{16}H_{21}N_3O_7$				
MOLECULAR WEIGHT: 367,35 g/mole				
BAA5540	**Boc-D-Gln-ONp**	BAA5540.0025	25 g	€ 150,00
N-alpha-t-Butyloxycarbonyl-D-glutamine p-nitrophenyl ester		BAA5540.0100	100 g	€ 425,00
CAS-NO: 74086-23-0				
FORMULA: $C_{16}H_{21}N_3O_7$				
MOLECULAR WEIGHT: 367,35 g/mole				

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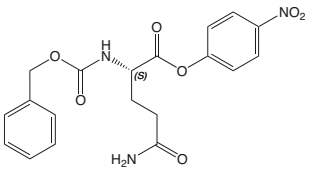
	Article No.	Quantity	Price
ZAA1218 Z-L-Gln-ONp	ZAA1218.0025	25 g	€ 65,00
N-alpha-Benzyloxycarbonyl-L-glutamine p-nitrophenyl ester	ZAA1218.0100	100 g	€ 160,00
CAS-NO: 7763-16-8			
FORMULA: $C_{19}H_{19}N_3O_7$			
MOLECULAR WEIGHT: 401,37 g/mole			



2.4.10. Glycine Based Substrates

	Article No.	Quantity	Price
HAA7970 H-Gly-AMC*HBr	HAA7970.0250	250 mg	€ 200,00
Glycine 7-amido-4-methylcoumarin hydrobromide, 98%	HAA7970.1000	1 g	€ 300,00
CAS-NO: 113728-13-5			
FORMULA: $C_{12}H_{12}N_2O_3$*HBr			
MOLECULAR WEIGHT: 232,24*80,91 g/mole			
HAA6620 H-Gly-pNA*HCl	HAA6620.0001	1 g	€ 45,00
Glycine p-nitroanilide hydrochloride	HAA6620.0005	5 g	€ 90,00
CAS-NO: 1205-88-5			
FORMULA: $C_8H_9N_3O_3$*HCl			
MOLECULAR WEIGHT: 195,18*36,45 g/mole			
HAA6600 H-Gly-ONp*HCl	HAA6600.0001	1 g	€ 45,00
Glycine p-nitrophenyl ester hydrochloride	HAA6600.0005	5 g	€ 85,00
CAS-NO: 16336-29-1			
FORMULA: $C_8H_8N_2O_4$*HCl			
MOLECULAR WEIGHT: 232,62 g/mole			
AAA1916 Ac-Gly-ONp	AAA1916.0001	1 g	€ 125,00
N-alpha-Acetyl-glycine p-nitrophenyl ester	AAA1916.0005	5 g	€ 255,00
CAS-NO: 3304-61-8			
FORMULA: $C_{10}H_{10}N_2O_5$			
MOLECULAR WEIGHT: 238,2 g/mole			
BAA5640 Boc-Gly-ONp	BAA5640.0025	25 g	€ 95,00
N-alpha-t-Butyloxycarbonyl-glycine p-nitrophenyl ester	BAA5640.0100	100 g	€ 250,00
CAS-NO: 3655-05-8			
FORMULA: $C_{13}H_{16}N_2O_6$			
MOLECULAR WEIGHT: 296,27 g/mole			
ZAA1216 Z-Gly-ONp	ZAA1216.0025	25 g	€ 50,00
N-alpha-Benzyloxycarbonyl-glycine p-nitrophenyl ester	ZAA1216.0100	100 g	€ 175,00
CAS-NO: 1738-86-9			
FORMULA: $C_{16}H_{14}N_2O_6$			
MOLECULAR WEIGHT: 330,3 g/mole			

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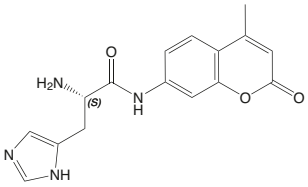
2.4.11. Histidine Based Substrate

HAA7680 H-L-His-AMC

CAS-NO: 191723-64-5
FORMULA: $C_{16}H_{16}N_4O_3$
MOLECULAR WEIGHT: 312,33 g/mole

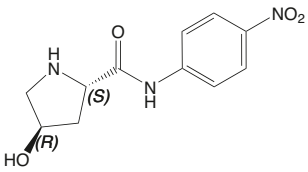


Article No.	Quantity	Price
HAA7680.0010	10 mg	€ 325,00
HAA7680.0025	25 mg	€ 475,00

2.4.12. Hydroxyproline Based Substrate

HAA1180 H-L-Hyp-pNA*HCl

trans-L-Hydroxyproline p-nitroanilide hydrochloride
FORMULA: $C_{11}H_{13}N_3O_4$*HCl
MOLECULAR WEIGHT: 251,24*36,45 g/mole

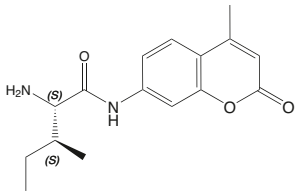


Article No.	Quantity	Price
HAA1180.0005	5 g	€ 250,00
HAA1180.0025	25 g	€ 1000,00

2.4.13. Isoleucine Based Substrates

HAA7690 H-L-Ile-AMC*TFA

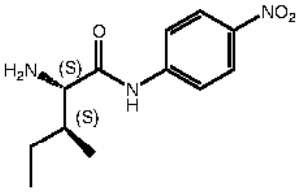
L-Isoleucine 7-amido-4-methylcoumarin, trifluoroacetate salt, 98%
CAS-NO: 191723-68-9
FORMULA: $C_{16}H_{20}N_2O_3$*CF_3COOH
MOLECULAR WEIGHT: 402,37 g/mole



Article No.	Quantity	Price
HAA7690.0050	50 mg	€ 300,00
HAA7690.0100	100 mg	€ 425,00

HAA2180 H-L-Ile-pNA

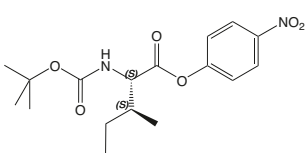
L-Isoleucine 4-nitroanilide
CAS-NO: 70324-66-2
FORMULA: $C_{12}H_{17}N_3O_3$
MOLECULAR WEIGHT: 251,29 g/mole



Article No.	Quantity	Price
HAA2180.0001	1 g	€ 150,00
HAA2180.0005	5 g	€ 175,00
HAA2180.0025	25 g	€ 450,00

BAA5730 Boc-L-Ile-ONp

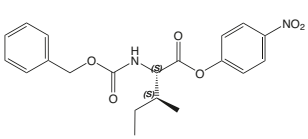
N-alpha-t-Butyloxycarbonyl-L-isoleucine p-nitrophenyl ester
CAS-NO: 16948-38-2
FORMULA: $C_{17}H_{24}N_2O_6$
MOLECULAR WEIGHT: 352,38 g/mole



Article No.	Quantity	Price
BAA5730.0005	5 g	€ 60,00
BAA5730.0025	25 g	€ 140,00

ZAA1224 Z-L-Ile-ONp

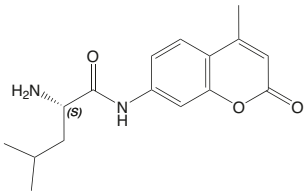
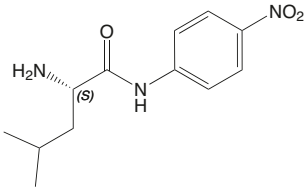
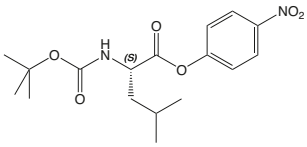
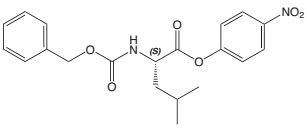
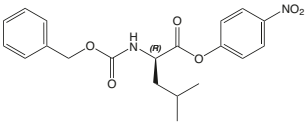
N-alpha-Benzyloxycarbonyl-L-isoleucine p-nitrophenyl ester
CAS-NO: 2130-99-6
FORMULA: $C_{20}H_{22}N_2O_6$
MOLECULAR WEIGHT: 386,39 g/mole



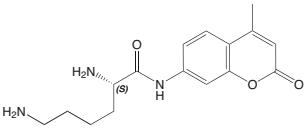
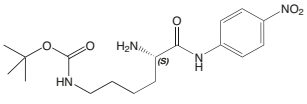
Article No.	Quantity	Price
ZAA1224.0025	25 g	€ 75,00

Prices are in EUR, net, exw Germany

2.4.14. Leucine Based Substrates

		Article No.	Quantity	Price
HAA1181	**H-L-Leu-AMC*HCl**	HAA1181.1000	1 g	€ 125,00
L-Leucine-7-amido-4-methylcoumarine hydrochloride CAS-NO: 62480-44-8 FORMULA: $C_{16}H_{20}N_2O_3$*HCl MOLECULAR WEIGHT: 324,8 g/mole		HAA1181.5000	5 g	€ 500,00
		HAA1181.9025	25 g	€ 2000,00
HAA1182	**H-L-Leu-pNA**	HAA1182.0025	25 g	€ 200,00
L-Leucine p-nitroanilide CAS-NO: 4178-93-2 FORMULA: $C_{12}H_{17}N_3O_3$ MOLECULAR WEIGHT: 251,29 g/mole		HAA1182.0100	100 g	€ 600,00
BAA5760	**Boc-L-Leu-ONp**	BAA5760.0025	25 g	€ 110,00
N-alpha-t-Butyloxycarbonyl-L-leucine p-nitrophenyl ester FORMULA: $C_{17}H_{24}N_2O_6$ MOLECULAR WEIGHT: 352,38 g/mole		BAA5760.0100	100 g	€ 325,00
ZAA1226	**Z-L-Leu-ONp**	ZAA1226.0005	5 g	€ 60,00
N-alpha-Benzyloxycarbonyl-L-leucine p-nitrophenyl ester CAS-NO: 1738-87-0 FORMULA: $C_{20}H_{22}N_2O_6$ MOLECULAR WEIGHT: 386,39 g/mole		ZAA1226.0025	25 g	€ 180,00
ZAA1205	**Z-D-Leu-ONp**	ZAA1205.0005	5 g	€ 75,00
N-alpha-Benzyloxycarbonyl-D-leucine p-nitrophenyl ester CAS-NO: 53335-17-3 FORMULA: $C_{20}H_{22}N_2O_6$ MOLECULAR WEIGHT: 386,39 g/mole		ZAA1205.0025	25 g	€ 300,00

2.4.15. Lysine Based Substrates

		Article No.	Quantity	Price
HAA7700	**H-L-Lys-AMC*AcOH**	HAA7700.0250	250 mg	€ 190,00
L-Lysine 7-amido-4-methylcoumarin, acetate salt CAS-NO: 201853-23-8 FORMULA: $C_{16}H_{21}N_3O_3$*CH_3COOH MOLECULAR WEIGHT: 303,36*60,05 g/mole		HAA7700.0500	500 mg	€ 275,00
		HAA7700.1000	1 g	€ 450,00
		HAA7700.2500	2,5 g	€ 1000,00
HAA1183	**H-L-Lys(Boc)-pNA**	HAA1183.0001	1 g	€ 85,00
N-epsilon-t-Butyloxycarbonyl-L-lysin-p-nitroanilide CAS-NO: 172422-76-3 FORMULA: $C_{17}H_{26}N_4O_5$ MOLECULAR WEIGHT: 366,42 g/mole		HAA1183.0005	5 g	€ 200,00
		HAA1183.0025	25 g	€ 800,00
		HAA1183.0100	100 g	€ 2400,00

Prices are in EUR, net, exw Germany

	Article No.	Quantity	Price
HAA6900 H-L-Lys(Z)-pNA	HAA6900.0001	1 g	€ 95,00
N-epsilon-Benzyloxycarbonyl-L-lysine p-nitroanilide	HAA6900.0005	5 g	€ 350,00
FORMULA: $C_{20}H_{24}N_4O_5$			
MOLECULAR WEIGHT: 400,46 g/mole			
BAA5780 Boc-L-Lys(Boc)-ONp	BAA5780.0025	25 g	€ 125,00
N-alpha-N-epsilon-di-t-Butyloxycarbonyl-L-lysine p-nitrophenyl ester	BAA5780.0100	100 g	€ 375,00
CAS-NO: 2592-19-0			
FORMULA: $C_{22}H_{33}N_3O_8$			
MOLECULAR WEIGHT: 467,51 g/mole			
BAA1208 Boc-L-Lys(Z)-pNA	BAA1208.0005	5 g	€ 55,00
N-alpha-t-Butyloxycarbonyl-N-epsilon-benzyloxycarbonyl-L-lysine 4-nitroanilid	BAA1208.0025	25 g	€ 150,00
CAS-NO: 51078-31-0			
FORMULA: $C_{25}H_{32}N_4O_7$			
MOLECULAR WEIGHT: 500,56 g/mole			
ZAA1229 Z-L-Lys(Z)-ONp	ZAA1229.0005	5 g	€ 60,00
N-alpha-N-epsilon-Bis-benzyloxycarbonyl-L-lysine p-nitrophenyl ester	ZAA1229.0025	25 g	€ 180,00
CAS-NO: 2116-82-7			
FORMULA: $C_{28}H_{29}N_3O_8$			
MOLECULAR WEIGHT: 535,53 g/mole			

2.4.16. Methionine Based Substrates

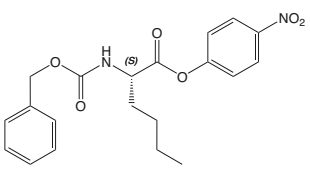
	Article No.	Quantity	Price
HAA7710 H-L-Met-AMC*TFA	HAA7710.0250	250 mg	€ 275,00
L-Methionine 7-amido-4-methylcoumarin, trifluoroacetate salt	HAA7710.0500	500 mg	€ 390,00
CAS-NO: 94367-35-8			
#FORMULA: $C_{15}H_{18}N_2O_3S*CF_3COOH$			
MOLECULAR WEIGHT: 420,41 g/mole			
HAA2110 H-L-Met-pNA	HAA2110.0001	1 g	€ 150,00
L-Methionine p-nitroanilide	HAA2110.0005	5 g	€ 500,00
CAS-NO: 6042-04-2	HAA2110.0025	25 g	€ 2000,00
FORMULA: $C_{11}H_{15}N_3O_3S$			
MOLECULAR WEIGHT: 269,32 g/mole			
BAA5820 Boc-L-Met-ONp	BAA5820.0025	25 g	€ 110,00
N-alpha-t-Butyloxycarbonyl-L-methionine p-nitrophenyl ester	BAA5820.0100	100 g	€ 325,00
CAS-NO: 2488-18-8			
FORMULA: $C_{16}H_{22}N_2O_6S$			
MOLECULAR WEIGHT: 370,41 g/mole			

Prices are in EUR, net, exw Germany

2.4.17. Norleucine Based Substrate

ZAA1232 Z-L-Nle-ONp

N-alpha-Benzyloxycarbonyl-L-norleucine p-nitrophenyl ester
CAS-NO: 24181-97-3
FORMULA: $C_{20}H_{22}N_2O_6$
MOLECULAR WEIGHT: 386,39 g/mole

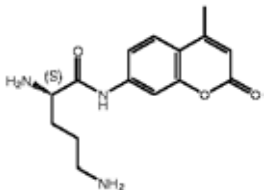


Article No.	Quantity	Price
ZAA1232.0005	5 g	€ 100,00
ZAA1232.0025	25 g	€ 400,00

2.4.18. Ornithine Based Substrate

HAA2185 H-L-Orn-AMC*HCl

L-Ornithine 7-amido-4-methylcoumarin hydrochloride
CAS-NO: 98516-75-7
FORMULA: $C_{15}H_{19}N_3O_3$*HCl
MOLECULAR WEIGHT: 289,33*36,46 g/mole



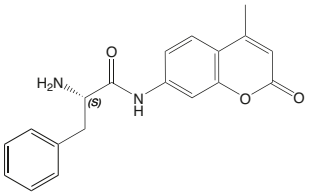
Article No.	Quantity	Price
HAA2185.0050	50 mg	€ 225,00
HAA2185.0250	250 mg	€ 550,00
HAA2185.1000	1 g	€ 1475,00

2.4.19. Phenylalanine Based Substrates

Phenylalanine based chromogenic/fluorogenic substrates can be used for the quantitative determination of proteases with specificity for aromatic amino acids, e.g. chymotrypsin, and many others such as aminopeptidase M-like enzyme from human skeletal muscle.

HAA7720 H-L-Phe-AMC*TFA

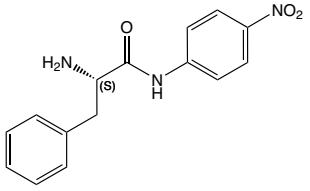
L-Phenylalanine 7-amido-4-methylcoumarin, trifluoroacetate salt, 99%
CAS-NO: 108321-84-2
FORMULA: $C_{19}H_{18}N_2O_3$*CF_3CO_2H
MOLECULAR WEIGHT: 436,39 g/mole



Article No.	Quantity	Price
HAA7720.0500	500 mg	€ 225,00
HAA7720.1000	1 g	€ 275,00

HAA1632 H-L-Phe-pNA

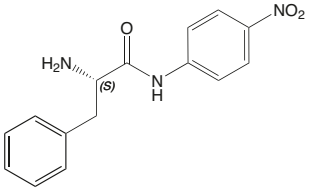
L-Phenylalnine-p-nitroanilide
CAS-NO: 2360-97-6
FORMULA: $C_{15}H_{15}N_3O_3$
MOLECULAR WEIGHT: 285,31 g/mole



Article No.	Quantity	Price
HAA1632.0005	5 g	€ 125,00
HAA1632.0025	25 g	€ 500,00
HAA1632.0100	100 g	€ 1500,00

HAA1184 H-L-Phe-pNA*HCl

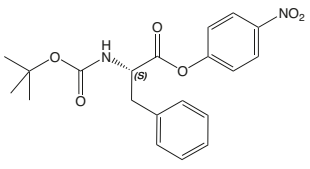
L-Phenylalnine-p-nitroanilide hydrochloride
CAS-NO: 2360-97-6
FORMULA: $C_{15}H_{15}N_3O_3$*HCl
MOLECULAR WEIGHT: 285,31*36,45 g/mole



Article No.	Quantity	Price
HAA1184.0001	1 g	€ 60,00
HAA1184.0005	5 g	€ 200,00
HAA1184.0025	25 g	€ 800,00

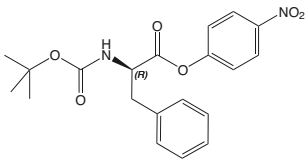
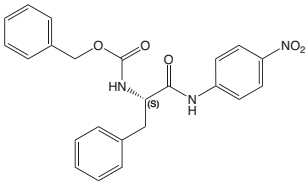
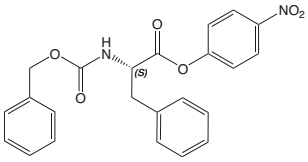
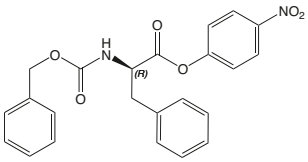
BAA5870 Boc-L-Phe-ONp

N-alpha-t-Butyloxycarbonyl-L-phenylalanine p-nitrophenyl ester
CAS-NO: 7535-56-0
FORMULA: $C_{20}H_{22}N_2O_6$
MOLECULAR WEIGHT: 386,39 g/mole



Article No.	Quantity	Price
BAA5870.0005	5 g	€ 50,00
BAA5870.0025	25 g	€ 110,00

Prices are in EUR, net, exw Germany

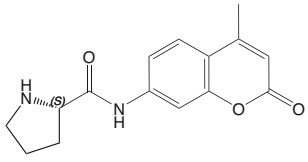
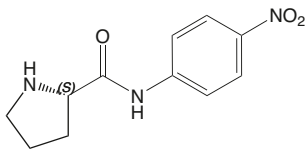
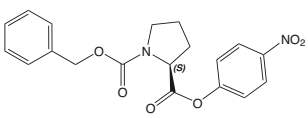
		Article No.	Quantity	Price
BAA5570	**Boc-D-Phe-ONp**	BAA5570.0005	5 g	€ 65,00
N-alpha-t-Butyloxycarbonyl-D-phenylalanine p-nitrophenyl ester		BAA5570.0025	25 g	€ 210,00
CAS-NO: 16159-70-9		BAA5570.0100	100 g	€ 625,00
FORMULA: $C_{20}H_{22}N_2O_6$				
MOLECULAR WEIGHT: 386,39 g/mole				
ZAA1266	**Z-L-Phe-pNA**	ZAA1266.0005	5 g	€ 75,00
N-alpha-Benzyloxycarbonyl-L-Phenylalnine-p-nitroanilide		ZAA1266.0025	25 g	€ 280,00
CAS-NO: 19647-71-3		ZAA1266.0100	100 g	€ 800,00
FORMULA: $C_{23}H_{21}N_3O_5$				
MOLECULAR WEIGHT: 419,41 g/mole				
ZAA1236	**Z-L-Phe-ONp**	ZAA1236.0005	5 g	€ 45,00
N-alpha-Benzyloxycarbonyl-L-phenylalanine p-nitrophenyl ester		ZAA1236.0025	25 g	€ 80,00
CAS-NO: 2578-84-9				
FORMULA: $C_{23}H_{20}N_2O_6$				
MOLECULAR WEIGHT: 420,42 g/mole				
ZAA1207	**Z-D-Phe-ONp**	ZAA1207.0005	5 g	€ 80,00
N-alpha-Benzyloxycarbonyl-D-phenylalanine p-nitrophenyl ester		ZAA1207.0025	25 g	€ 250,00
CAS-NO: 2578-85-0				
FORMULA: $C_{23}H_{20}N_2O_6$				
MOLECULAR WEIGHT: 420,4 g/mole				

References:

- Ishiura S., *et al*., Human skeletal muscle contains two major aminopeptidases: an anion activated aminopeptidase B and an aminopeptidase M-like enzyme. *J. Biochem.* 1987; **102**: 1023-31.
- O'Donnell-Tormey J., Quigley J.P., Detection and partial characterization of a chymostatin-sensitive endopeptidase in transformed fibroblasts. *Proc. Natl. Acad. Sci. U.S.A.* 1983; **80**: 344-8.

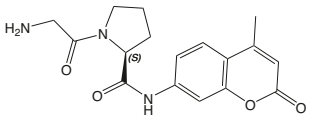
2.4.20. Proline Based Substrates

Proline based chromogenic/fluorogenic substrates can be used e.g. for the determination of prolyl endopeptidase.

		Article No.	Quantity	Price
HAA7730	**H-L-Pro-AMC*HBr**	HAA7730.0100	100 mg	€ 190,00
L-Proline 7-amido-4-methylcoumarin hydrobromide		HAA7730.0250	250 mg	€ 300,00
CAS-NO: 115388-93-7		HAA7730.0500	500 mg	€ 450,00
FORMULA: $C_{15}H_{16}N_2O_3$*HBr				
MOLECULAR WEIGHT: 272,30*80,91 g/mole				
HAA7180	**H-L-Pro-pNA*HCl**	HAA7180.0001	1 g	€ 120,00
L-Proline p-nitroanilide hydrochloride		HAA7180.0005	5 g	€ 450,00
CAS-NO: 7369-91-7net				
FORMULA: $C_{11}H_{13}N_3O_3$*HCl				
MOLECULAR WEIGHT: 235,23*36,45 g/mole				
ZAA1242	**Z-L-Pro-ONp**	ZAA1242.0005	5 g	€ 45,00
N-alpha-Benzyloxycarbonyl-L-proline p-nitrophenyl ester		ZAA1242.0025	25 g	€ 75,00
CAS-NO: 3304-59-4				
FORMULA: $C_{19}H_{18}N_2O_6$				
MOLECULAR WEIGHT: 370,35 g/mole				

Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
HAA7980	**H-Gly-L-Pro-AMC*HBr**	HAA7980.0005	5 mg	€ 175,00
Glycyl-L-proline 7-amido-4-methylcoumarin hydrobromide, 98%		HAA7980.0100	100 mg	€ 280,00
CAS-NO: 115035-46-6				
FORMULA: $C_{17}H_{19}N_3O_4$*HBr				
MOLECULAR WEIGHT: 329,35*80,91 g/mole				



H-Gly-L-Pro-AMC is a fluorogenic substrate for dipeptidyl-aminopeptidase IV and prolyl endopeptidase.

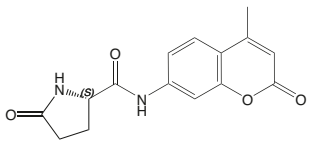
Reference:

- Kato T., *et al.*, Fluorescence assay of x-prolyl dipeptidyl-aminopeptidase activity with a new fluorogenic substrate. *Biochem. Med.* 1978; **19**: 351-9.

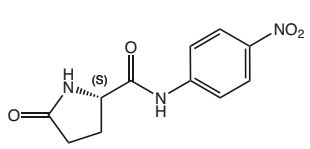
2.4.21. Pyroglutamic Acid Based Substrates

Pyroglutamic acid based chromogenic/fluorogenic substrates can be used for the determination of proglutamyl peptidase and in identification of *Enterococcus spp.* and group A *streptococci* (*Streptococcus pyogenes*).

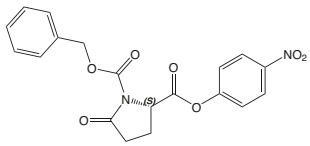
		Article No.	Quantity	Price
HAA7740	**H-L-Pyr-AMC**	HAA7740.1000	1 g	€ 550,00
L-Pyroglutamic acid 7-amido-4-methylcoumarin, 99%		HAA7740.5000	5 g	€ 2200,00
CAS-NO: 66642-36-2				
FORMULA: $C_{15}H_{14}N_2O_4$				
MOLECULAR WEIGHT: 286,29 g/mole				



HAA2115	**H-L-Pyr-pNA**	HAA2115.0001	1 g	€ 250,00
L-Pyroglutamic acid p-nitroanilide		HAA2115.0005	5 g	€ 960,00
CAS-NO: 66642-35-1				
FORMULA: $C_{11}H_{11}N_3O_4$				
MOLECULAR WEIGHT: 249,22 g/mole				



ZAA1245	**Z-L-Pyr-ONp**	ZAA1245.0005	5 g	€ 65,00
(S)-N-alpha-Benzyloxycarbonyl-pyroglutamic acid p-nitrophenyl ester		ZAA1245.0025	25 g	€ 190,00
CAS-NO: 40356-52-3				
FORMULA: $C_{19}H_{16}N_2O_7$				
MOLECULAR WEIGHT: 384,33 g/mole				

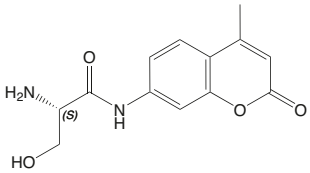


References:

- Fujiwara K., Tsuru D., New chromogenic and fluorogenic substrates for pyrrolidonyl peptidase. *J. Biochem. (Tokyo)* 1978; **83**: 1145-9.
- Manafi M., Sommer R., Rapid identification of Enterococci with a new fluorogenic-chromogenic assay. *Water Sci. Technol.* 1993; **27**: 271-74.

2.4.22. Serine Based Substrate

		Article No.	Quantity	Price
HAA7750	**H-L-Ser-AMC*HCl**	HAA7750.0250	250 mg	€ 410,00
L-Serine 7-amido-4-methylcoumarin hydrochloride, 98%				
CAS-NO: 115918-60-0				
FORMULA: $C_{13}H_{14}N_2O_4$*HCl*1,25H_2O				
MOLECULAR WEIGHT: 298,72 g/mole				



Reference:

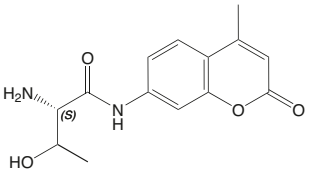
- Huston A.L., *et al.*, Purification, Characterization, and Sequencing of an Extracellular Cold-Active Aminopeptidase Produced by Marine Psychrophile Colwellia psychrerythraea Strain 34H. *Appl. Environ. Microbiol.* 2004; 70: 3321-8.

Prices are in EUR, net, exw Germany

2.4.23. Threonine Based Substrate

HAA7760 H-L-Thr-AMC

L-Threonine 7-amido-4-methylcoumarin, 98%
CAS-NO: 191723-66-7
FORMULA: $C_{14}H_{16}N_2O_4$
MOLECULAR WEIGHT: 276,29 g/mole

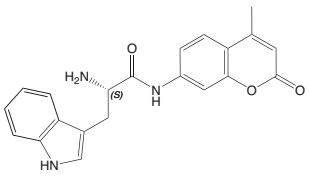


Article No.	Quantity	Price
HAA7760.0250	250 mg	€ 500,00
HAA7760.1000	1 g	€ 1350,00

2.4.24. Tryptophane Based Substrates

HAA7770 H-L-Trp-AMC*HCl

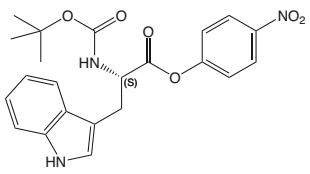
L-Tryptophan 7-amido-4-methylcoumarin hydrochloride, 99%
FORMULA: $C_{21}H_{19}N_3O_3$*HCl
MOLECULAR WEIGHT: 397,86 g/mole



Article No.	Quantity	Price
HAA7770.0100	100 mg	€ 225,00
HAA7770.0500	500 mg	€ 490,00
HAA7770.1000	1 g	€ 590,00

BAA5970 Boc-L-Trp-ONp

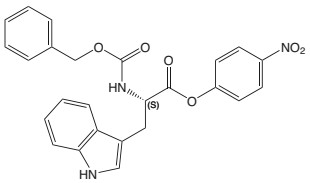
N-alpha-t-Butyloxycarbonyl-L-tryptophane p-nitrophenyl ester
CAS-NO: 15160-31-3
FORMULA: $C_{22}H_{23}N_3O_6$
MOLECULAR WEIGHT: 425,43 g/mole



Article No.	Quantity	Price
BAA5970.0005	5 g	€ 120,00
BAA5970.0025	25 g	€ 325,00

ZAA1252 Z-L-Trp-ONp

N-alpha-Benzyloxycarbonyl-L-tryptophane p-nitrophenyl ester
CAS-NO: 16624-64-9
FORMULA: $C_{25}H_{21}N_3O_6$
MOLECULAR WEIGHT: 459,44 g/mole

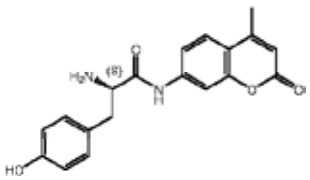


Article No.	Quantity	Price
ZAA1252.0005	5 g	€ 65,00
ZAA1252.0025	25 g	€ 180,00

2.4.25. Tyrosine Based Substrates

HAA2190 H-L-Tyr-AMC

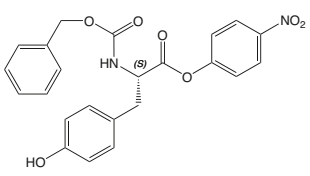
L-Tyrosine 7-amido-4-methylcoumarin
CAS-NO: 94099-57-7
FORMULA: $C_{19}H_{18}N_2O_4$
MOLECULAR WEIGHT: 338,36 g/mole



Article No.	Quantity	Price
HAA2190.0050	50 mg	€ 150,00
HAA2190.0250	250 mg	€ 425,00
HAA2190.1000	1 g	€ 1100,00

ZAA1257 Z-L-Tyr-ONp

N-alpha-Benzyloxycarbonyl-L-tyrosine p-nitrophenyl ester
CAS-NO: 3556-56-7
FORMULA: $C_{23}H_{20}N_2O_7$
MOLECULAR WEIGHT: 436,4 g/mole



Article No.	Quantity	Price
ZAA1257.0005	5 g	€ 90,00
ZAA1257.0025	25 g	€ 350,00

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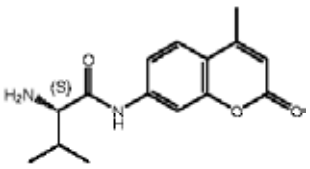
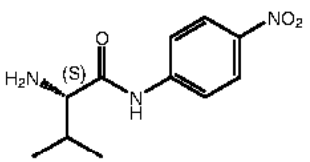
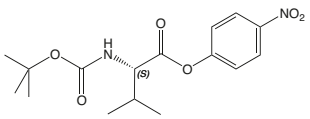
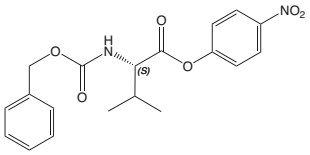
2.4.26. Valine Based Substrates

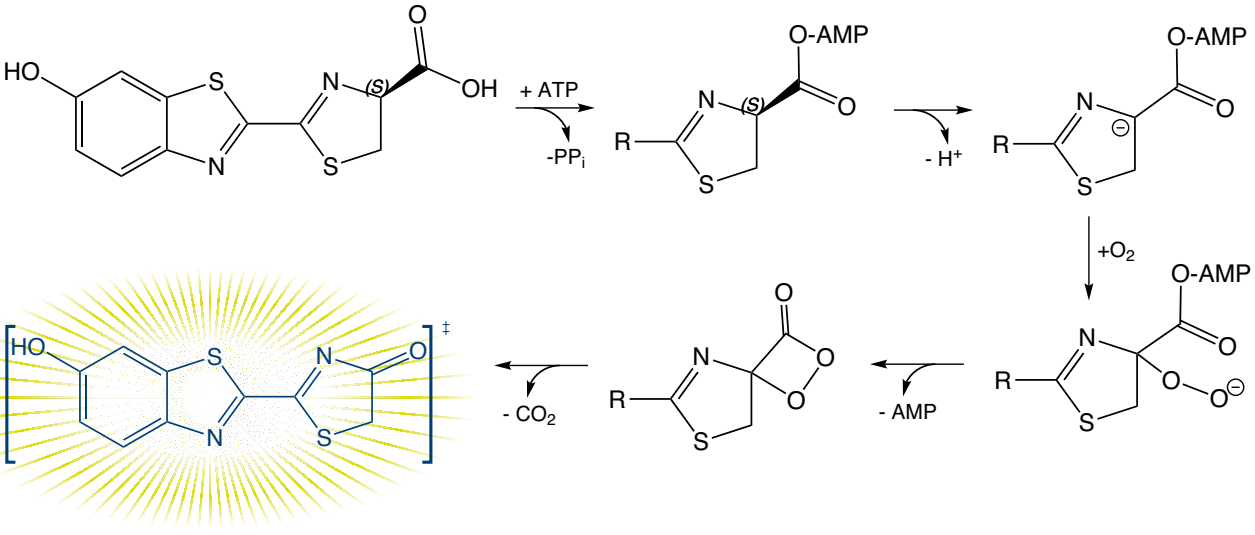
		Article No.	Quantity	Price
HAA2195 H-L-Val-AMC*TFA L-Valine 7-amido-4-methylcoumarin, trifluoroacetate salt CAS-NO: 191723-67-8 FORMULA: $C_{15}H_{18}N_2O_3CF_3COOH$ MOLECULAR WEIGHT: 274,32*114,02 g/mole		HAA2195.0050 HAA2195.0250 HAA2195.1000	50 mg 250 mg 1 g	€ 175,00 € 450,00 € 1200,00
HAA2200 H-L-Val-pNA*HCl L-Valine 4-nitroanilide hydrochloride CAS-NO: 77835-49-5 FORMULA: $C_{11}H_{15}N_3O_3$*HCl MOLECULAR WEIGHT: 237,26*36,46 g/mole		HAA2200.0001 HAA2200.0005	1 g 5 g	€ 225,00 € 650,00
BAA6030 Boc-L-Val-ONp N-alpha-t-Butyloxycarbonyl-L-valine p-nitrophenyl ester CAS-NO: 16948-40-6 FORMULA: $C_{16}H_{22}N_2O_6$ MOLECULAR WEIGHT: 338,35 g/mole		BAA6030.0005 BAA6030.0025	5 g 25 g	€ 50,00 € 125,00
ZAA1258 Z-L-Val-ONp N-alpha-Benzyloxycarbonyl-L-valine p-nitrophenyl ester CAS-NO: 10512-93-3 FORMULA: $C_{19}H_{20}N_2O_6$ MOLECULAR WEIGHT: 372,37 g/mole		ZAA1258.0005 ZAA1258.0025	5 g 25 g	€ 50,00 € 125,00

2.5. Miscellaneous Substrates

2.5.1. Luciferin

In nature, the american firefly (*photinus pyralis*) uses the luciferase bioluminescence to find a partner for reproduction. The result of the luciferase reaction is the emission of yellow-green light at 560 nm. This reaction requires the enzyme luciferase, the substrate D-luciferin and the co-factors ATP, Mg^{2+} and oxygen. The reaction is a cascade of several steps: the initial adenylation of luciferin is followed by oxidation to oxyluciferin.

The oxyluciferin resulting from this reaction is in an electronically excited state. On relaxation to ground state a photon is released (from 550 nm (yellow-green) at neutral pH to 620 nm (red) at low pH).



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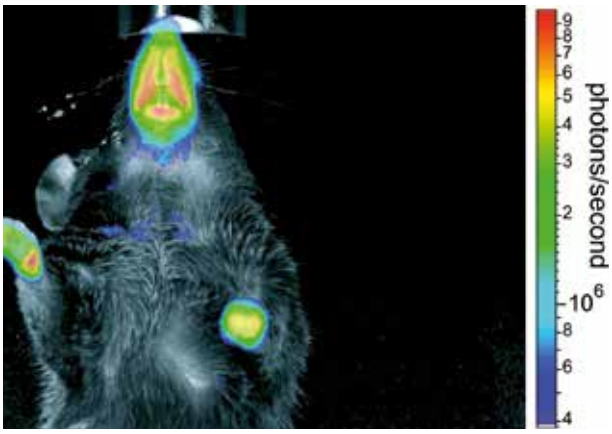
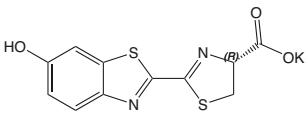
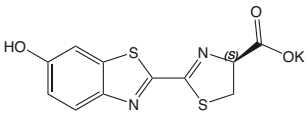
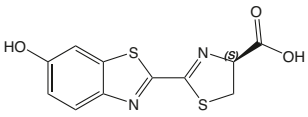
In modern biotechnology there are numerous applications for the luciferase system.

- **Food industry**: Positive luciferase test on food surfaces as a clear sign for **microbial contamination**.[1]
- ***luc* reporter gene system**: Higly sensitive method for the identification of **gene expression** even at very low levels (picture).[2]
- Identification of **protein-protein interactions**.
- Measuring of **cellular receptor activity**.
- **Monitoring of tumor growth**.[3]

D-Luciferin and the water soluble potassium salt of D-luciferin are available as luciferase substrates. Potassium salt of L-luciferin is an inhibitor of firefly luciferase and a substrate for luciferyl-CoA synthetase.



Luciferase activity in transgenic Egr-1-luc mice. Anaesthetized mice received 6 mg luciferin in 100 µl PBS by i.p. injection. Ten minutes after injection bioluminescence imaging measurement was carried out.[2]

		Article No.	Quantity	Price
LS-1207 **L-Luciferin*K** (L)-4,5-Dihydro-2-(6-hydroxy-2-benzothiazolyl)-4-thiazolecarboxylic acid, Firefly, potassium salt FORMULA: $C_{11}H_7N_2O_3S_2K$ MOLECULAR WEIGHT: 318,42 g/mole		LS-1207.0025 LS-1207.0100	25 mg 100 mg	€ 200,00 € 300,00
LS-1206 **D-Luciferin*K** (S)-4,5-Dihydro-2-(6-hydroxy-2-benzothiazolyl)-4-thiazolecarboxylic acid, Firefly, potassium salt CAS-NO: 115144-35-9 FORMULA: $C_{11}H_7N_2O_3S_2K$ MOLECULAR WEIGHT: 318,42 g/mole		LS-1206.0250 LS-1206.1000 LS-1206.9010	250 mg 1 g 10 g	€ 200,00 € 275,00 € 1890,00
LS-1205 **D-Luciferin** ((S)-4,5-Dihydro-2-(6-hydroxy-2-benzothiazolyl)-4-thiazolecarboxylic acid, Firefly (synthetic), 99% CAS-NO: 2591-17-5 FORMULA: $C_{11}H_8N_2O_3S_2$ MOLECULAR WEIGHT: 280,33 g/mole		LS-1205.0250 LS-1205.1000	250 mg 1 g	€ 200,00 € 275,00

References:

- [1] Hawronskyj, J.-M. und Holah, J., ATP: a universal hygiene monitor. *Trends Food Sci. Tech.* 1997; **8**: 79-84.
- [2] Dussmann, P. *et al.*, Live in vivo imaging of Egr-1 promoter activity during neonatal development, liver regeneration and wound healing. *BMC Dev. Biol.* 2011; **11**: 28.
- [3] O'Connell-Rodwell, CE. *et al.*, In vivo analysis of heat-shock-protein-70 induction following pulsed laser irradiation in a transgenic reporter mouse. *J. Biomed. Opt.* 2008; **13(3)**: 030501.

2.5.2. Coelenterazines

Luciferase enzymes are not only present in fireflies but in many other organisms. Another promintent luciferase group was first discovered in *Coelenterata* and the corresponding light emitting molecule was therefore named coelenterazine. Coelenterazine is a cell-permeable substrate for many aquatic organism photoproteins such as aequorin, obelin, Rluc (*Renilla reniformis* luciferase) or Gluc (*Gausseria* luciferase). Some organisms exhibit molecules similar to coelenterazine, e.g. coelenterazine h.

Coelenterazine reacts with the photoproteins in presence of oxygen thus enabling them to release coelenteramid, CO_2 and one photon at a wavelength of 465 nm. It can also be used for detecting changes in intracellular Ca^{2+} concentration in cells that have been transfected with apoaequorin cDNA. Coelenterazine also acts as a powerful antioxidant.

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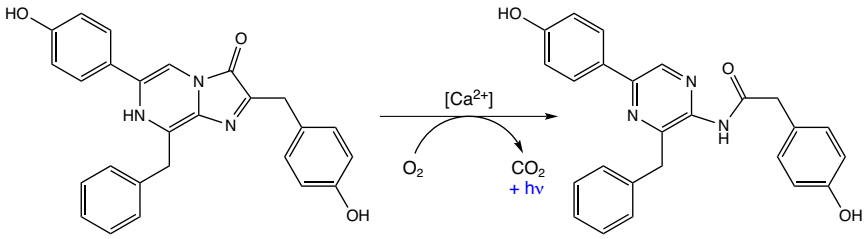


		Article No.	Quantity	Price
LS-3385	**Coelenterazine, native** 2-(p-Hydroxybenzyl)-6-(p-hydroxyphenyl)-8-benzyl-imidazo[1,2-a] pyrazin-3-(7H)-one CAS-NO: 55779-48-1 FORMULA: $C_{26}H_{21}N_3O_3$ MOLECULAR WEIGHT: 423,46 g/mole	LS-3385.0025 LS-3385.0050 LS-3385.0100	2,5 mg 5 mg 10 mg	€ 400,00 € 550,00 € 650,00
LS-3375	**Coelenterazine h** 2,8-Dibenzyl-6-(p-hydroxyphenyl)-imidazo[1,2a]pyrazin-3-(7H)-one CAS-NO: 50909-86-9 FORMULA: $C_{26}H_{21}N_3O_2$ MOLECULAR WEIGHT: 407,48 g/mole	LS-3375.0010	10 mg	€ 495,00
LS-3365	**Coelenterazine 400a** 2,8-Dibenzyl-6-phenyl-imidazo[1,2a]pyrazin-3-(7H)-one CAS-NO: 70217-82-2 FORMULA: $C_{26}H_{21}N_3O$ MOLECULAR WEIGHT: 391,48 g/mole	LS-3365.0001 LS-3365.0025 LS-3365.0005 LS-3365.0010	1 mg 2,5 mg 5 mg 10 mg	€ 400,00 € 550,00 € 625,00 € 800,00
LS-3370	**Coelenterazine e** 12-Benzyl-8-hydroxy-2-(4-hydroxybenzyl)-5,6-dihydrobenzo[f] imidazo[1,2-a]quinoxalin-3(11H)-one CAS-NO: 114496-02-5 FORMULA: $C_{28}H_{23}N_3O_3$ MOLECULAR WEIGHT: 449,5 g/mole			please inquire!
LS-3380	**Coelenterazine hcp** 2-Benzyl-8-(cyclopentylmethyl)-6-(4-hydroxyphenyl)imidazo[1,2-a] pyrazin-3(7H)-one CAS-NO: 123437-32-1 FORMULA: $C_{25}H_{25}N_3O_2$ MOLECULAR WEIGHT: 399,48 g/mole			please inquire!

Coelenterazine h has a 16 times higher, coelenterazine hcp a 190 times higher luminescence intensity than native coelenterazine. Additionally, coelenterazine hcp has a faster response time.

References:

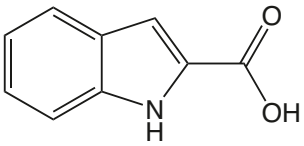
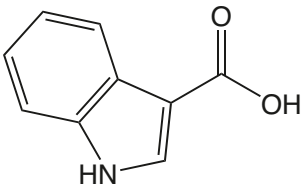
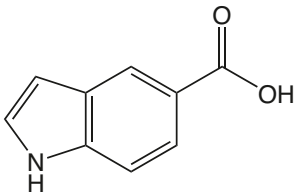
- Nakajima-Shimada, J. *et al.*, Monitoring of intracellular calcium in Saccharomyces cerevisiae with an apoaequorin cDNA expression system. *Proc. Natl. Acad. Sci. USA* 1991; **88**: 6878-6882.
- Rizzuto, R. *et al.*, Rapid changes of mitochondrial Ca^{2+} revealed by specifically targeted recombinant aequorin. Nature 1992; **358**: 325-327.
- Lucas, M. & Solano, F., Coelenterazine is a superoxide anion-sensitive chemiluminescent probe: its usefulness in the assay of respiratory burst in neutrophils. *Anal. Biochem.* 1992; **206**: 273-277.
- Sheu, Y.-A. *et al.*, Measurement of intracellular calcium using bioluminescent aequorin expressed in human cells. *Anal. Biochem.* 1993; **209**: 343-347.
- Button, D. & Brownstein, M., Aequorin-expressing mammalian cell lines used to report Ca^{2+} mobilization. *Cell Calcium* 1993; 14: 663-671.

Interested in any other coelenterazine derivatives (p, cp, cp, f, fch, fcp)?

Inquire via info@iris-biotech.de!

Prices are in EUR, net, exw Germany

2.5.3. Decarboxylase Substrates

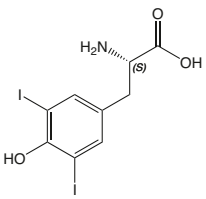
		Article No.	Quantity	Price
HAA8350	**Indole-2-carboxylic acid**	HAA8350.0500	500 g	€ 250,00
CAS-NO: 1477-50-5 FORMULA: $C_9H_7NO_2$ MOLECULAR WEIGHT: 161,16 g/mole		HAA8350.1000	1 kg	€ 450,00
HAA8370	**Indole-3-carboxylic acid**	HAA8370.010	10 g	€ 140,00
CAS-NO: 771-50-6 FORMULA: $C_9H_7NO_2$ MOLECULAR WEIGHT: 161,16 g/mole		HAA8370.0025	25 g	€ 175,00
		HAA8370.0100	100 g	€ 230,00
		HAA8370.0250	250 g	€ 380,00
HAA8400	**Indole-5-carboxylic acid**	HAA8400.0100	100 g	€ 380,00
CAS-NO: 1670-81-1 FORMULA: $C_9H_7NO_2$ MOLECULAR WEIGHT: 161,16 g/mole				

The formation of indole can be detected by monitoring absorbance. These compounds are used as chromogenic substrates for cloning genes encoding dioxygenases that act on aromatic acids. The p-cumate-degrading strain *Pseudomonas putida F1* and the m- and p-toluate-degrading strain *P. putida* mt-2 transform indole-2-carboxylate and indole-3-carboxylate to colored products identified as indigo, indirubin, and isatin. Dioxygenase is thought to catalyse the first step in this reaction. Indole-2-carboxylic acid is also a competitive antagonist of potentiation by glycine at the NMDA receptor.

References:

- Eaton R.W., Chapman P.J., Formation of indigo and related compounds from indolecarboxylic acids by aromatic acid-degrading bacteria: chromogenic reactions for cloning genes encoding dioxygenases that act on aromatic acids. *J. Bacteriol.* 1995; **177**: 6983-8.
- Yoshida T., *et al.*, Novel reversible indole-3-carboxylate decarboxylase catalyzing nonoxidative decarboxylation. *Biosci. Biotechnol. Biochem.* 2002; **66**: 2388-94.

2.5.4. Diiodotyrosine Transaminase Substrate

		Article No.	Quantity	Price
HAA7780	**H-L-Tyr(3,5-I_2)-OH*2H_2O**	HAA7780.0100	100 g	€ 225,00
3,5-Diiodo-L-tyrosine dihydrate CAS-NO: 300-39-0 FORMULA: $C_9H_9I_2NO_3$*2H_2O MOLECULAR WEIGHT: 469,02 g/mole		HAA7780.0250	250 g	€ 375,00
		HAA7780.1000	1 kg	€ 950,00

Substrate for diiodotyrosine transaminase and thyroid hormone aminotransferase. Intermediate in the biosynthesis and alternative pathways of metabolism of thyroid hormones.

References:

- Nakano, M., Purification and properties of halogenated tyrosine and thyroid hormone transaminase from rat kidney mitochondria. *J. Biol. Chem.* 1967; **242**: 73-81.
- Balsam, A., *et al.*, Formation of diiodotyrosine from thyroxine. Ether-link cleavage, an alternate pathway of thyroxine metabolism. *J. Clin. Invest.* 1983; **72(4)**: 1234-1245.

Prices are in EUR, net, exw Germany

3. Harmane Derivatives - Substrates for Metabolic P450 Drug Interactions

3.1. Principle of Metabolic Drug Interactions

Drug interactions are being observed, whenever a substance affects the activity of a given drug. This can result in an increase or decrease of the given drug's activity or a completely new effect that neither compound produces on its own. Typically, a drug-drug interaction is mentioned in this context. However, interactions may also exist between drugs and any other intake, like foods, herbs, alcohol, nicotine, etc. Effects observed may come to mind out of accidental misuse or due to lack of knowledge about the active ingredients involved in the relevant substances.

The majority of pharmacokinetic drug-drug interactions occur during drug metabolism in two ways. Either one drug (the perpetrator) may inhibit the metabolism of another drug (the victim), or a perpetrator drug may increase the metabolism of a victim drug. This effect is caused by induction of drug-metabolizing enzymes happening through activation of nuclear receptors. Assessing receptor activation by potential perpetrator compounds can predict whether there is a potential for drug-drug interactions, which may be the result of various processes, like alterations in drug metabolism. These processes may include changes in the pharmacokinetics of the drug, in particular absorption, distribution, metabolism, and excretion. Alternatively, drug interactions may be the result of the pharmacodynamic properties of the drug, e.g. the co-administration of a receptor antagonist and an agonist for the same receptor.

One notable system involved in metabolic drug interactions is the enzyme system comprising the cytochrome P450 oxidases. This system may be affected by either enzyme induction or enzyme inhibition.

Enzyme Induction:

Drug A stimulates the body to produce more of an enzyme which metabolises drug B. This reduces the effective concentration of drug B, which may lead to loss of effectiveness of drug B. Drug A effectiveness is not altered.

Enzyme inhibition:

Drug A inhibits the production of the enzyme metabolising drug B, thus an elevation of drug B occurs possibly leading to an overdose.

The examples described above may have different outcomes depending on the nature of the drugs. For example, if Drug B is a prodrug, then enzyme activation is required for the drug to reach its active form. Hence, enzyme induction by Drug A would increase the effectiveness of the drug B by increasing its metabolism to its active form. Enzyme inhibition by Drug A would decrease the effectiveness of Drug B.

Generally speaking, drug interactions are to be avoided, due to the possibility of poor or unexpected outcomes. However, drug interactions also have been deliberately used in co-administration of two or several drugs:

- A historical example is the co-administration of **probenecid with penicillin** prior to mass production of penicillin. Probenecid retards the excretion of penicillin, so a dose of penicillin persists longer when taken with it.
- Co-administration of **carbidopa with levodopa** (available as carbidopa/levodopa): Levodopa is used in the management of Parkinson's disease and must reach the brain in an un-metabolized state to be beneficial. When given by itself, levodopa is metabolized in the peripheral tissues outside the brain, which decreases the effectiveness of the drug and increases the risk of adverse effects. As carbidopa inhibits the peripheral metabolism of levodopa, the co-administration of carbidopa with levodopa allows more levodopa to reach the brain un-metabolized and also reduces the risk of side effects.
- Detailed charts have been compiled to provide a summary of drug interactions between the HIV drugs and key interactions between protease inhibitors, NNRTIs, NRTIs, or entry/integrase inhibitors and other drugs that may be prescribed to the HIV$^+$ patient. (http://www.hiv-druginteractions.org/Interactions.aspx)

References:

- Pelkonen O. *et al*., Inhibition and induction of human cytochrome P450 enzymes: current status. *Arch. Toxicol.* 2008; **82**: 667-715.
- Lipp E., Tackling Drug-Interaction Issues Early On. *Genetic Engineering & Biotechnology News* 2008; **28(12)**: 14-20.

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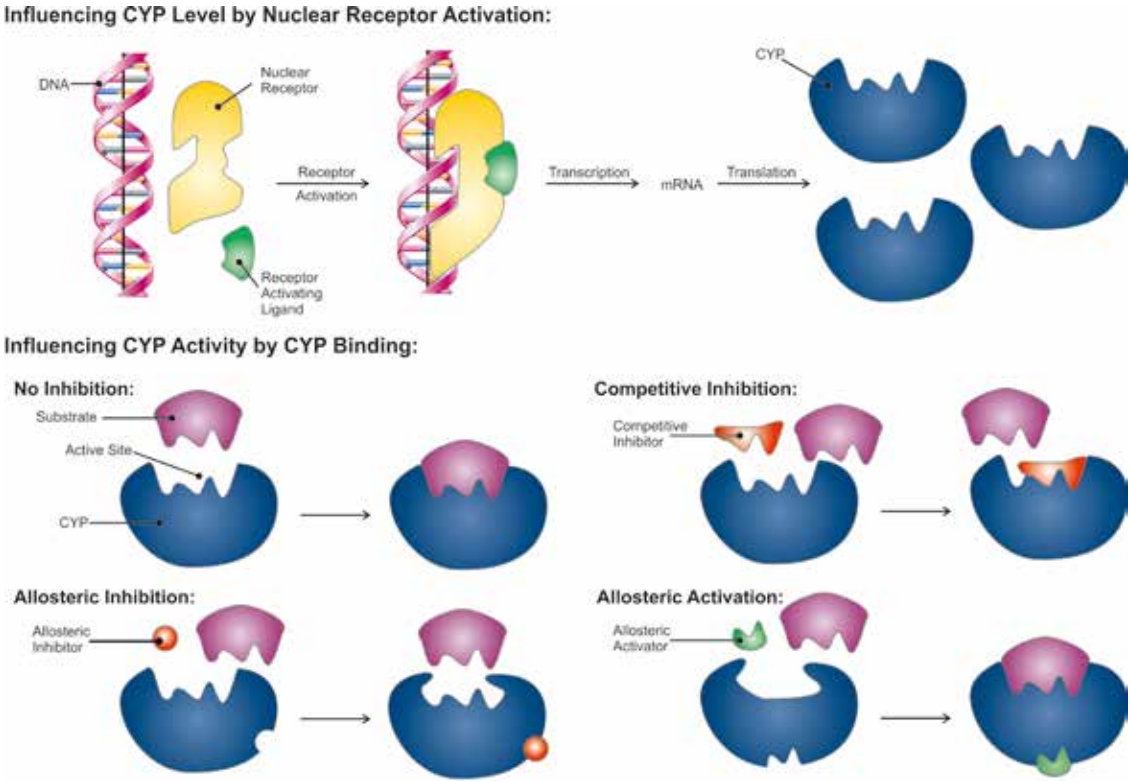
3.2. Cytochrome P450 Drug Interactions

Cytochrome P450 (CYP) enzymes are responsible for the oxidative metabolism of xenobiotics and play a major role in the phase I metabolism of pharmaceuticals. In clinical practice, the influence on CYP activity is the major cause for pharmacokinetic drug interactions. Xenobiotics can affect CYP activities by

1. influencing CYP levels by binding to CYP-gene regulating nuclear receptors such as constitutive androstane receptor (CAR) or pregnane X receptor (PXR). The primary function of these nuclear receptors is to sense the presence of endobiotic or foreign substances and in response to up-regulate the expression of proteins involved in the metabolism and clearance of these substances from the body (next figure, upper part).
2. direct action on CYP enzymes as competitive or allosteric inhibitors or allosteric activators (next figure, lower part).



Validated in vitro tests (in vitro phenotyping assays) need to be established in order to assess the inhibitory activity of drugs or secondary plant metabolites on CYP enzymes. The most promising tools for this purpose are rapid screening methods based on liquid chromatography with mass spectrometric (LC/MS/MS) or fluorometric (LC/fluorescence) detection and microtiter plate-based assays using fluorescence detection.

Substrates for in vitro phenotyping studies should be rapidly converted to single products (metabolites) which are specifically detectable with LC/MS/MS, LC/fluorescence or microtiterplate-based fluorometric assays. The substrate turnover should be fast so that very low amounts of the expensive CYP isoenzymes have to be applied. In practice, all currently available CYP substrates have distinct disadvantages which have to be taken into account when in vitro phenotyping assays are developed. The most often used drugs such as midazolam or tolbutamide are favorable for LC/MS/MS analyses but their corresponding metabolites are very expensive. Radioactive CYP substrates e.g. [6β-3H]testosterone are expensive and require special laboratories and equipment. Artificial substrates e.g. coumarin or resorufin derivatives are applicable in microtiterplate-based fluorometric assays. In this case, quenching or intrinsic fluorescence are often a major problem, especially when secondary plant metabolites or herbal extracts are screened for inhibitory activity. Such problems can be overcome by separation of the metabolites from the inhibitors or matrix using liquid chromatography. Unfortunately, coumarin and resorufin derivatives are not favorable for LC/fluorescence or LC/MS/MS detection.

The use of LC/MS/MS for the simultaneous determination of inhibitory activities of drugs on multiple CYP enzymes was reported several times. The biggest advantage of MS/MS detection with triple quadrupole or ion trap instruments is

the highly specific detection of product ions using Selected Reaction Monitoring (SRM) or Multiple Reaction Monitoring (MRM), respectively. Both methods allow the selective quantification of metabolites or – in most cases – their corresponding daughter ions which normally provides ion chromatograms without interfering matrix components.

References:

- Dierks E.A. *et al.*, A method for the simultaneous evaluation of the activities of seven major human drug-metabolizing cytochrome P450s using an in vitro cocktail of probe substrates and fast gradient liquid chromatography tandem mass spectrometry. *Drug Metab. Dispos.* 2001; **29**: 23-29.
- Unger M, Frank A, Simultaneous determination of the inhibitory potency of herbal extracts on the activity of six major cytochrome P450 enzymes using liquid chromatography/mass spectrometry and automated online extraction. *Rapid Commun. Mass Spectrom.* 2004; **18**: 2273-2281.
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- Chauret N. *et al.*, Description of a 96-well plate assay to measure cytochrome P4503A inhibition in human liver microsomes using a selective fluorescent probe. *Anal. Biochem.* 1999; **276**: 215-226.
- Yueh M.F. *et al.*, High volume bioassays to assess CYP3A4-mediated drug interactions: induction and inhibition in a single cell line. *Drug Metab. Dispos.* 2005; **33**: 38-48.
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3.3. Harmane Derivatives - A new Class of High Turnover Substrates

An ideal substrate for in vitro phenotyping studies with CYP enzymes should be a high turnover substrate which is sensitively and specifically detectable by liquid chromatography or microtiterplate-based methods with mass spectrometric or fluorometric detection.

Especially for new molecular entities which are often tested for CYP inhibition at later stages of drug development, microtiterplate-based fluorometric assays are often replaced by LC/MS/MS or even LC/fluorescence methods. By using monolithic silica rods and flow rates of 3-5 ml/min total run times of 4-5 min can be obtained with LC/fluorescence and even LC/UV detection. Faster analyses can be done using ultra performance liquid chromatography (UPLC) with sub 2 µm silica particles which allow LC/MS/MS or LC/fluorescence analyses of samples in less than a minute.

Fluorescence detection is a useful alternative for the quantification of metabolites because this method provides excellent signal-to-noise ratios which are favourable when low amounts of metabolites have to be determined. Additionally, if the fluorescence detection is used in combination with liquid chromatography, intrinsic fluorescence and quenching is not an issue.

Since basic isoquinoline or β-carboline alkaloids show a strong fluorescence, they can be used as an interesting alternative to the frequently applied resorufin or coumarin derivatives. Due to the basic nitrogen in these alkaloids their metabolites can be sensitively detected using both fluorescence and mass spectrometry. By alkylation or benzylation of the β-carboline alkaloid harmane (1-methyl-9H-pyrido[3,4-b]indole) high turnover substrates of drug-metabolizing CYP enzymes are obtained and their corresponding metabolites are detectable with LC/fluorescence, LC/MS/MS or microtiterplate-based fluorometric methods. In particular, the quaternary nitrogen of e.g. 2-benzyl-7-benzyloxyharmane or 2-methyl-7-methoxyharmane makes these substrates ideal candidates for in vitro phenotyping studies with CYP enzymes because the corresponding metabolites have limits of detection as low as 50 pg/ml using LC/MS or LC/MS/MS with Electrospray Ionization. Fortunately, this extremely high sensitivity allows the application of CYP isoenzyme concentrations less than 1 pg/ml.

CYP enzymes are highly selective concerning their ability to convert the different harmane substrates presented in this brochure. For example, BBH (LS-3180) is metabolised by CYP3A4, CYP1B1 and CYP2D6, whereas MCBH (LS-3205) is metabolised selectively by the subfamily CYP2C (see figure next page).

References:

- Dierks E.A. *et al.*, A method for the simultaneous evaluation of the activities of seven major human drug-metabolizing cytochrome P450s using an in vitro cocktail of probe substrates and fast gradient liquid chromatography tandem mass spectrometry; *Drug Metab. Dispos.* 2001; **29**: 23-29.
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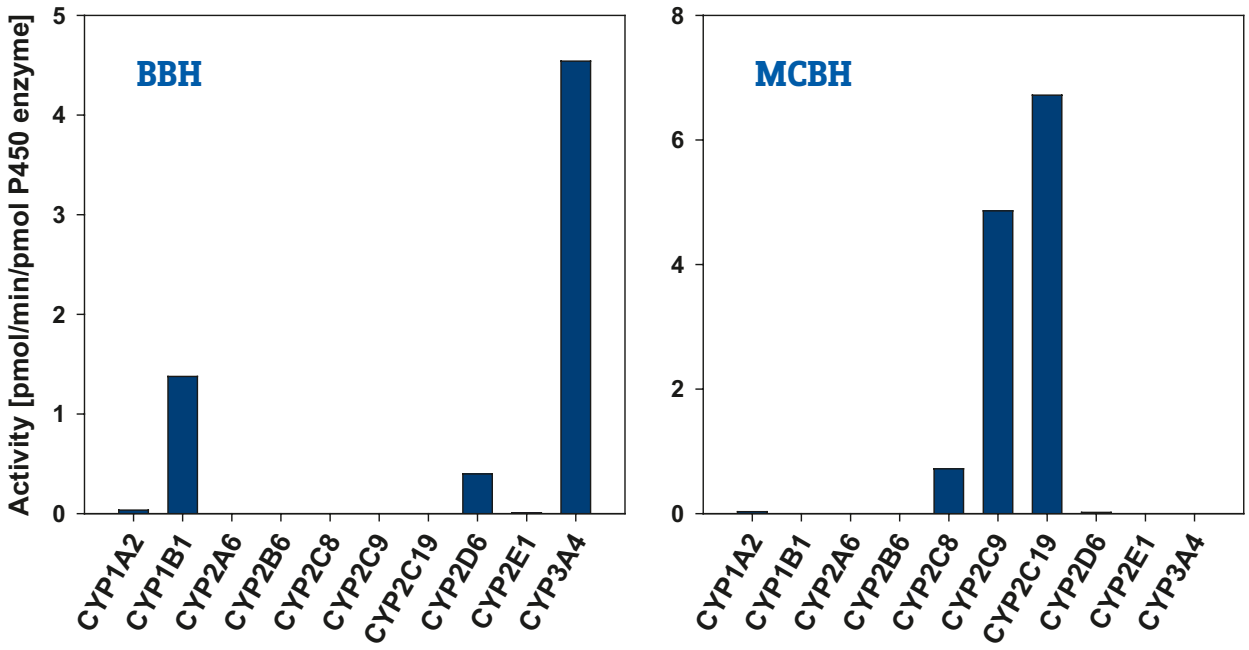
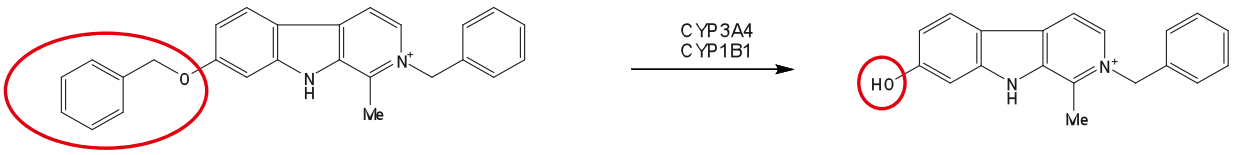
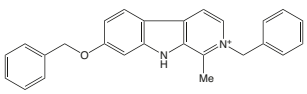
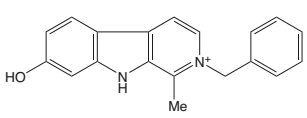


Metabolism of BBH (2 µM) and MCBH (10 µM) by human drug metabolising cytochrome P450 enzymes.

Currently available Harmane Substrates



- metabolized primarily by cytochrome P450 isoenzymes 3A4 and 1B1
- Low K_m-value and high activity for CYP3A4 and CYP1B1
- currently the best CYP1B1 substrate available
- ideal for LC/fluorescence and LC/MS
- suitable for fluorescence detection in microtiter plates

		Article No.	Quantity	Price
LS-3180	**BBH*TFA**	LS-3180.0005	5 mg	€ 275,00
2-Benzyl-7-benzyloxyharmane trifluoroacetate, metabolized primarily by cytochrome P_{450} isoenzyme 3A4 and 1B1 FORMULA: $C_{26}H_{23}N_2O*CF_3CO_2H$ MOLECULAR WEIGHT: 379,47*114,02 g/mole		LS-3180.0010	10 mg	€ 475,00
LS-3185	**BBH*TFA**	LS-3185.0005	5 mg	€ 275,00
2-Benzyl-7-hydroxyharmane trifluoroacetate FORMULA: $C_{19}H_{17}N_2O*CF_3CO_2H$ MOLECULAR WEIGHT: 289,35*114,02 g/mole		LS-3185.0010	10 mg	€ 475,00

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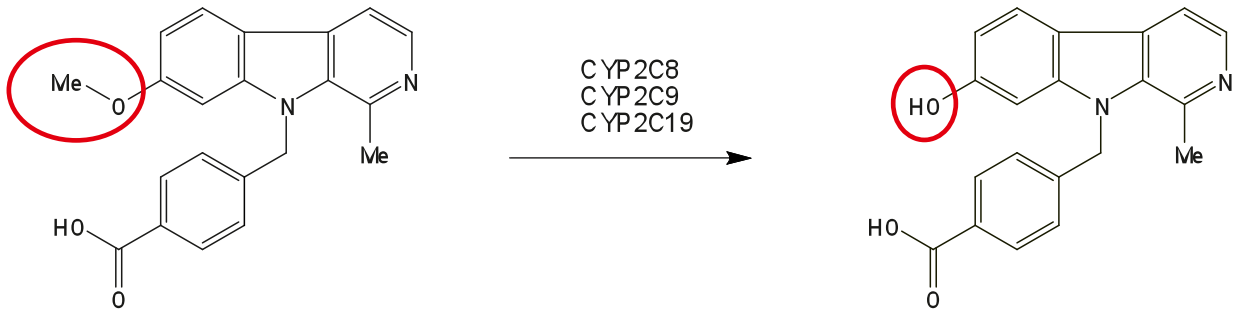
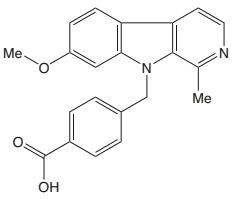


- metabolized primarily by cytochrome P450 isoenzymes 2C8, 2C9, and 2C19
- ideal for LC/fluorescence and LC/MS

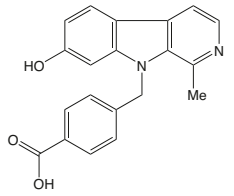
		Article No.	Quantity	Price
LS-3205	**MCBH**	LS-3205.0005	5 mg	€ 275,00
		LS-3205.0010	10 mg	€ 475,00

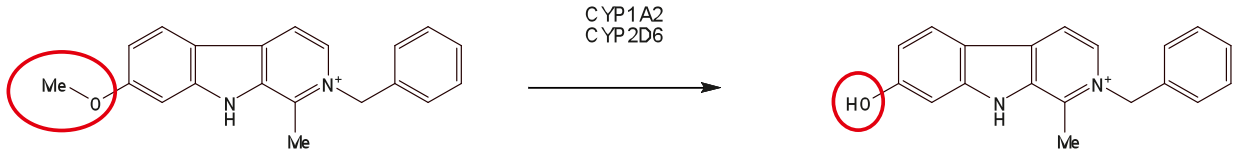
7-Methoxy-9-carboxybenzylharmane,
metabolized primarily by
cytochrome P_{450} isoenzyme 2C8, 2C9, and 2C19
FORMULA: $C_{20}H_{16}N_2O_3$
MOLECULAR WEIGHT: 346,38 g/mole



LS-3210	**HCBH**	LS-3210.0005	5 mg	€ 275,00
		LS-3210.0010	10 mg	€ 475,00

7-Hydroxy-9-carboxybenzylharmane
FORMULA: $C_{20}H_{16}N_2O_3$
MOLECULAR WEIGHT: 332,35 g/mole

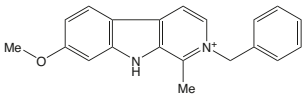




- metabolized primarily by cytochrome P450 isoenzymes 1A2 and 2D6
- ideal for LC/fluorescence and LC/MS
- suitable for fluorescence detection in microtiter plates

		Article No.	Quantity	Price
LS-3200	**BMH*TFA**	LS-3200.0005	5 mg	€ 275,00
		LS-3200.0010	10 mg	€ 475,00

2-Benzyl-7-methoxyharmane trifluoroacetate,
metabolized primarily by cytochrome P_{450} isoenzyme 1A2 and 2D6
FORMULA: $C_{20}H_{19}N_2O*CF_3CO_2H$
MOLECULAR WEIGHT: 303,38*114,02 g/mole



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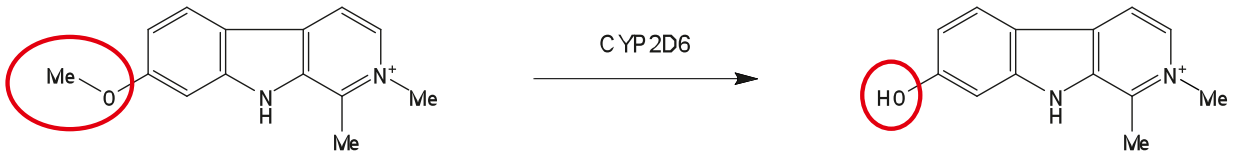
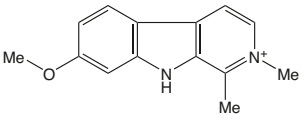
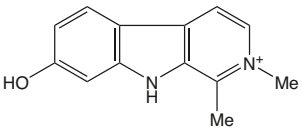


- metabolized exclusively by cytochrome P450 isoenzyme 2D6
- Low K_m-value and high activity combined with excellent selectivity
- can be used with HLM (human liver microsomes)
- ideal for LC/fluorescence and LC/MS
- suitable for fluorescence detection in microtiter plates

		Article No.	Quantity	Price
LS-3215	**MHH*TFA**	LS-3215.0005	5 mg	€ 275,00
2-Methyl-7-methoxyharmane trifluoroacetate, metabolized primarily by cytochrome P_{450} isoenzyme 2D6 FORMULA: $C_{13}H_{13}N_2O*CF_3CO_2H$ MOLECULAR WEIGHT: 213,25*114,02 g/mole		LS-3215.0010	10 mg	€ 475,00
LS-3220	**MHH*TFH**	LS-3220.0005	5 mg	€ 275,00
2-Methyl-7-hydroxyharmane trifluoroacetate FORMULA: $C_{14}H_{15}N_2O*CF_3CO_2H$ MOLECULAR WEIGHT: 227,28*114,02 g/mole		LS-3220.0010	10 mg	€ 475,00

Typical assay protocol for CYP inhibition experiments (sample volume 500 µL):

- Prepare reaction buffer: 3 mM $MgCl_2$ in 100 mM potassium phosphate pH 7.4.
- Thaw CYP sample, prepare 1 µM CYP (1000 pmole/mL) in reaction buffer and store on wet ice.
- Prepare 1 mM harmane substrate in DMSO.
- Prepare 100x concentrated solutions (e.g. 100 µM for a final concentration of 1µM, 50µM for a final concentration of 500nM etc.) of inhibitor in DMSO. This is to ensure that to every assay an identical amount of DMSO is added as DMSO might also affect CYP activity.
- Prepare 50 mM NADPH in reaction buffer.
- Prepare sample in test tube: Add 470 µL of reaction buffer, 10 µL of CYP solution (final concentration 20nM), 5 µL substrate solution (final concentration 10 µM) and 5 µL of 100x inhibitor solution and pre-incubate in water bath at 37°C for 5 min.
- Start reaction by addition of 10 µL of NADPH solution (final concentration 1 mM) and incubate in water bath at 37°C for 30 min.
- Stop reaction after 30 min by addition of 250 µL ice-cold methanol (containing a corresponding internal standard).
- Centrifuge for 3 min at 9000 g and 4°C.
- Withdraw supernatant from protein pellet.
- Analyze supernatant according to your analytical method, eg. LC/fluorescence or LC/MS/MS.

The final DMSO concentration in the method described above is 2% (v/v). This may in some cases influence cytochrome P450s. Therefore care should be taken that DMSO concentration is constant in all assays. Alternatively acetonitrile could be tested as solvent as it is tolerated by most human CYPs at concentrations up to 2%.

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4. Glucuronides

A glucuronide, also known as glucuronoside, is any substance produced by linking glucuronic acid to another substance via a glycosidic bond. Glucuronidation, the conversion of chemical compounds to glucuronides, is a biological method to excrete preferably nonpolar toxic substances, drugs, but also natural substances, like steroids, hormones or bilirubin, out of the body. Glucuronic acid is attached via a glycosidic bond to the substance. The resulting glucuronide has much higher water solubility than the original substance for their subsequent elimination from the body through urine or faeces (via bile from the liver).

Hormones may also be glucuronidated to allow for easier transport around the body. Pharmacologists have linked drugs to glucuronic acid to allow for more effective delivery of a broad range of substances. Sometimes toxic substances are also less toxic after glucuronidation. Ethylglucuronide (EtG), for example, is a chemical compound which can be found in nature. After excessive alcohol intoxication (ethanol), EtG can be found in human hair. The majority of alcohol is being oxidized to acetaldehyde, however, to a smaller extent, EtG as glucuronide is formed. Once EtG is in hair it does not further decompose and can be detected by immunological methods.

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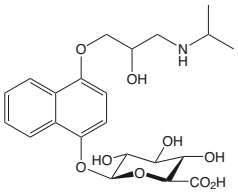
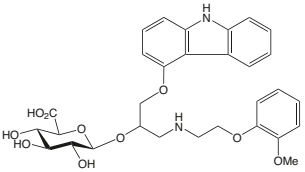
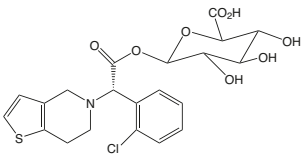
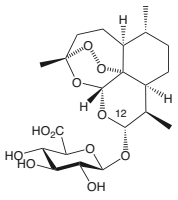
- Liston H. *et al.*, Drug glucuronidation in clinical psychopharmacology. *Journal of clinical psychopharmacology* 2001; **21(5)**: 500-515.

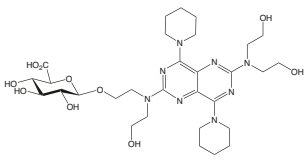
		Article No.	Quantity	Price
GBB1650	**4-Hydroxy propranolol-O-beta-D-glucuronide** 4-Hydroxy propranolol-O-beta-D-glucuronide CAS-NO: 94731-13-2 FORMULA: $C_{22}H_{29}NO_9$ MOLECULAR WEIGHT: 451,47 g/mole		please inquire!	
GBB1605	**Carvedilol-O-beta-D-glucuronide** Carvedilol-O-beta-D-glucuronide CAS-NO: 114869-83-9 FORMULA: $C_{30}H_{34}N_2O_{10}$ MOLECULAR WEIGHT: 582,6 g/mole		please inquire!	
GBB1575	**Clopidogrel acyl-beta-D-glucuronide** Clopidogrel acyl-beta-D-glucuronide FORMULA: $C_{21}H_{22}ClNO_8S$ MOLECULAR WEIGHT: 483,92 g/mole		please inquire!	
GBB1610	**Dihydroartemisinin-12-alpha-O-beta-D-glucuronide** Dihydroartemisinin-12-alpha-O-beta-D-glucuronide CAS-NO: 198976-06-6 FORMULA: $C_{21}H_{32}O_{11}$ MOLECULAR WEIGHT: 460,47 g/mole		GBB1610.0001 GBB1610.0002 GBB1610.0005	1 mg 2 mg 5 mg	€ 375,00 € 625,00 € 1200,00

Prices are in EUR, net, exw Germany

	Article No.	Quantity	Price

GBB1615 Dipyridamole mono-O-beta-D-glucuronide

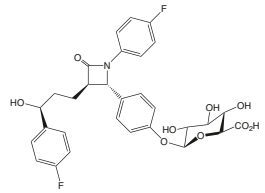
Dipyridamole mono-O-beta-D-glucuronide
CAS-NO: 63912-02-7
FORMULA: $C_{30}H_{48}N_8O_{10}$
MOLECULAR WEIGHT: 680,75 g/mole



please inquire!

GBB1655 Ezetimibe phenoxy-beta-D-glucuronide

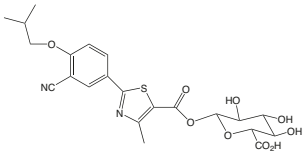
Ezetimibe phenoxy-beta-D-glucuronide
CAS-NO: 190448-57-8
FORMULA: $C_{30}H_{29}F_2NO_9$
MOLECULAR WEIGHT: 585,55 g/mole



please inquire!

GBB1580 Febuxostat acyl-beta-D-glucuronide

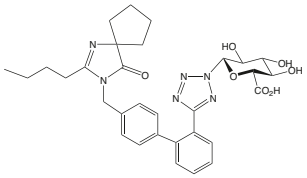
Febuxostat acyl-beta-D-glucuronide
FORMULA: $C_{22}H_{24}N_2O_9S$
MOLECULAR WEIGHT: 492,5 g/mole



please inquire!

GBB1555 Irbesartan-N-beta-D-glucuronide

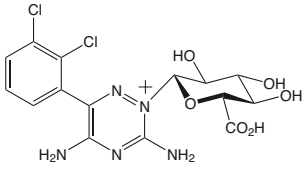
Irbesartan-N-beta-D-glucuronide
CAS-NO: 160205-58-3
FORMULA: $C_{31}H_{36}N_6O_7$
MOLECULAR WEIGHT: 604,65 g/mole



please inquire!

GBB1560 Lamotrigine-N-2-beta-D-glucuronide

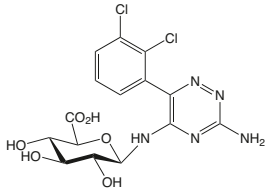
Lamotrigine-N-2-beta-D-glucuronide
CAS-NO: 133310-19-7
FORMULA: $C_{15}H_{16}Cl_2N_5O_6$
MOLECULAR WEIGHT: 433,22 g/mole



GBB1560.0001	1 mg	€ 425,00
GBB1560.0005	5 mg	€ 1600,00
GBB1560.0010	10 mg	€ 2750,00

GBB1565 Lamotrigine-N-5-beta-D-glucuronide

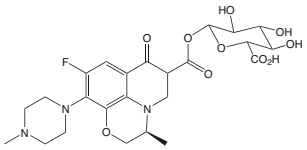
Lamotrigine-N-5-beta-D-glucuronide
CAS-NO: 136565-77-0
FORMULA: $C_{15}H_{15}Cl_2N_5O_6$
MOLECULAR WEIGHT: 432,22 g/mole



please inquire!

GBB1585 Levofloxacin acyl-beta-D-glucuronide

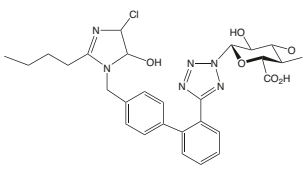
Levofloxacin acyl-beta-D-glucuronide
CAS-NO: 160962-46-9
FORMULA: $C_{24}H_{28}FN_3O_{10}$
MOLECULAR WEIGHT: 537,49 g/mole



please inquire!

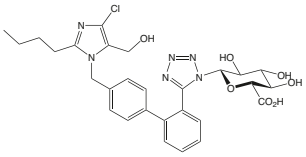
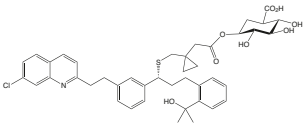
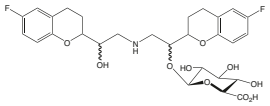
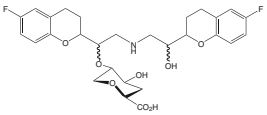
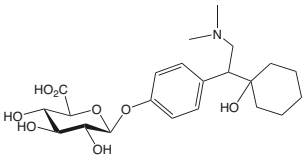
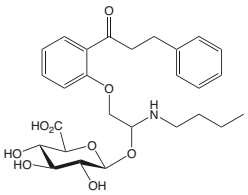
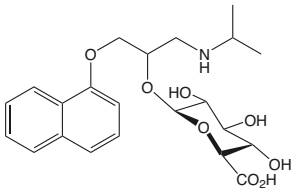
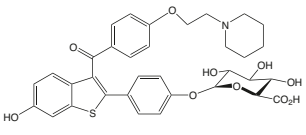
GBB1570 Losartan-N-beta-D-glucuronide

Losartan-N-beta-D-glucuronide
CAS-NO: 138584-35-7
FORMULA: $C_{28}H_{31}ClN_6O_7$
MOLECULAR WEIGHT: 599,03 g/mole



GBB1570.0001	1 mg	€ 295,00
GBB1570.0002	2 mg	€ 475,00
GBB1570.0005	5 mg	€ 1100,00
GBB1570.0010	10 mg	€ 1500,00

Prices are in EUR, net, exw Germany

	Article No.	Quantity	Price
GBB1572 Losartan-N1-beta-D-glucuronide	GBB1572.0001	1 mg	€ 295,00
Losartan-N_1-beta-D-glucuronide FORMULA: $C_{28}H_{31}ClN_6O_7$ MOLECULAR WEIGHT: 599,03 g/mole	GBB1572.0002	2 mg	€ 475,00
	GBB1572.0005	5 mg	€ 1100,00
	GBB1572.0010	10 mg	€ 1500,00
GBB1590 Montelukast acyl-beta-D-glucuronide	please inquire!		
Montelukast acyl-beta-D-glucuronide FORMULA: $C_{41}H_{44}ClNO_9S$ MOLECULAR WEIGHT: 672,31 g/mole			
			
GBB1620 Nebivolol-O-glucuronide (mixture of 2 and 4 diasteromers)	please inquire!		
Nebivolol-O-glucuronide (mixture of 2 and 4 diasteromers) FORMULA: $C_{28}H_{33}F_2NO_{10}$ MOLECULAR WEIGHT: 581,56 g/mole			
			
			
GBB1660 O-Desmethyl venlafaxine-beta-D-glucuronide	please inquire!		
O-Desmethyl venlafaxine-beta-D-glucuronide CAS-NO: 1021933-98-1 FORMULA: $C_{22}H_{33}NO_8$ MOLECULAR WEIGHT: 439,5 g/mole			
			
GBB1625 Propafenone-O-beta-D-glucuronide	please inquire!		
Propafenone-O-beta-D-glucuronide FORMULA: $C_{27}H_{35}NO_9$ MOLECULAR WEIGHT: 517,57 g/mole			
			
GBB1630 Propranolol-O-beta-D-glucuronide	please inquire!		
Propranolol-O-beta-D-glucuronide CAS-NO: 66322-66-5 FORMULA: $C_{22}H_{29}NO_8$ MOLECULAR WEIGHT: 435,47 g/mole			
			
GBB1635 Raloxifene 4'-beta-D-glucuronide	please inquire!		
Raloxifene 4'-beta-D-glucuronide CAS-NO: 182507-22-8 FORMULA: $C_{34}H_{35}NO_{10}S$ MOLECULAR WEIGHT: 649,71 g/mole			
			

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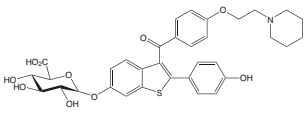
	Article No.	Quantity	Price

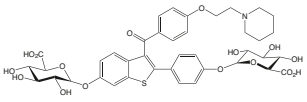
GBB1640 Raloxifene 6-beta-D-glucuronide



Raloxifene 6-beta-D-glucuronide
CAS-NO: 174264-50-7
FORMULA: $C_{34}H_{35}NO_{10}S$
MOLECULAR WEIGHT: 649,71 g/mole

please inquire!

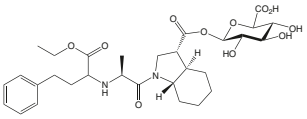
GBB1645 Raloxifene 4',6-bis-beta-D-glucuronide



Raloxifene 6-beta-D-glucuronide
CAS-NO: 182507-20-6
FORMULA: $C_{40}H_{43}NO_{16}S$
MOLECULAR WEIGHT: 825,83 g/mole

please inquire!

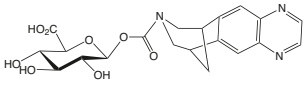
GBB1595 Trandolapril acyl-beta-D-glucuronide



Trandolapril acyl -beta-D-glucuronide
CAS-NO: 87679-37-6
FORMULA: $C_{30}H_{42}N_2O_{11}$
MOLECULAR WEIGHT: 606,66 g/mole

please inquire!

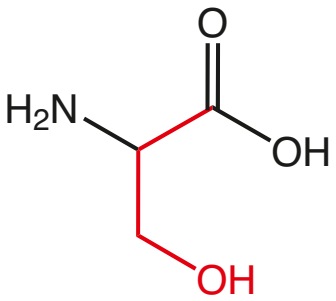
GBB1600 Varenicline-N-carbamoyl-O-beta-D-glucuronide



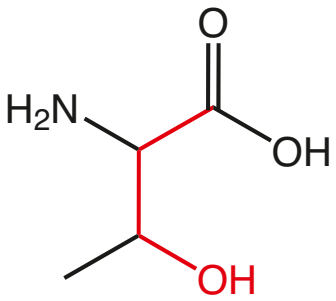
Varenicline-N-carbamoyl-O-beta-D-glucuronide
CAS-NO: 535920-98-0
FORMULA: $C_{20}H_{21}N_3O_8$
MOLECULAR WEIGHT: 431,4 g/mole

GBB1600.0001	1 mg	€ 450,00
GBB1600.0005	5 mg	€ 925,00
GBB1600.0010	10 mg	€ 1550,00

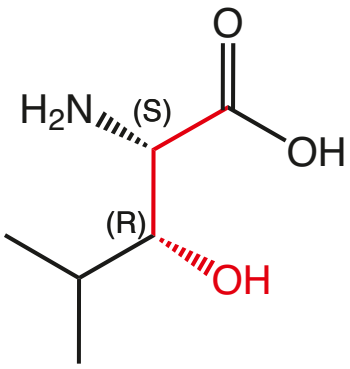
Amino Acid Analogues for Peptidomimetics and Medicinal Chemistry.



serine



threonine



3-hydroxy-leucine
HAA1650

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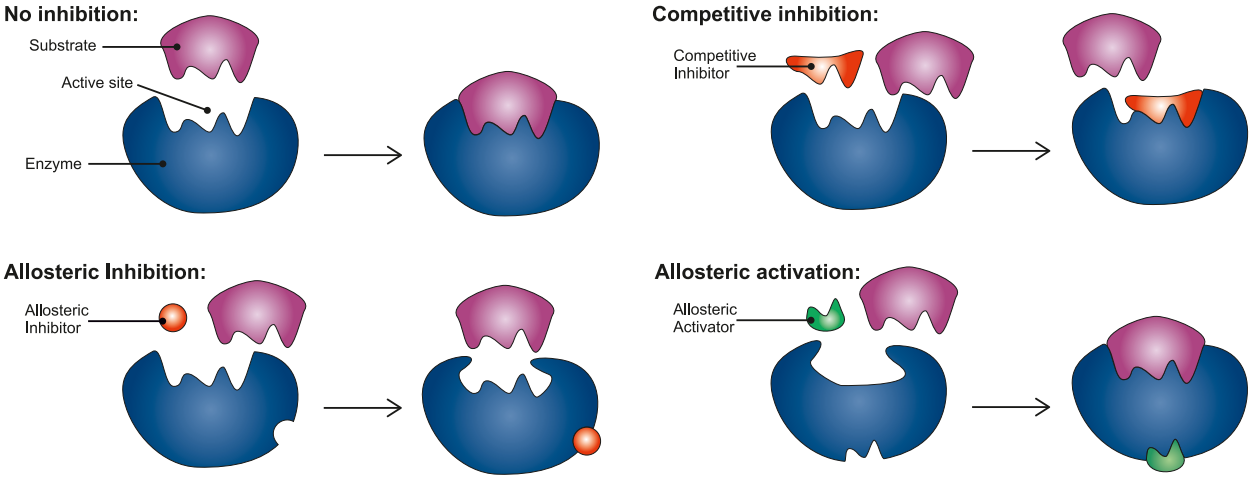
5. Inhibitors

Enzyme inhibitors are molecules that decrease enzyme activity. While competitive inhibitors prevent the substrate from binding by occupying the enzyme's substrate binding site, non-competitive inhibition is a form of mixed inhibition where the binding of the inhibitor to the enzyme reduces its activity, but does not directly affect the binding of substrates. Enzyme inhibitors can be used to study the function of specific enzymes, diseases or metabolic or regulatory pathways.

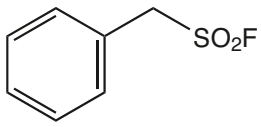
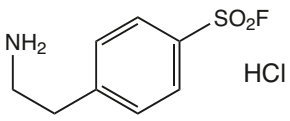


5.1. Protease Inhibitors

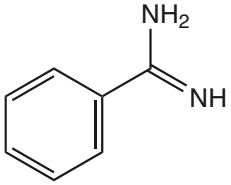
Protease inhibitors are used for two major purposes:

1. To prevent protein degradation during protein isolation.
2. To study proteolysis in cells.

Probably one of the most important protease inhibitors is phenylmethylsulfonyl fluoride (PMSF). PMSF is a serine protease inhibitor that irreversibly inhibits serine proteases by sulfonylation of the serine residue in the active site of the protease. It is widely used in protocols for the isolation of proteins.

		Article No.	Quantity	Price
LS-3400 PMSF Phenylmethanesulfonyl fluoride CAS-NO: 329-98-6 FORMULA: $C_7H_7FO_2S$ MOLECULAR WEIGHT: 174,19 g/mole		LS-3400.0010	10 g	€ 150,00
		LS-3400.0025	25 g	€ 200,00
		LS-3400.0100	100 g	€ 300,00
		LS-3400.0250	250 g	€ 550,00
LS-3355 AEBSF*HCl 4-(2-Aminoethyl)-benzenesulfonylfluoride hydrochloride CAS-NO: 30827-99-7 FORMULA: $C_8H_{10}FNO_2S*HCl$ MOLECULAR WEIGHT: 203,23*36,45 g/mole		LS-3355.0005	0,5 g	€ 175,00
		LS-3355.0050	5 g	€ 325,00
		LS-3355.0100	10 g	€ 475,00

AEBSF is also an irreversible serine protease inhibitor. It has been shown to inhibit trypsin, chymotrypsin, plasmin kallikrein and thrombin. It inhibits by acylating the active site of the enzyme. As an alternative to PMSF, AEBSF offers lower toxicity, improved solubility in water and improved stability in aqueous solutions. AEBSF has been used in cell culture in concentrations of up to 0.25 mM. Aqueous solutions are stable between pH 5 and 6; limited stability above pH 7.5.

		Article No.	Quantity	Price
LS-3360 Benzamidine*HCl*H2O Benzenecarboximidamide hydrochloride monohydrate CAS-NO: 1670-14-0 FORMULA: $C_7H_8N_2*HCl*H_2O$ MOLECULAR WEIGHT: 120,15*36,45*18,01 g/mole		LS-3360.0100	100 g	€ 125,00
		LS-3360.0250	250 g	€ 175,00
		LS-3360.0500	500 g	€ 225,00
		LS-3360.1000	1 kg	€ 375,00

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Benzamidine-HCl is a reversible inhibitor of the serine proteases thrombin, plasmin and trypsin. Typically 1 mM is used for general protease inhibition. Benzamidine linked to sepharose is used for affinity chromatography of serine proteases.

PMSF, AEBSF and benzamidine are examples for protease inhibitors that are part of many isolation buffers in protein isolation protocols.

References:

- Turini P. *et al.*, The action of phenylmethylsulfonyl fluoride on human acetylcholinesterase, chymotyrpsin and trypsin. *J. Pharmacol. Exp. Ther.* 1969; **167(1)**: 98-104.
- Baker B.R., Cory M., Irreversible enzyme inhibitors. 180. Irreversible inhibitors of the C'1a component of complement derived from m-(phenoxypropoxy)benzamidine and phenoxyacetamide. *J. Med. Chem.* 1971; **14(2)**: 119-25.
- Markwardt F. *et al.*, Synthetic low molecular weight inhibitors of serum kallikrein. Biochem. Pharmacol. 1974; **23(16)**, 2247-56.
- Lunn G., Sansone E.B., Degradation and disposal of some enzyme inhibitors. Scientific note. *Appl. Biochem. Biotechnol.* 1994; **48(2)**: 57-9.
- Jeffcoate S.L., White N., Use of benzamidine to prevent the destruction of thyrotropin-releasing hormone (TRH) by blood. *J. Clin. Endocrinol. Metab.* 1974; **38(1)**: 155-7.
- Deutscher M.P., Maintaining protein stability. *Methods Enzymol.* 1990; **182**: 83-9.

5.2. Protein Kinase Inhibitors

Protein kinases are enzymes that transfer phosphate groups from high-energy donors (typically nucleoside triphosphates) to surface exposed serine, threonine, tyrosine or histidine side chains of other proteins and thus alter their biological properties. There are more than 500 different protein kinases in the human proteome involved in regulatory pathways. They control metabolism, gene expression, hormone response, cell growth and many others. Therefore these kinases are also involved in emergence or fighting of various diseases such as cancer. For this reason, inhibitors that block particular protein kinases are invaluable tools for the investigation of regulatory pathways and diseases and of course especially for therapy.

		Article No.	Quantity	Price
LS-1370	**Arachidoyl-DL-carnitine chloride** Eicosanoyl-DL-carnitine chloride CAS-NO: 149116-07-4 FORMULA: $C_{27}H_{54}NO_4Cl$ MOLECULAR WEIGHT: 492,19 g/mole	LS-1370.0250	250 mg	€ 550,00
LS-3320	**Palmitoyl-DL-carnitine chloride** 3-Carboxy-N,N,N-trimethyl-2-(palmitoyloxy)propan-1-aminium chloride CAS-NO: 6865-14-1 FORMULA: $C_{23}H_{46}ClNO_4$ MOLECULAR WEIGHT: 436,07 g/mole	LS-3320.0100 LS-3320.2000 LS-3320.9010	100 mg 2 g 10 g	€ 150,00 € 575,00 € 900,00
LS-3345	**Palmitoyl-L-carnitine chloride** (R)-3-Carboxy-N,N,N-trimethyl-2-(palmitoyloxy)propan-1-aminium chloride CAS-NO: 18877-64-0 FORMULA: $C_{23}H_{46}ClNO_4$ MOLECULAR WEIGHT: 436,07 g/mole	LS-3345.0500 LS-3345.1000 LS-3345.2500	500 mg 1 g 2,5 g	€ 675,00 € 1200,00 € 2400,00

Palmitoyl-L-carnitine and palmitoyl-DL-carnitine are specific inhibitors of protein kinase C which has various calcium-dependent effects in mammalia.

References:

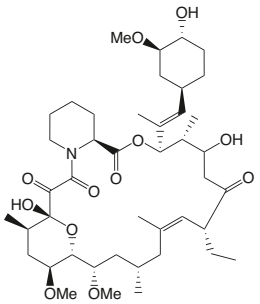
- Nakadate T., Blumberg P.M., Modulation by palmitoylcarnitine of protein kinase C activation. *Cancer Res.* 1987; **47(24 Pt 1)**: 6537-42.
- Xiao C.Y. *et al.*, Palmitoyl-L-carnitine modifies the myocardial levels of high-energy phosphates and free fatty acids. *Basic Res. Cardiol.* 1997; **92(5)**: 320-30.

Prices are in EUR, net, exw Germany

Article No.	Quantity	Price

LS-1012 Ascomycin

Ascomycin
CAS-NO: 104987-12-4 and 11011-38-4
FORMULA: $C_{43}H_{69}NO_{12}$
MOLECULAR WEIGHT: 792,03 g/mole



please inquire!

Acomycin is a strong immunosuppressant that inhibits allogenic T-lymphocyte proliferation. It binds with high affinity to FKBP and inhibits calcineurin phosphatase in the nM range; ethyl analog of FK506.

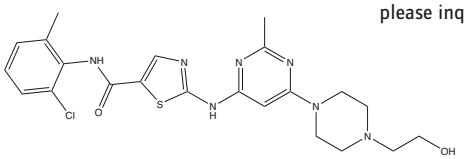
Reference:

- Paul C. *et al.*, Ascomycins: promising agents for the treatment of inflammatory skin diseases. *Expert Opin. Investig. Drugs* 2000; **9(1)**: 69-77.

Article No.	Quantity	Price

LS-1203 Dasatinib

N-(2-chloro-6-methylphenyl)-2-(6-(4-(2-hydroxyethyl)piperazin-1-yl)-2-methylpyrimidin-4-ylamino)thiazole-5-carboxamide
CAS-NO: 302962-49-8
FORMULA: $C_{22}H_{26}ClN_7O_2S$
MOLECULAR WEIGHT: 488,01 g/mole



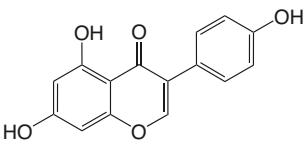
please inquire!

Dasatinib is a tyrosine kinase inhibitor of Src and Bcr/Abl. Dasatinib inhibits as well Lyn and Src kinase activities *in vitro*. It is the API in the drug sold under the trade name Sprycel®.

Article No.	Quantity	Price

LS-1032 Genistein

4',5,7-Trihydroxyisoflavone
CAS-NO: 446-72-0
FORMULA: $C_{15}H_{10}O_5$
MOLECULAR WEIGHT: 270,24 g/mole



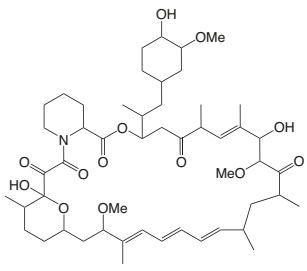
LS-1032.0500	500 mg	€ 125,00
LS-1032.1000	1 g	€ 175,00
LS-1032.2000	2 g	€ 250,00

Genistein is an isoflavone with anticancer, antiproliferation, and chemopreventive effects. It induces cell differentiation. Genistein inhibits protein histidine kinase.

Article No.	Quantity	Price

LS-1056 Rapamycin

Rapamycin, RAPA, Rapamune, Sirolimus, RPM
CAS-NO: 53123-88-9
FORMULA: $C_{51}H_{79}NO_{13}$
MOLECULAR WEIGHT: 914,2 g/mole



please inquire!

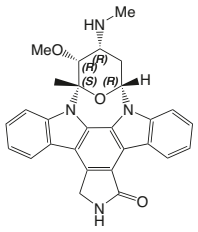
Rapamycin is an immunosuppressant drug that prevents rejection of transplanted organs and is used in the coating of DES (drug eluting stents). It binds the cytosolic protein FKBP12. The Rapamycin-FKBP12 complex inhibits the Ser/Thr-proteinkinase mTOR (mammalian target of rapamycin) and thus blocks several cytokine mediated signal transduction pathways.

Prices are in EUR, net, exw Germany

Article No.	Quantity	Price

LS-1061 Staurosporine

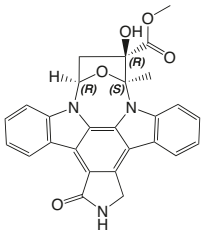
Staurosporine, Antibiotic AM-2282
CAS-NO: 62996-74-1
FORMULA: $C_{28}H_{26}N_4O_3$
MOLECULAR WEIGHT: 466,54 g/mole



please inquire!

LS-1034 K-252a

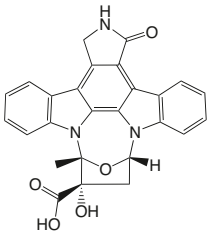
(+)-K-252a (9S,10R,12R)-2,3,9,10,11,12-Hexahydro-10-hydroxy-9-methyl-1-oxo-9,12-epoxy-1H-diindolo[1,2,3-fg:3',2',1'-kl]pyrrolo[3,4-i][1,6]benzodiazocine-10-carboxylic acid methyl ester
CAS-NO: 99533-80-9
FORMULA: $C_{27}H_{21}N_3O_5$
MOLECULAR WEIGHT: 467,49 g/mole



please inquire!

LS-1035 K-252b

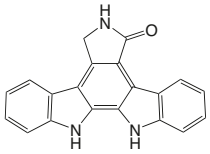
K-252b
CAS-NO: 99570-78-2
FORMULA: $C_{26}H_{19}N_3O_5$
MOLECULAR WEIGHT: 453,46 g/mole



please inquire!

LS-1085 K-252c

K-252c
CAS-NO: 85753-43-1
FORMULA: $C_{20}H_{13}N_3O$
MOLECULAR WEIGHT: 311,34 g/mole



please inquire!

K-252s are a family of staurosporine-like compounds, which are general and potent inhibitors of various protein kinases, possibly acting by interfering at or near the ATP binding site.

K-252a is a potent inhibitor of various protein kinases including protein kinase A, C and G.

K-252b is a non-selective protein kinase inhibitor, ecto-protein kinase inhibitor and PKC inhibitor.

K-252c is a cell permeable protein kinase inhibitor active at submicromolar concentrations.

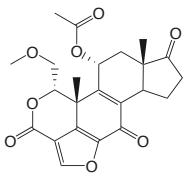
References:

- Knüsel, B., Hefti, F., K-252 Compounds: Modulators of Neurotrophin Signal Transduction. *J. Neurochem.* 1992; **59 (6)**: 1987-96.
- Horton, P.A. *et al.*, Staurosporine aglycone (K252-c) and arcyriaflavin A from the marine ascidian, Eudistoma sp.. *Experientia.* 1994; **50(9)**: 843-5.

Article No.	Quantity	Price

LS-1068 Wortmannin

Wortmannin
CAS-NO: 19545-26-7
FORMULA: $C_{23}H_{24}O_8$
MOLECULAR WEIGHT: 428,44 g/mole



please inquire!

Wortmannin is a specific inhibitor of phosphoinositide-3-kinases (PI3Ks) with an IC_{50} of around 5 nM and can also inhibit other PI3K-related enzymes such as mTOR, DNA-PK, MIcK and MapK.

References:

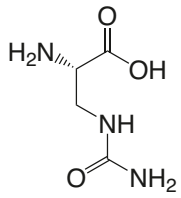
- Powis, G. *et al.*, Wortmannin, a potent and selective inhibitor of phosphatidylinositol-3-kinase. *Cancer Res.* 1994; **54(9)**: 2419-23.
- Vanhaesebroeck, B. *et al.*, Synthesis and function of 3-phosphorylated inositol lipids. *Annu Rev Biochem.* 2001; **70**: 535-602.

Prices are in EUR, net, exw Germany

5.3. L-Albizziine

HAA8150 L-Albizziine

H-beta-Ureido-Ala-OH, 2-Amino-3-ureido-L-propionic acid, 98%
CAS-NO: 1483-07-4
FORMULA: $C_4H_9N_3O_3$
MOLECULAR WEIGHT: 147,13 g/mole



Article No.	Quantity	Price
HAA8150.0100	100 mg	€ 175,00
HAA8150.0250	250 mg	€ 200,00
HAA8150.1000	1 g	€ 300,00
HAA8150.5000	5 g	€ 890,00

Albizziine acts as a competitive inhibitor of asparagine synthetase with respect to glutamine in mammalian cells. It acts also as an inhibitor of glutamate synthase in ectomycorrhizal fungal isolates and inhibitor of glutamine metabolism in microbes.

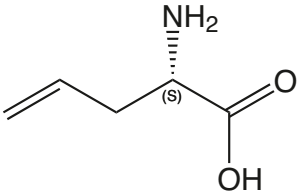
References:

- Andrulis I.L. *et al.*, Characterization of single step albizziin-resistant Chinese hamster ovary cell lines with elevated levels of asparagine synthetase activity. *J. Biol. Chem.* 1985; **260**: 7523-7
- Dura M.A. *et al.*, Purification and characterisation of a glutaminase from Debaryomyces spp. *Int. J. Food Microbiol.* 2002; **76**: 117-26.
- Schroeder D.D. *et al.*, Biosynthesis of the purines. XXXII. Effect of albizziin and other reagents on the activity of formylglycinamide ribonucleotide amidotransferase. *J. Biol. Chem.* 1969; **244**: 5856-65.

5.4. Allylglycine

HAA7320 H-L-AllylGly-OH

(S)-Allylglycine, (S)-2-Aminopent-4-enoic acid, 4,5-Dehydro-L-norleucine (>98%, >99%ee)
CAS-NO: 16338-48-0
FORMULA: $C_5H_9NO_2$
MOLECULAR WEIGHT: 115,13 g/mole



Article No.	Quantity	Price
HAA7320.0001	1 g	€ 200,00
HAA7320.0005	5 g	€ 720,00

Allylglycine is a glycine derivative. It is an inhibitor of the enzyme glutamate decarboxylase. Inhibition of glutamate decarboxylase blocks GABA biosynthesis, leading to lower levels of the neurotransmitter. It is used to induce convulsions in animals in scientific studies.

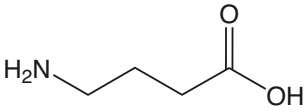
References:

- Abshire V.M. *et al.*, Injection of L-allylglycine into the posterior hypothalamus in rats causes decreases in local GABA which correlate with increases in heart rate. *Neuropharmacology* 1988; **27(11)**: 1171-7. doi:10.1016/0028-3908(88)90013-5. PMID 3205383.
- Sajdyk T. *et al.*, Chronic inhibition of GABA synthesis in the bed nucleus of the stria terminalis elicits anxiety-like behavior. *J. Psychopharmacol. (Oxford)* 2008; **22 (6)**: 633-41. doi:10.1177/0269881107082902. PMID 18308797.

5.5. GABA

HAA1061 H-GABA-OH

4-Aminobutanoic Acid, gamma-Amino-n-butyric acid, Piperidic acid
CAS-NO: 56-12-2
FORMULA: $C_4H_9NO_2$
MOLECULAR WEIGHT: 103,12 g/mole



Article No.	Quantity	Price
		please inquire!

GABA is the major inhibitory neurotransmitter in brain; GABAA and GABAB receptor agonist.

Reference:

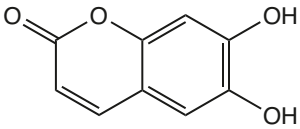
- Curtis D.R. *et al.*, GABA, bicuculline and central inhibition. *Nature* 1970; **226**: 1222-4.

Prices are in EUR, net, exw Germany

5.6. Lipoxygenase Inhibitor

LS-3395 Esculetin

6,7-Dihydroxycoumarin
CAS-NO: 305-01-1
FORMULA: $C_9H_6O_4$
MOLECULAR WEIGHT: 178,14 g/mole

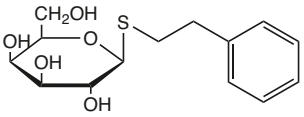


Article No.	Quantity	Price
LS-3395.0025	25 g	€ 150,00
LS-3395.0050	50 g	€ 200,00
LS-3395.0100	100 g	€ 250,00
LS-3395.0250	250 g	€ 500,00
LS-3395.0500	500 g	€ 900,00

5.7. PETG

GBB1710 PETG

Phenylethyl-beta-D-thiogalactopyranoside
CAS-NO: 63407-54-5
FORMULA: $C_{14}H_{20}O_5S$
MOLECULAR WEIGHT: 300,38 g/mole



Article No.	Quantity	Price
GBB1710.0001	1 g	€ 295,00
GBB1710.0010	10 g	€ 1350,00

PETG is a cell-permeant competitive reversible inhibitor of of beta-galactosidase activity. It is used in reporter gene expression assay (*E.coli lacZ*) for stopping the reaction.

PETG is also used in flow cytometric analysis and sorting of viable eukaryotic cells expressing *lacZ* reporter gene constructs (FACS-Gal).

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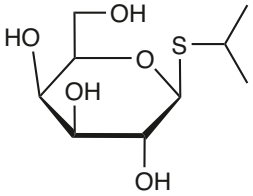
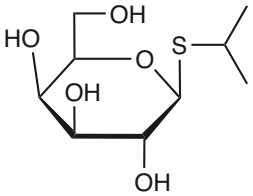
6. Inducers

Inducers are substances that positively regulate the expression of one or several genes. Either they bind to a repressor molecule which then can no longer bind to a gene's operator sequence or they bind to an activator molecule which then can bind better to the activation sequence.

Induction is very common in metabolic pathways that are not permanently in use. Once a rare substrate is present, the genes coding for the metabolic enzymes to degrade this substrate have to be expressed. Typically, the substrate itself is the inducer molecule for the expression of these genes. Once the newly generated metabolic enzymes have degraded the substrate molecules, the activation signal is switched off again due to the absence of inducer.

Artificial inducers that mimic natural substrates but cannot be degraded by the induced methabolic pathway are called "gratuitous" inducers. They avoid the later "turn off" of the activation signal.

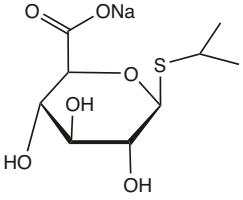
6.1. IPTG and IPTGlcA

		Article No.	Quantity	Price
GBB1230	**IPTG (Dioxane free)**			
Isopropyl-beta-D-thiogalactopyranoside, dioxane free, 99% CAS-NO: 367-93-1 FORMULA: $C_9H_{18}O_5S$ MOLECULAR WEIGHT: 238,3 g/mole		GBB1230.0005	5 g	€ 150,00
GBB1343	**IPTG (dioxane grade)**			
Isopropyl-beta-D-thiogalactopyranoside (max. 5ppm dioxane), 99% CAS-NO: 367-93-1 FORMULA: $C_9H_{18}O_5S$ MOLECULAR WEIGHT: 238,3 g/mole		GBB1343.0025 GBB1343.0100	25 g 100 g	€ 200,00 € 250,00

IPTG is a gratuitous beta-D-galactosidase inducer. In *Escherichia coli* IPTG functions by binding to the *lac* repressor LacI and altering its conformation. This inactivation prevents the repressor from binding to the operator of the *lac* operon and thus ends the repression of the beta-galactosidase coding gene *lacZ*. IPTG is a commonly used reagent in cloning procedures that require induction of beta-galactosidase activity or induction of expression of many other recombinant genes that can be cloned under the control of the *lac* operator sequence.

References:

- Ausubel F.M. *et al.*, Current Protocols in Molecular Biology. *Massachusetts General Hospital & Harvard Medical School*, 1994; 1'4'3. 16'2'3. 1'15'1.
- Sambrook J. *et al.*, Molecular Cloning. *Cold Spring Harbor Laboratory Press NY*, 1989.
- Silhavy T.J., Beckwith J., Genetic analysis of protein export in Escherichia coli. *Methods Enzymol.* 1983; **97**: 3-11.

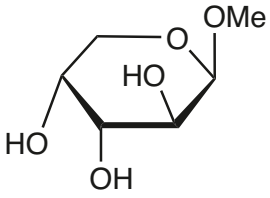
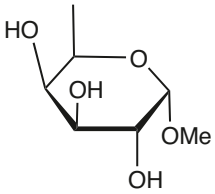
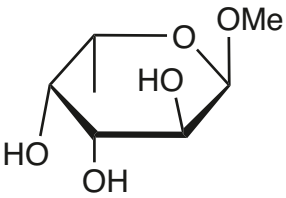
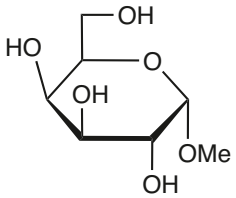
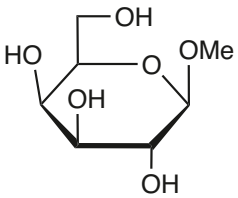
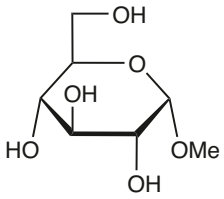
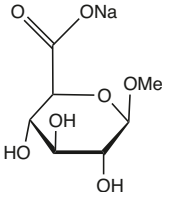
		Article No.	Quantity	Price
GBB1231	**IPTGlcA*Na**			
Isopropyl-beta-D-thioglucuronic acid sodium salt, 98% CAS-NO: 208589-93-9 FORMULA: $C_9H_{15}O_6SNa$ MOLECULAR WEIGHT: 274,27 g/mole		GBB1231.0100 GBB1231.0500	100 mg 500 mg	€ 220,00 € 540,00

Isopropyl-beta-D-thioglucuronic acid is a gratuitous inducer of beta-glucuronidase and it very effectively enhances the sensitivity of beta-glucuronidase assays in *E. coli*.

Prices are in EUR, net, exw Germany

6.2. 1-O-Methyl-Glycosides

Many 1-O-Methyl-Gycosides are weak substrates but effective inducers of the according glycosidases. OMe-α-D-Glc (GBB1251) is furthermore used as an inhibitor of lectin-conjugate binding or for eluting glycoproteins or other glycoconjugates from columns of agarose lectins.

		Article No.	Quantity	Price
GBB1144 Methyl-beta-D-Ara Methyl-beta-D-arabinopyranoside CAS-NO: 5328-63-2 FORMULA: $C_6H_{12}O_6$ MOLECULAR WEIGHT: 164,16 g/mole		GBB1144.0005	5 g	€ 250,00
GBB1176 1-OMe-alpha-D-Fuc Methyl-6-deoxy-alpha-D-galactopyranoside CAS-NO: 1128-40-1 FORMULA: $C_7H_{14}O_5$ MOLECULAR WEIGHT: 178,19 g/mole		GBB1176.0500 GBB1176.0001 GBB1176.0005	500 mg 1 g 5 g	€ 185,00 € 275,00 € 900,00
GBB1178 1-OMe-alpha-L-Fuc Methyl-6-deoxy-alpha-L-galactopyranoside CAS-NO: 14687-15-1 FORMULA: $C_7H_{14}O_5$ MOLECULAR WEIGHT: 178,19 g/mole		GBB1178.0001 GBB1178.0002	1 g 2 g	€ 175,00 € 275,00
GBB1119 1-OMe-alpha-D-Gal 1-O-Methyl-alpha-D-galactopyranoside, 98% CAS-NO: 3396-99-4 FORMULA: $C_7H_{14}O_6$ MOLECULAR WEIGHT: 194,19 g/mole		GBB1119.0025 GBB1119.0100 GBB1119.0250 GBB1119.0500 GBB1119.1000	25 g 100 g 250 g 500 g 1 kg	€ 200,00 € 290,00 € 580,00 € 1010,00 € 1720,00
GBB1120 1-OMe-beta-D-Gal 1-O-Methyl-beta-D-galactopyranoside, 98% CAS-NO: 1824-94-8 FORMULA: $C_7H_{14}O_6$ MOLECULAR WEIGHT: 194,19 g/mole		GBB1120.0005 GBB1120.0025	5 g 25 g	€ 125,00 € 175,00
GBB1251 1-OMe-alpha-D-Glu 1-O-Methyl-alpha-D-glucopyranoside, 99% CAS-NO: 97-30-3 FORMULA: $C_7H_{14}O_6$ MOLECULAR WEIGHT: 194,19 g/mole		GBB1251.0250 GBB1251.0500	250 g 500 g	€ 150,00 € 200,00
GBB1254 1-OMe-beta-D-GlcUA*Na 1-O-Methyl-beta-D-glucuronic acid, sodium salt, 99% CAS-NO: 134253-42-2 FORMULA: $C_7H_{11}O_7Na$ MOLECULAR WEIGHT: 230,15 g/mole		GBB1254.0001 GBB1254.0010 GBB1254.0050 GBB1254.0100	1 g 10 g 50 g 100 g	€ 200,00 € 470,00 € 1300,00 € 1970,00

Prices are in EUR, net, exw Germany

	Article No.	Quantity	Price
GBB1252 1-OMe-alpha-D-Xyl 1-O-Methyl-alpha-D-xylopyranoside, 98% CAS-NO: 91-09-8 FORMULA: $C_6H_{12}O_5$ MOLECULAR WEIGHT: 164,16 g/mole	GBB1252.0005	5 g	€ 175,00
	GBB1252.0025	25 g	€ 270,00
GBB1255 1-OMe-beta-D-Xyl 1-O-Methyl-beta-D-xylopyranoside, 98% CAS-NO: 612-05-5 FORMULA: $C_6H_{12}O_5$ MOLECULAR WEIGHT: 164,16 g/mole	GBB1255.0010	10 g	€ 175,00
	GBB1255.0025	25 g	€ 300,00
	GBB1255.0100	100 g	€ 1000,00

References:

- Florez I.G., *et al*.., The specificity of induction of alpha-galactosidase from Saccharomyces carlsbergensis. *Biochim. Biophys. Acta* 1981; **674**: 71-7.
- Biely P., Petrakova E., Novel inducers of the xylan-degrading enzyme system of Cryptococcus albidus. *J. Bacteriol.* 1984; **160(1)**: 408-12.
- Russell W.M., Klaenhammer T.R., Identification and cloning of gusA, encoding a new beta-glucuronidase from Lactobacillus gasseri ADH. *Appl. Environ. Microbiol.* 2001; **67**: 1253-61.

Amino Acid Analogues for Peptidomimetics and Medicinal Chemistry.

Amidino-Glycine
BAA6380

Amino-guanidino propionic acid
FAA1772

Amino-guanidino butyric acid
FAA6160

Arginine

4-(guanidino)methyl cyclohexane carboxylic acid
BAA1790

4-(guanidino)cyclohexane carboxylic acid
BAA6380

2-(2-(amidino)ethoxy) acetic acid
BAA6070

2-(2-(2-(amidino)ethoxy) ethoxy)acetic acid
BAA6080

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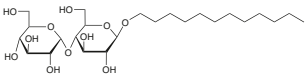
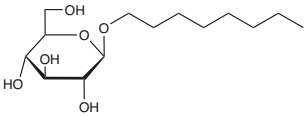
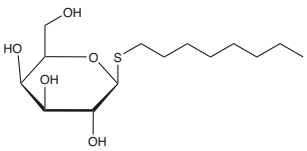
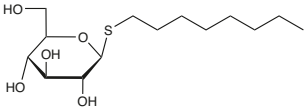
7. Non-Ionic Carbohydrate Based Detergents

Alkyl-Glycosides in different combinations can be used as non-ionic detergents for the isolation and solubilization of membrane proteins in their native state. Some of them are able to increase the resolution of proteins in proteomics analysis. They are stable in aqueous solution and can easily be removed by dialysis.

		Article No.	Quantity	Price
GBB1350 DDM n-Dodecyl-beta-D-maltoside, Lauryl maltoside, Lauryl-beta-D-maltoside, Lauryl-beta-D-maltopyranoside CAS-NO: 69227-93-6 FORMULA: $C_{24}H_{46}O_{11}$ MOLECULAR WEIGHT: 510,63 g/mole		GBB1350.0005 GBB1350.0025	5 g 25 g	€ 330,00 € 1100,00
GBB1351 Oct-beta-D-Glc n-Octyl-beta-D-glucopyranoside ultra-pure, 98% CAS-NO: 29836-26-8 FORMULA: $C_{14}H_{28}O_6$ MOLECULAR WEIGHT: 292,38 g/mole		GBB1351.0005 GBB1351.0010 GBB1351.0025	5 g 10 g 25 g	€ 200,00 € 225,00 € 300,00
GBB1352 Oct-beta-D-S-Gal n-Octyl-beta-D-thiogalactopyranoside CAS-NO: 42891-16-7 FORMULA: $C_{14}H_{28}O_5S$ MOLECULAR WEIGHT: 308,44 g/mole		GBB1352.9010	10 g	€ 320,00
GBB1353 Oct-beta-D-S-Glc n-Octyl-beta-D-thioglucopyranoside, 98% CAS-NO: 85618-21-9 FORMULA: $C_{14}H_{28}O_5S$ MOLECULAR WEIGHT: 308,44 g/mole		GBB1353.0010 GBB1353.0025	10 g 25 g	€ 225,00 € 325,00

References:

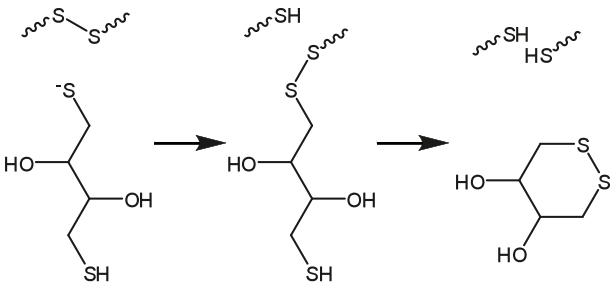
- Taylor R.M. *et al.*, Single-step immunoaffinity purification and characterization of dodecylmaltoside-solubilized human neutrophil flavocytochrome b. *Biochim. Biophys. Acta* 2003; **1612**: 65-75.
- Saito S., Tsuchiya T., Characteristics of n-octyl-beta-D-thioglucopyranoside, a new non-ionic detergent useful for membrane biochemistry. *Biochem. J.* 1984; **222**: 829-32.
- Tsuchiya T., Saito S., Use of N-octyl-beta-D-thioglucoside, a new nonionic detergent, for solubilization and reconstitution of membrane proteins. *J. Biochem.* 1984; **96**: 1593-7.
- Aveldano M.I. *et al.*, Solubilization of myelin membranes by detergents. *J. Neurochem.* 1991; **57**: 250-7.
- Fanger B.O., Adaptation of the Bradford protein assay to membrane-bound proteins by solubilizing in glucopyranoside detergents. *Anal. Biochem.* 1987; **162**: 11-7.
- Gould R.J. *et al.*, Effects of Octyl beta-glucoside on insulin binding to solubilized membrane receptors. *Biochemistry* 1981; **20**: 6776-81.
- Hallden G. *et al.*, A new membrane permeabilization method for the detection of intracellular antigens by flow cytometry. *J. Immunol. Methods* 1989; **124**: 103-9.
- Jackson M.L. *et al.*, Solubilization of phosphatidylcholine bilayers by octyl glucoside. *Biochemistry* 1982; **21**: 4576-82.
- Lopez M.F., Proteome analysis. I. Gene products are where the biological action is. *J. Chromatogr. B. Biomed. Sci. Appl.* 1999; **722**: 191-202.
- Mimms L.T. *et al.*, Phospholipid vesicle formation and transmembrane protein incorporation using octyl glucoside. *Biochemistry* 1981; **20**: 833-40.
- Yoshida M. *et al.*, Dissociation of the complex of dystrophin and its associated proteins into several unique groups by n-Octyl-beta-D-glucoside. *Eur. J. Biochem.* 1994; **222**: 1055-61.

Prices are in EUR, net, exw Germany

8. Sulfhydryl Reactive Reagents

8.1. Cleland's Reagent - DTT

Cleland's reagent, also known as **DL-Dithiothreitol** or **DTT** is a water soluble protective reagent for sulfhydryl groups. It reduces disulfide linkages to free sulfhydryl groups in proteins and enzymes. It is a component of buffers used in protocols for the isolation and purification of proteins. DTT is a very strong reducing agent, due to the property to form a six-membered ring with an internal disulfide bond in oxidized form. The redox potential is -0.33 V at pH 7. The pK_a values of the thiol groups are 9.2 and 10.1 respectively. The reduction of a typical disulfide bond proceeds by two sequential thiol-disulfide exchange reactions as illustrated below. The reducing power of DTT is limited to pH values above 7, since only the negatively charged thiolate form is the reactive agent in opening disulfide bonds.

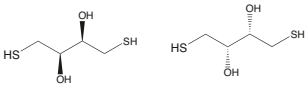


DTT is also used as a reducing agent for thiolated DNA. The terminal sulfurs of thiolated DNA have a tendency to oxidize and form dimers in solution, especially in the presence of oxygen. Dimerization significantly lowers the efficiency of subsequent coupling reactions such as DNA immobilization on gold surfaces in biosensors. Normally DTT is mixed with a DNA solution and allowed to react, and then is removed by filtration (solid catalyst) or by chromatography (liquid form).

DTT is frequently used to reduce the disulfide bonds of proteins and in order to prevent intramolecular (cyclization) and intermolecular (oligomerisation, polymerization) disulfide bonds from cysteine residues of proteins. However, DTT cannot reduce solvent-inaccessible disulfide bonds, so reduction of disulfide bonds is sometimes carried out under denaturing conditions (e.g., at high temperatures, or in the presence of strong denaturating agents such as 6 M guanidinium hydrochloride, 8 M urea, or 1% sodium dodecylsulfate). Conversely, the solvent exposure of different disulfide bonds can be assayed by their rate of reduction in the presence of DTT.

DTT can also be used as an oxidizing agent. Its inherent advantage is that effectively no mixed-disulfide species will be formed, which can occur with other agents such as glutathione.

	Article No.	Quantity	Price
RL-1020 DTT (racemic)	RL-1020.0025	25 g	€ 200,00
Cleland's Reagent, DL-Dithiothreitol, (2S,3S;2R,3R)-threo-1,4-Dimercapto-2,3-butandiol CAS-NO: 3483-12-3 FORMULA: $C_4H_{10}O_2S_2$ MOLECULAR WEIGHT: 154,25 g/mole	RL-1020.0100	100 g	€ 275,00



Our production process does not involve carcinogenic intermediates. It is therefore a safe process, taking care of the integrity of environment and of the health of all personnel involved in production and handling.

References:

- Cleland W.W., Dithiothreitol, A New Protective Reagent for SH Groups. *Biochemistry*; 1964; **3**: 480–2. doi:10.1021/bi00892a002.
- Ruegg U.T., Rudinger J., Cleavage of disulfide bonds in proteins; *Methods Enzymol.* 1977; **47**: 111.
- Bruckdorfer T., *et al.*, From Production of Peptides in Milligram Amounts for Research to Multi-Tons Quantities for Drugs of the Future. *Current Pharmaceutical Biotechnology* 2004; **5**: 29-43.

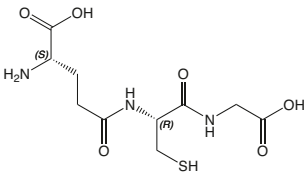
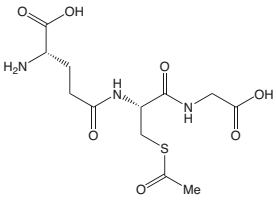
Bulk Quantities of DTT are under continuous production.

Ton lot quantities are available within short delivery time.

Prices are in EUR, net, exw Germany

8.2. Glutathion - GSH

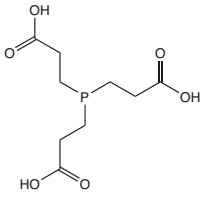
Glutathione is a tripeptide made up of the amino acids glutamic acid, cysteine, and glycine. The primary biological function of glutathione is to act as a non-enzymatic reducing agent to help keep cysteine thiol side chains in a reduced state on the surface of proteins. Glutathione is also used to prevent oxidative stress in most cells and helps to trap free radicals that can damage DNA and RNA. Affinity chromatography using glutathione-agarose permits rapid, mild, non-denaturing and highly selective purification of proteins containing glutathione binding sequences, such as glutathione S-transferase (GST), glutathione peroxidase and glyoxalase.

		Article No.	Quantity	Price
HAA7940 Glutathione reduced Gamma-L-Glutamyl-L-cysteinyl-glycine CAS-NO: 70-18-8 FORMULA: $C_{10}H_{17}N_3O_6S$ MOLECULAR WEIGHT: 307,32 g/mole		HAA7940.0025	25 g	€ 200,00
		HAA7940.0100	100 g	€ 275,00
		HAA7940.0250	250 g	€ 470,00
LS-1270 SAG S-Acetyl-Glutathione, S-Acetyl-gamma-L-glutamyl-L-cysteinyl-glycine CAS-NO: 5054-47-5 FORMULA: $C_{12}H_{19}N_3O_7S$ MOLECULAR WEIGHT: 349,36 g/mole		LS-1270.0005	5 g	€ 50,00
		LS-1270.0025	25 g	€ 200,00
		LS-1270.0100	100 g	€ 650,00

References:

- Simons P.C., Vander Jagt D.L., Purification of glutathione S-transferases from human liver by glutathione-affinity chromatography. *Anal. Biochem.* 1977; **82**: 334.
- Toribio F., Methods for purification of glutathione peroxidase and related enzymes. *J. Chromatogr.* 1996; **684**: 77.
- Simons P.C., Vander Jagt D.L., Purification of glutathione S-transferases by glutathione-affinity chromatography. *Methods Enzymol.* 1981; **77**: 235.
- Wu G. *et al.*, Glutathione metabolism and its implications for health. *J. Nutr.* 2004; **134**: 489-92.

8.3. TCEP

		Article No.	Quantity	Price
LS-3405 TCEP*HCl Tris-(2-carboxyethyl)phosphine hydrochloride salt CAS-NO: 51805-45-9 FORMULA: $C_9H_{15}O_6P$*HCl MOLECULAR WEIGHT: 250,19*36,45 g/mole		LS-3405.0005	5 g	€ 150,00
		LS-3405.0025	25 g	€ 200,00
		LS-3405.0100	100 g	€ 550,00

TCEP is a very effective reagent for cleaving disulfide bonds and has been applied to the cleavage of disulfide linkage patterns in peptides with tightly clustered cystines. Compared to thiol containing agents used for this purpose, TCEP has the advantage of being an odorless, more powerful reducing agent. It will not form mixed disulfides with the protein to be reduced, is more hydrophilic, more resistant to oxidation in air and does not reduce metals used in metal affinity chromatography.

TCEP is particularly useful when labeling cysteine residues with maleimides. Sulfur containing reducing agents like DTT or β-mercaptoethanol have to be removed before the labeling reaction as they would also react with the label. Yet, removal of DTT or β-mercaptoethanol is sometimes accompanied by air oxidation of the thiols back to the disulfides. TCEP can keep the cysteines from forming disulfide bonds and unlike DTT or β-mercaptoethanol, it will not react as readily with the maleimide.

References:

- Burns J. A. *et al.*, Selective reduction of disulfides by tris(2-carboxyethyl)phosphine. *J. Org. Chem.* 1991; **56**: 2648-2650.
- Ruegg U.T., Rudinger J., Reductive cleavage of cystine disulfides with tributylphosphine. *Methods Enzymol.* 1977; **47**: 111-116.
- Shafer D. E. *et al.* Reaction of Tris(2-carboxyethyl)phosphine (TCEP) with Maleimide and α-Haloacyl Groups: Anomalous Elution of TCEP by Gel Filtration. *Anal. Biochem.* 2002; **282(1)**: 161-164.

Prices are in EUR, net, exw Germany

9. Linking Reagents

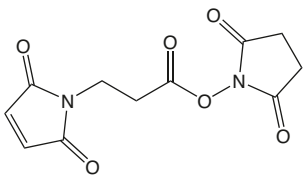
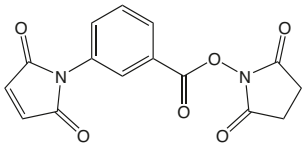
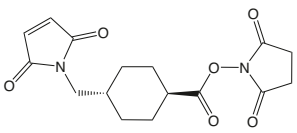
Cross-linking reagents are typically homo- or hetero-bifunctional molecules, thereby offering the possibility to connect target groups of different (bio-)molecules. Most cross-linkers are chemical reagents with functional groups such as maleimides, succinimidyl esters (NHS esters) or iodoacetamides. Others (like ATFBA) need photoactivation by light. A selection of typical functional groups used for cross-linking is given in the table of chapter 9.2.. Cross-linking can be performed between two big biopolymers (e.g. proteins like enzymes, antibodies) or between a biopolymer and a smaller molecule (e.g. a dye, drug or peptide) yielding a stable conjugate that can be used in a broad range of applications such as diagnostic assays, research or medical therapy.

Homobifunctional cross-linkers carry two identical reactive groups that couple e.g. two amines, thiols, alcohols or acids within one molecule (thus stabilizing its structure) or between two molecules (thus covalently connecting them). When coupling different species with each other, these relatively non-specific reagents lead to a variety of different conjugates or even aggregates of high molecular weight. Especially linkers aiming at amines, acids or alcohols often lead to a multitude of results as these groups are found very frequently surface-exposed in proteins. On an average, cysteine residues are not as frequently present and thus the use of thiol specific linkers may lead to more defined results.

Conjugations that use hetero-bifunctional reagents can be more easily controlled so as to optimize the stoichiometry of the target molecules. Thus, heterobifunctional cross-linking reagents are very useful for preparing conjugates between two different biomolecules.

Conjugation can also be achieved non-covalently by using high affinity binding partners with low dissociation rates. Typical examples are the complex formations between biotin and avidin/streptavidin or between antibody and antigen. Yet, the different complex builders (biotin, avidin,...) have to be connected covalently to the desired molecules beforehand.

9.1. Short-Distance Cross-Linkers

		Article No.	Quantity	Price
MAA1020 **Mal-beta-Ala-OSu**		MAA1020.0001	1 g	€ 250,00
		MAA1020.0005	5 g	€ 475,00
PEG2090 **MBS**		PEG2090.0100	100 mg	€ 275,00
		PEG2090.0001	1 g	€ 550,00
MAA1000 **Mal-AMCHC-OSu**		MAA1000.0001	1 g	€ 180,00
		MAA1000.0005	5 g	€ 720,00

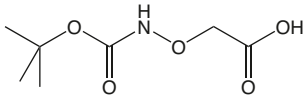
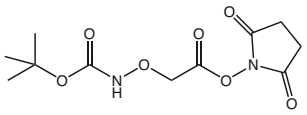
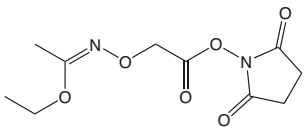
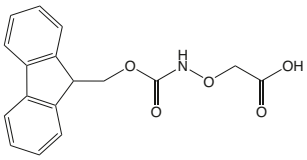
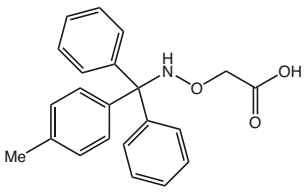
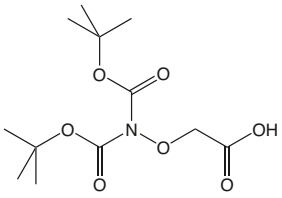
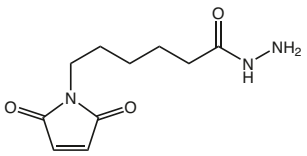
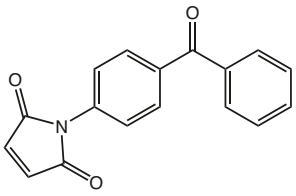
3-(Maleimido)propionic acid N-succinimidyl ester, N-Maleoyl-beta-alanine N'-hydroxysuccinimide ester
CAS-NO: 55750-62-4
FORMULA: $C_{11}H_{10}N_2O_6$
MOLECULAR WEIGHT: 266,21 g/mole

3-(Maleinimido-1-yl)benzoic acid N-hydroxy-succinimidyl ester
CAS-NO: 58626-38-3
FORMULA: $C_{15}H_{10}N_2O_6$
MOLECULAR WEIGHT: 314,25 g/mole

trans-N-Succinimidyl 4-(maleimidomethyl)cyclohexane-1-carboxylate
CAS-NO: 64987-85-5
FORMULA: $C_{16}H_{18}N_2O_6$
MOLECULAR WEIGHT: 334,33 g/mole

These heterobifunctional cross-linking reagents carry amine and thiol reactivity. They are useful for preparation of enzyme immunoconjugates and hapten carrier molecule conjugates containing 6 / 7 / 9 atom linkers respectively.

Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
BAA1017	**Boc-AOAc-OH**	BAA1017.0005	5 g	€ 120,00
2-(t-Butyloxycarbonyl-aminooxy)-acetic acid CAS-NO: 42989-85-5 FORMULA: $C_7H_{13}NO_5$ MOLECULAR WEIGHT: 191,19 g/mole		BAA1017.0025	25 g	€ 450,00
BAA1965	**Boc-AOAc-NHS**	BAA1965.0100	100 mg	€ 225,00
t-Butyloxycarbonyl-aminooxyacetic acid N-hydroxysuccinimide ester CAS-NO: 80366-85-4 FORMULA: $C_{11}H_{16}N_2O_7$ MOLECULAR WEIGHT: 288,25 g/mole		BAA1965.0250	250 mg	€ 500,00
		BAA1965.1000	1 g	€ 800,00
		BAA1965.5000	5 g	€ 1200,00
		BAA1965.9001	10 g	€ 1950,00
EAA1000	**Eei-AOAc-OSu**	EAA1000.0001	1 g	€ 150,00
N-(1-Ethoxyethylidene)-2-aminooxyacetic acid N-hydroxysuccinimidyl ester CAS-NO: 960607-67-4 FORMULA: $C_{10}H_{14}N_2O_6$ MOLECULAR WEIGHT: 258,21 g/mole		EAA1000.0005	5 g	€ 600,00
		EAA1000.0025	25 g	€ 2400,00
FAA0015	**Fmoc-AOAc-OH**	FAA0015.0001	1 g	€ 80,00
2-(9-Fluorenylmethyloxycarbonyl-aminooxy)-acetic acid CAS-NO: 123106-21-8 FORMULA: $C_{17}H_{15}NO_5$ MOLECULAR WEIGHT: 313,3 g/mole		FAA0015.0005	5 g	€ 300,00
		FAA0015.0025	25 g	€ 1200,00
MAA1030	**Mtt-AOAc-OH**	MAA1030.0005	5 g	€ 250,00
4-Methyltrityl-aminooxyacetic acid FORMULA: $C_{22}H_{21}NO_3$ MOLECULAR WEIGHT: 347,41 g/mole		MAA1030.0025	25 g	€ 1000,00
BAA1840	**(Boc)2-AOAc-OH*H2O**	BAA1840.0001	1 g	€ 85,00
Bis-Boc-Aoa, {[Bis(t-Butyloxycarbonyl)amino]oxy}acetic acid monohydrat CAS-NO: 293302-31-5net FORMULA: $C_{12}H_{21}NO_7*H_2O$ MOLECULAR WEIGHT: 291,30*18,01 g/mole		BAA1840.0005	5 g	€ 275,00
		BAA1840.0025	25 g	€ 1100,00
LS-3390	**EMCH*TFA**	LS-3390.0010	10 mg	€ 275,00
6-(2,5-Dioxo-2,5-dihydro-1H-pyrrol-1-yl)hexanehydrazide 2,2,2-trifluoroacetate CAS-NO: 151038-94-7 FORMULA: $C_{10}H_{15}N_3O_3*CF_3COOH$ MOLECULAR WEIGHT: 225,24*114,02 g/mole				
LS-3350	**4-(N-Maleimido)benzophenone**	LS-3350.0100	100 mg	€ 175,00
1-(4-Benzoylphenyl)-1H-pyrrole-2,5-dione CAS-NO: 92944-71-3 FORMULA: $C_{17}H_{11}NO_3$ MOLECULAR WEIGHT: 277,28 g/mole		LS-3350.0500	500 mg	€ 375,00

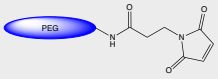
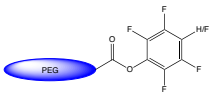
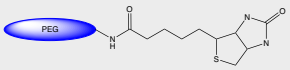
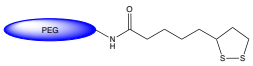
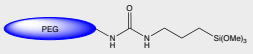
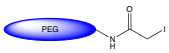
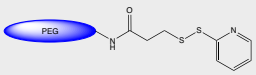
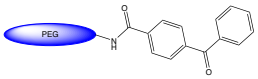
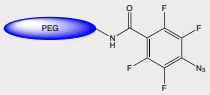
The maleimide of 4-(*N*-Maleimido)benzophenone chemically reacts with thiols and upon UV illumination, the photoreactive benzophenone component reacts with nucleophiles or forms C-H insertion products.

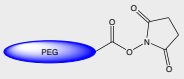
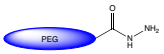
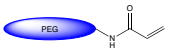
Prices are in EUR, net, exw Germany

9.2. PEG based Cross-Linkers

Due to the many different requirements, cross-linkers with different functional groups and lengths are available. In principle, the length of a cross-linker could be varied by introduction of various alkyls between the two functional groups. Yet, with growing length, alkyls confer increasing hydrophobicity which might lower water solubility and lead to aggregation of the linked compounds. Therefore, typically a link of (poly)ethylene glycol connects the two functional groups. It improves solubility in water and human liquids, is almost non-immunogenic and will not be degraded in human liquids.

We offer homo- and hetero-bifunctional PEG based linkers with various functional groups as shown in the subsequent table:

Functional Group		Targets
Azido		Alkynes via Click reaction
Maleinimide		Thiols
Tfp, Pfp		Amines Hydrazides
Biotin		Avidin Streptavidin
Lipoamide		Gold and Silver particles
Silane		Silicate particles
Iodo		Thiols
OPPS		Thiols
Benzophenone		Nucleophiles with UV
ATFBA		Nucleophiles with UV

Functional Group		Targets
Alkyne		Azides via Click reaction
NHS ester		Amines
Hydrazide		Carbonyls
Aldehyde		Amines
Acryloyl		Olefines; other with UV
Amino		NHS Esters
Bromo		Thiols
Epoxy		Amines Alcohols Thiols
Acid		Amines Alcohols Thiols
Hydroxy		Acids

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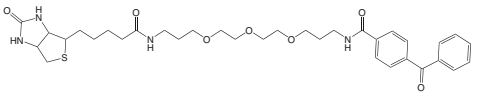
The length of our PEG-based crosslinkers ranges from monodisperse compounds with 1 - 48 ethylen glycol units up to polydisperse linkers with a molecular mass up to 20,000 Da.

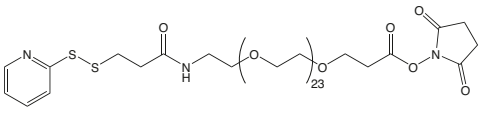
		Article No.	Quantity	Price
PEG1415	**Biotin-dPEG™(3)-Benzophenone**	PEG1415.0025	25 mg	€ 300,00
		PEG1415.0100	100 mg	€ 400,00

N-(3-(2-(2-(3-(Biotinamino)propoxy)ethoxy)ethoxy)propyl)-4-benzophenone
FORMULA: $C_{34}H_{46}N_4O_7S$
MOLECULAR WEIGHT: 654,82 g/mole



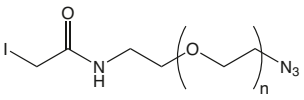
PEG2260	**OPSS-PEG(24)-NHS**	PEG2260.0100	100 mg	€ 400,00
		PEG2260.0001	1 g	€ 1100,00

alpha-[3-(o-Pyridyldisulfido)propanoylamido]-omega-succinimidyl ester 24(ethylene glycol)
FORMULA: $C_{63}H_{113}N_3O_{29}S_2$
MOLECULAR WEIGHT: 1440,7 g/mole



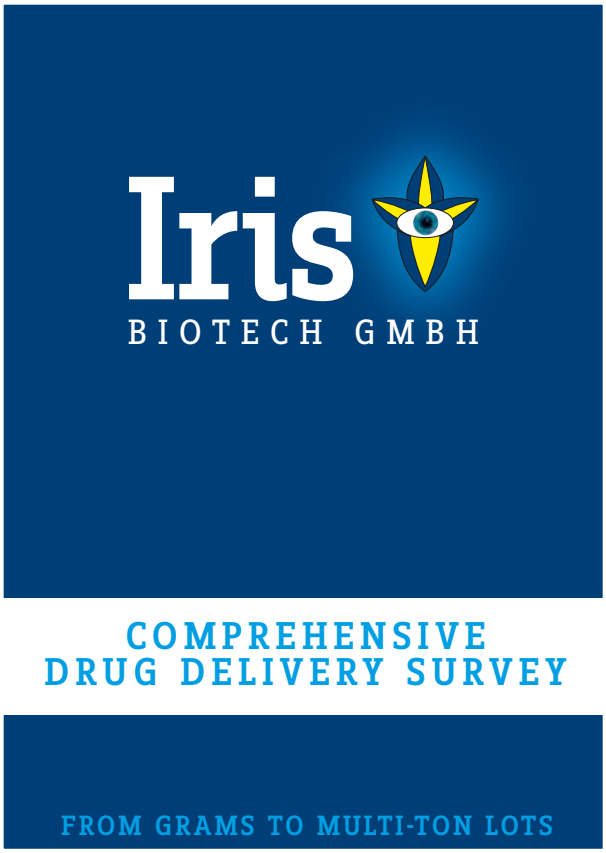
PEG3140	**I-PEG-N3**	PEG3140.0100	100 mg	€ 250,00
		PEG3140.0500	500 mg	€ 675,00

alpha-Iodo-omega-azido poly(ethylene glycol) (PEG-MW 20000 Dalton)
MOLECULAR WEIGHT: 20000 Da



These three compounds above are exemplary for the hundreds of PEGs available from our product range. For more information about PEGs and other drug carrier and drug delivery systems, please ask for our Brochure "Comprehensive Drug Delivery Survey", containing the world's largest selection of PEGylating reagents.

Ask for your copy via info@iris-biotech.de



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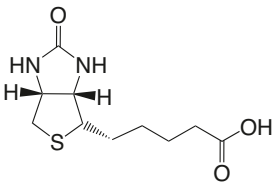
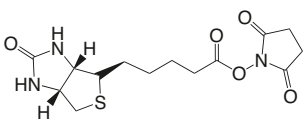
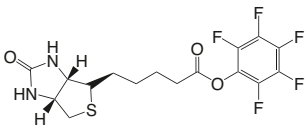
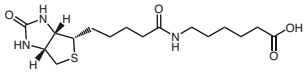
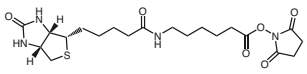
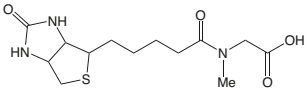
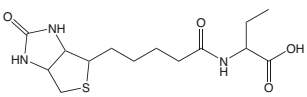
10. Immunological Tools

10.1. Biotinylation Reagents

The affinity and specificity of the avidin-biotin interaction have been exploited for numerous applications in immunology, histochemistry, and affinity chromatography, to name a few. Biotinylation is a common technique for transforming poorly detectable molecules into probes that can be recognized by labeled biotin-binding proteins or an affinity capture matrix. Antibodies can be "tagged" with biotinylation reagents and used to probe cells or tissues for specific antigens or haptens.

		Article No.	Quantity	Price
LS-1070	**D-Biotin**	LS-1070.0005	5 g	€ 35,00
Hexahydro-2-oxo-1H-thieno[3,4-d]imidazole-4-pentanoic acid, Vitamin H CAS-NO: 58-85-5 FORMULA: $C_{10}H_{16}N_2O_3S$ MOLECULAR WEIGHT: 244,31 g/mole		LS-1070.0025	25 g	€ 125,00
		LS-1070.0100	100 g	€ 400,00
RL-1006	**Biotin-OSu**	RL-1006.0001	1 g	€ 95,00
N-Hydroxysuccinimidobiotin CAS-NO: 35013-72-0 FORMULA: $C_{14}H_{19}N_3O_5S$ MOLECULAR WEIGHT: 341,39 g/mole		RL-1006.0005	5 g	€ 325,00
		RL-1006.0025	25 g	€ 1300,00
RL-8615	**Biotin-OPfp**	RL-8615.0001	1 g	€ 125,00
Biotin pentafluorophenyl ester CAS-NO: 120550-35-8 FORMULA: $C_{16}H_{15}F_5N_2O_3S$ MOLECULAR WEIGHT: 410,36 g/mole		RL-8615.0005	5 g	€ 500,00
		RL-8615.0025	25 g	€ 2000,00
RL-2025	**Biotin-Ahx-OH**	RL-2025.0001	1 g	€ 175,00
6-Biotinylamino-hexanoic acid CAS-NO: 72040-64-3 FORMULA: $C_{16}H_{27}N_3O_4S$ MOLECULAR WEIGHT: 357,47 g/mole		RL-2025.0005	5 g	€ 500,00
		RL-2025.0025	25 g	€ 2000,00
RL-2020	**Biotin-Ahx-NHS**	RL-2020.0001	1 g	€ 225,00
6-Biotinylamino-hexanoic acid-N-hydroxysuccinimidyl ester CAS-NO: 72040-63-2 FORMULA: $C_{20}H_{30}N_4O_6S$ MOLECULAR WEIGHT: 454,54 g/mole		RL-2020.0005	5 g	€ 750,00
		RL-2020.0025	25 g	€ 3000,00
PEG2550	**Biotin-Sar-OH**	PEG2550.1000	1 g	€ 375,00
N-Biotinylsarcosine, N-Biotinyl-N-methyl-2-aminoacetic acid FORMULA: $C_{13}H_{21}N_3O_4S$ MOLECULAR WEIGHT: 717,84 g/mole				
PEG2555	**Biotin-2-Abu-OH**	PEG2555.0001	1 g	€ 375,00
N-alpha-Biotinoyl-2-DL-aminobutyric acid FORMULA: $C_{14}H_{23}N_3O_4S$ MOLECULAR WEIGHT: 329,52 g/mole				

PEG2550 and PEG2555 are biotinidase resistant amine reactive biotinylation PEGylation reagents especially for in vivo experiments or clinical analysis where serum samples are being used. Biotinidase is ubiquitous in serum and might rapidly cleave biotin from the detection system. Sarcosine and 2-aminobutyric acid are spacers showing a high level of resistance to biotinidase, while maintaining a high binding rate and affinity for avidin and streptavidin.

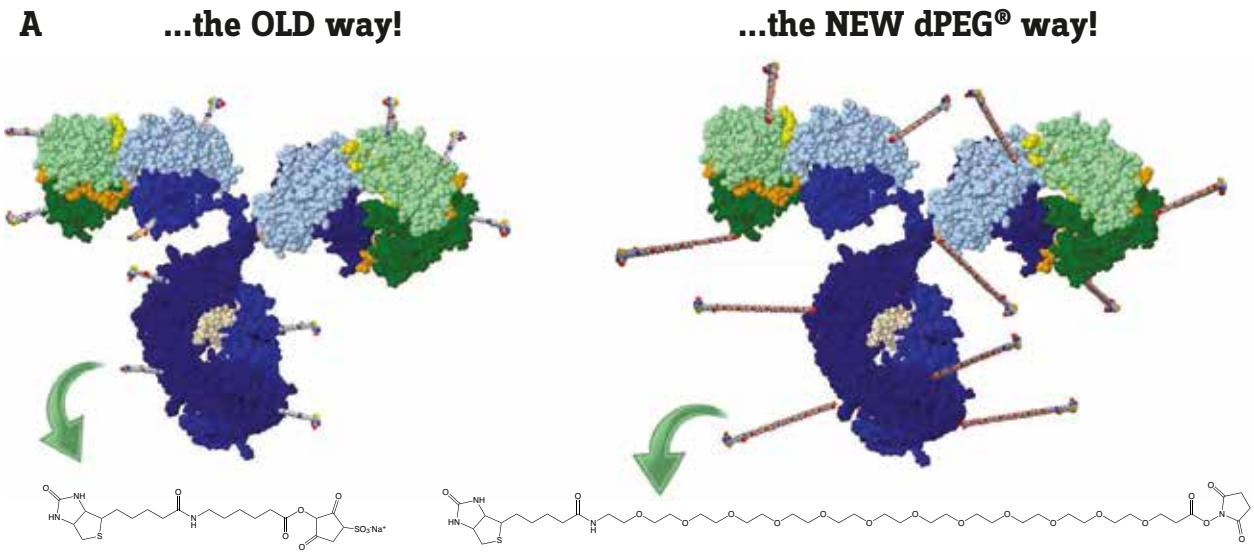
Prices are in EUR, net, exw Germany

Biotin-dPEG® reagents

PEGs are molecules comprised of repeating ethylene glycol units and are built up in a stepwise fashion. While traditional PEGs prepared by polymerization techniques are polydisperse, or at best "monodisperse" mixtures, dPEG®s are true single molecules of definite and specified length. These small, hydrophilic, non-immunogenic reagents have shown promise in a number of potentially important applications and continue to build evidence that "less is more" when it comes to PEGylation. PEGs have a dramatic impact on protein solubility, stability, and aggregation, and are able to improve ELISAs, IHC assays, and formulations in many aspects.

Some protein biotin conjugates are particularly susceptible to aggregation and loss of antigen binding ability. The detectable protein-biotin-IgG complex is also prone to aggregation and precipitation, which can complicate assays and provide irreproducible and/or erroneous results.

In comparison, biotinylated IgGs employing a dPEG® linker show no tendency for aggregation, maintain a high affinity for antigen, and the resulting complexes with the biotin-binding proteins remain completely soluble:

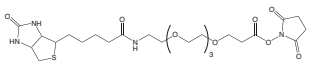
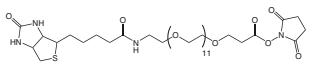
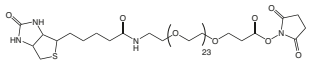
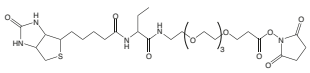


Comparison between Biotin-LC labeled and Biotin-dPEG® labeled antibodies.

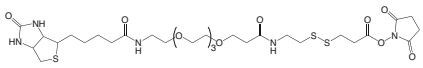
(A) Schematic representation of biotin labeled antibody: "Classical" aliphatic LC linker creates hydrophobic surface with biotin moiety in very close proximity (left side of IgG scheme). dPEG®12 linker creates hydrophilic "slippery" surface with biotin moiety given more space for interaction (right side of IgG scheme).

(B) Mixing 3 nmol streptavidin with 0.9 nmol either Biotin-LC-GAR antibody (left tube) or Biotin-dPEG®12-GAR antibody (right tube) clearly demonstrates the ability of the hydrophilic dPEG® spacer to solubilize the resulting streptavidin-biotin-IgG complex completely while the steptavidin-biotin-LC-GAR complex is obviously precipitating from solution.

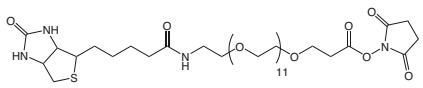
Available Biotin-dPEG-NHS labeling compounds:

		Article No.	Quantity	Price
PEG1870	**Biotin-dPEG™(4)-NHS**			
15-Biotinamino-4,7,10,13-tetraoxa-pentadecanoic acid succinimidyl ester FORMULA: $C_{25}H_{40}N_4O_{10}S$ MOLECULAR WEIGHT: 588,67 g/mole		PEG1870.0050	50 mg	€ 250,00
		PEG1870.0001	1 g	€ 800,00
PEG1860	**Biotin-dPEG™(12)-NHS**			
alpha-Biotin-omega-carboxy succinimidyl ester dodeca(ethylene glycol) FORMULA: $C_{41}H_{72}N_4O_{18}S$ MOLECULAR WEIGHT: 941,09 g/mole		PEG1860.0050	50 mg	€ 300,00
		PEG1860.0001	1 g	€ 1300,00
PEG4250	**Biotin-dPEG™(24)-NHS**			
alpha-Biotin-omega-(succinimidyl propionate) 24(ethylene glycol) FORMULA: $C_{65}H_{120}N_4O_{30}S$ MOLECULAR WEIGHT: 1469,72 g/mole		PEG4250.0050	50 mg	€ 375,00
		PEG4250.1000	1 g	€ 1450,00
PEG1845	**Biotin-dPEG™(4)-NHS-(Biotinidase resistant)**			
18-Biotinamino-17-oxo-4,7,10,13-tetraoxa-16-azaicosan-1-oic acid succinimidyl ester FORMULA: $C_{29}H_{47}N_5O_{11}S$ MOLECULAR WEIGHT: 673,78 g/mole		PEG1845.0100	100 mg	€ 275,00
		PEG1845.0001	1 g	€ 1250,00

PEG1845 combines the biotinidase resistance of 2-amino-butyric acid spacer with the advantages of a dPEG® linker, resulting in an optimal biotin binding with streptavidin conjugates. The chain length from amide to terminal carbonyl is 19.2 Angstroms, which is about the same length as the frequently used LC-LC spacer, which is ideal for the streptavidin binding pocket, yet avoiding the undesired hydrophobic aggregation risk of the LC-LC spacer. This biotinidase resistant amine reactive biotinylation reagent is especially suitable for in vivo experiments or clinical analysis where serum samples are being used.

		Article No.	Quantity	Price
PEG1910	**Biotin-dPEG™(4)-S-S-NHS**			
1-Biotinamino-15-oxo-3,6,9,12-tetraoxa-19,20-dithia-16-azatricosan-23-oic acid succinimidyl ester FORMULA: $C_{30}H_{49}N_5O_{11}S_3$ MOLECULAR WEIGHT: 751,93 g/mole		PEG1910.0050	50 mg	€ 300,00
		PEG1910.0500	500 mg	€ 900,00

Biotin-PEG-S-S-NHS can be used to label a primary antibody molecule that has specificity for a certain protein. Incubation of the biotinylated antibody with a sample, such as a cell lysate, allows the antibody to bind to its target. Capture of the antibody-antigen complex on an immobilized streptavidin reagent effectively isolates the target protein from the other proteins in the sample. The disulfide linkage in the spacer arm of the biotin tag permits elution of the immune complex from the streptavidin support under mild conditions by using e.g. DTT, avoiding strong denaturating conditions typically required to break the streptavidin-biotin interaction.

		Article No.	Quantity	Price
PEG4890	**Biotin-dPEG™(12)-NHS Biotinylation Kit**			
Superior Biotinylation Kit, containing all components required for biotinylation of a target molecule with amino function, including purification of the biotinylated conjugate. FORMULA: $C_{41}H_{72}N_4O_{18}S$ MOLECULAR WEIGHT: 941,09 g/mole		PEG4890.0001	1 Kit	€ 350,00

This kit contains a superior biotinylation reagent in an easy to use format. The biotinylation reagent is designed for simple conjugation to your target molecule and optimal geometry for binding with streptavidin using a hydrophilic linker that **eliminates aggregation and non-specific binding**. The kit contains all of the components required for biotinylation of your target molecule, including purification of the biotinylated product.

Prices are in EUR, net, exw Germany

10.2. Biotin- / Streptavidin-Peroxidase Conjugates

As already shown for antibody-biotin-conjugates, dPEG®(12) linkers also improve the performance of Biotin- and Streptavidin-reporter enzyme conjugates. Additionally to conjugates with horseradish peroxidase we also offer a variation with a more stable peroxidase (called qSP) which can be applied for fast blotting products, e.g. I-Blot, etc. that could by now only use Alkaline Phosphatase detection.

10.2.1. Biotin Peroxidase Conjugates

		Article No.	Quantity	Price
LS-3455	**Biotin-dPEG™(12)-HRP** Biotin-Horseradish peroxidase conjugate with hydrophilic PEG(12) connection	LS-3455.0001	1 mg	€ 225,00
LS-3460	**Biotin-dPEG™(12)-qSP** Biotin-stabilized horseradish peroxidase conjugate with hydrophilic PEG(12) connection	LS-3460.0001	1 mg	€ 225,00

10.2.2. Streptavidin Peroxidase Conjugates

		Article No.	Quantity	Price
LS-3335	**SA-dPEG™(12)-HRP** Straptavidin-Horseradish peroxidase conjugate with hydrophilic dPEG® 12 connection	LS-3335.0001	1 mg	€ 200,00
LS-3340	**SA-dPEG™(12)-qSP** Straptavidin-stabilized horseradish peroxidase conjugate with hydrophilic dPEG® 12 connection	LS-3340.0001	1 mg	€ 225,00

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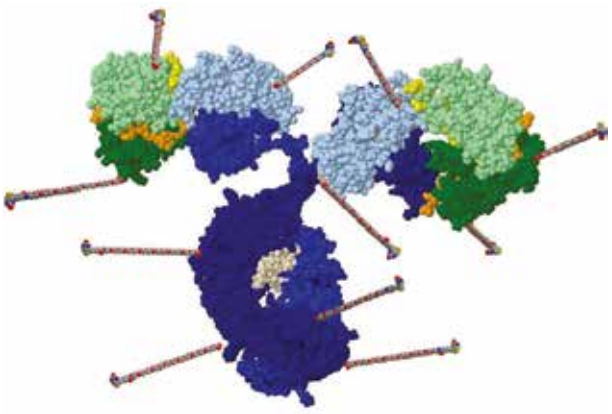
10.3. Secondary Antibodies with dPEG® Technology

As described above, the dPEG® linker technology offers various advantages compared to conventional immunological applications like elimination of non-specific binding and increase of signal to noise ratio.

To take advantage of the superior dPEG® linker technology, you do not have to perform the labeling of secondary antibodies yourself. We offer dPEG® labeled and conjugated secondary antibodies. **Eliminate background, minimize dilutions and save time!** Our dPEG® based secondary antibody products are setting a new standard in performance and ease of using all of your protein based assays.

10.3.1. Biotin Antibody Conjugates



		Article No.	Quantity	Price
LS-3410	**Biotin-dPEG™(12)-GAM IgG (adsorbed)** Biotinylated PEG(12) goat-anti-mouse antibody, adsorbed	LS-3410.0001	1 mg	€ 235,00
LS-3325	**Biotin-dPEG™(12)-GAR (adsorbed)** Biotinylated PEG(12) goat-anti-rabbit antibody, adsorbed	LS-3325.0001	1 mg	€ 235,00
LS-3415	**Biotin-dPEG™(12)-DAM IgG (adsorbed)** Biotinylated PEG(12) donkey-anti-mouse antibody, adsorbed	LS-3415.0001	1 mg	€ 235,00
LS-3420	**Biotin-dPEG™(12)-GAG IgG (adsorbed)** Biotinylated PEG(12) goat-anti-guinea antibody, adsorbed	LS-3420.0001	1 mg	€ 235,00
LS-3425	**Biotin-dPEG™(12)-GAH (Fc) IgG** Biotinylated PEG(12) goat-anti-human (Fc) antibody, not adsorbed	LS-3425.0005	0,5 mg	€ 210,00
LS-3430	**Biotin-dPEG™(12)-GAH (Fc) IgG** Biotinylated PEG(12) goat-anti-human (Fc) antibody, not adsorbed	LS-3430.0005	0,5 mg	€ 325,00

Prices are in EUR, net, exw Germany

10.3.2. Antibody Peroxidase Conjugates

Our dPEG® based secondary antibodies are available as conjugates with "classical" horseradish peroxidase and with the stabilized peroxidase qSP.

		Article No.	Quantity	Price
LS-3330	**HRP-dPEG™(12)-GAR** Goat Anti-Rabbit IgG-PEG(12)-Horseradish Peroxidase	LS-3330.0005	0,5 mg	€ 325,00
LS-3435	**HRP-dPEG™(12)-GAM** Goat Anti-Mouse-PEG(12)-Horseradish Peroxidase	LS-3435.0005	0,5 mg	€ 345,00
LS-3440	**qSP-dPEG™(12)-GAM** Goat Anti-Mouse-PEG(12)-stabilized Horseradish Peroxidase	LS-3440.0005	0,5 mg	€ 325,00
LS-3445	**qSP-dPEG™(12)-GAR** Goat Anti-Rabbit-PEG(12)-stabilized Horseradish Peroxidase	LS-3445.0005	0,5 mg	€ 325,00
LS-3450	**qSP-dPEG™(12)-GAH (H+L)** Goat Anti-Human-PEG(12)-stabilized Horseradish Peroxidase (H+L)	LS-3450.0005	0,5 mg	€ 345,00

The product range of secondary antibody conjugates is under permanent development.

Please check our webpage www.iris-biotech.de for the latest additions.

Prices are in EUR, net, exw Germany

11. Dyes and Fluorescence Labels

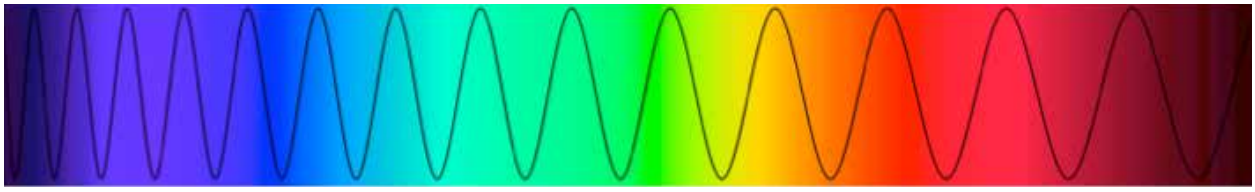
Dyes and other labels which are non-native, modifying living systems, should be bioorthogonal, not alter the biological activity of the labelled component and be inert to physiological conditions.

We offer almost 100 Labels with an excitation range from UV to near-IR and various reactive moieties: carboxylic acids and NHS esters for modification of amines, maleimides for modification of thiols, and azides or alkynes for click chemistry.

The click reaction is highly valuable because of the inertness of the conjugation triazol linkage and the selective and efficient reaction between the labelling target and the label. Therefore this technique has found successful applications especially in the field of labelling proteins and particularly DNA.

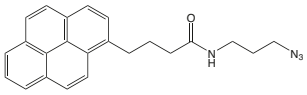
References:

- Achatz D.E. *et al.*, Probing the Activity of Matrix Metalloproteinase II Using a Sequentially Click-Labeled Silica Nanoparticle FRET Probe. *ChemBioChem* 2009; **10**: 2316-1320. DOI: 10.1002/cbic.200900261.
- Kele P. *et al.*, Clickable Fluorophores for Biological Labeling - With or Without Copper. *Org. Biomol. Chem.* 2009; **7**: 3486-3490. DOI: 10.1039/b907741c.
- Kele P. *et al.*, Dual Labeling of Biomolecules by Click Chemistry: a Sequential Approach. Angew. Chem. 2009; 121: 350-353; *Angew. Chem. Intl. Ed.* 2009; **48**: 344-347. DOI: 10.1002/ange.200804514.



11.1. UV Excitation (<400 nm)

	Article No.	Quantity	Price
DYB1190 Pyrene-Azide	DYB1190.0001	1 mg	€ 175,00
Pyrene-Azide N-(3-Azidopropyl)-4-(pyren-1-yl)butanamide FORMULA: $C_{23}H_{22}N_4O$ MOLECULAR WEIGHT: 370,45 g/mole	DYB1190.0005	5 mg	€ 450,00



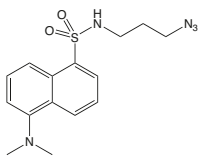
Spectral and other Properties:

- Absorption 340 nm
- Emission 376 nm
- Extinction coefficient 43.000 l/(mol*cm)

Soluble in:

- DMSO, DMF, MeCN

	Article No.	Quantity	Price
DYB1180 Dansyl-Azide	DYB1180.0001	1 mg	€ 175,00
Dansyl-Azide N-(3-Azidopropyl)-5-(dimethylamino)naphthalene-1-sulfonamide FORMULA: $C_{15}H_{19}N_5O_2S$ MOLECULAR WEIGHT: 333,41 g/mole	DYB1180.0005	5 mg	€ 350,00

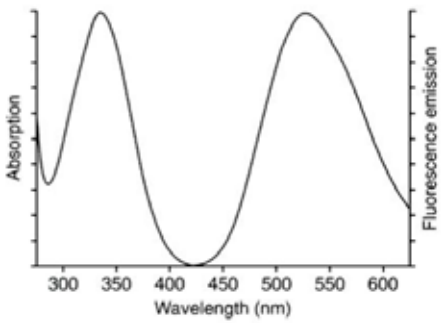


Spectral and other Properties:

- Absorption 340 nm
- Emission 520 nm
- Extinction coefficient 4.200 l/(mol*cm)

Soluble in:

- DMSO, DMF, MeOH



Prices are in EUR, net, exw Germany

Article No.	Quantity	Price
DYB1100.0005	5 mg	€ 200,00
DYB1100.0010	10 mg	€ 375,00

DYB1100 Eterneon-350/430-NHS

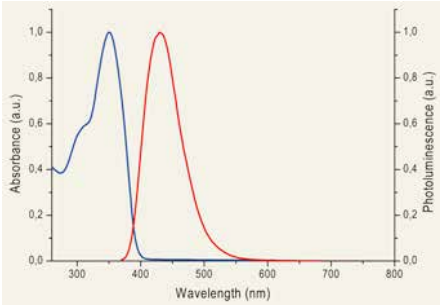
Eterneon-350/430-NHS
MOLECULAR WEIGHT: 353,44 g/mole

Spectral and other Properties:

- Absorption 350 nm
- Emission 430 nm
- Extinction coefficient 15.220 l/(mol*cm)
- Quantum Yield 70%

Soluble in:

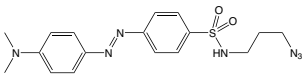
- DMSO, DMF, DCM, Water/Tween, PBS



Article No.	Quantity	Price
DYB1170.0001	1 mg	€ 175,00
DYB1170.0005	5 mg	€ 375,00

DYB1170 Dabsyl-Azide

Dabsyl-Azide N-(3-Azidopropyl)-4-((4-(dimethylamino)phenyl)diazenyl)benzenesulfonamide
FORMULA: $C_{17}H_{21}N_7O_2S$
MOLECULAR WEIGHT: 387,46 g/mole



Soluble in:

- DMSO, DMF, MeCN, EtOAc

Article No.	Quantity	Price
DYB1110.0005	5 mg	€ 200,00
DYB1110.0010	10 mg	€ 375,00

DYB1110 Eterneon-350/455-NHS

Eterneon-350/455-NHS
MOLECULAR WEIGHT: 353,44 g/mole

Article No.	Quantity	Price
DYB1050.0005	5 mg	€ 200,00
DYB1050.0010	10 mg	€ 375,00

DYB1050 Eterneon-350/455-Azide

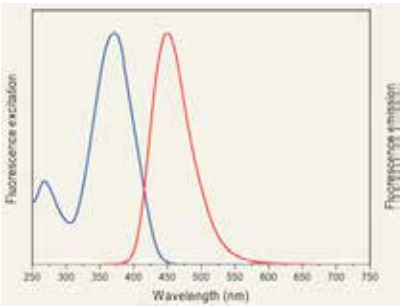
Eterneon-350/455-Azide
MOLECULAR WEIGHT: 456,6 g/mole

Spectral and other Properties:

- Absorption 350 nm
- Emission 455 nm
- Extinction coefficient 27.300 l/(mol*cm)
- Quantum Yield 74%

Soluble in:

- DMSO, DMF, DCM, Water/Tween, PBS



Interested in custom synthesis of labeled peptides?

Send us your sequence including quantity and desired purity!

Prices are in EUR, net, exw Germany

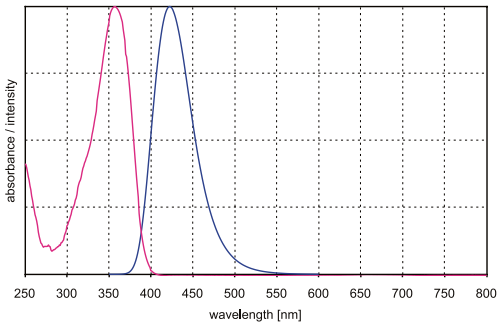
	Article No.	Quantity	Price
DYD1000 DY-350-NHS			
DY-350 Succinimidyl Ester FORMULA: $C_{39}H_{27}N_5O_{15}S_2$ MOLECULAR WEIGHT: 874,1 g/mole	DYD1000.0001	1 mg	€ 185,00
	DYD1000.0005	5 mg	€ 750,00
DYD1005 DY-350-Mal			
DY-350 Maleinimide FORMULA: $C_{41}H_{30}N_6O_{14}S_2$ MOLECULAR WEIGHT: 899,15 g/mole	DYD1005.0001	1 mg	€ 210,00
	DYD1005.0005	5 mg	€ 950,00

Spectral and other Properties:

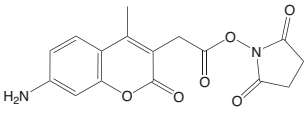
- Absorption 353 nm
- Emission 432 nm
- Extinction coefficient 19.000 l/(mol*cm)

Soluble in:

- Water, MeOH, EtOH, DMF, DMSO



	Article No.	Quantity	Price
RL-1005 AMCA-OSu			
7-Amino-4-methyl-3-coumarinylacetyl succinimidyl ester CAS-NO: 113721-87-2 FORMULA: $C_{16}H_{14}N_2O_6$ MOLECULAR WEIGHT: 330,3 g/mole	RL-1005.0001	1 g	€ 500,00
	RL-1005.0005	5 g	€ 2000,00



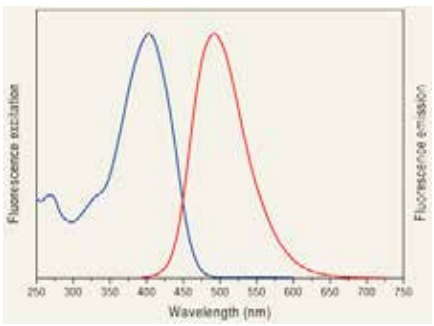
	Article No.	Quantity	Price
DYB1120 Eterneon-384/480-NHS			
Eterneon-384/480-NHS MOLECULAR WEIGHT: 435,56 g/mole	DYB1120.0005	5 mg	€ 200,00
	DYB1120.0010	10 mg	€ 375,00
DYB1060 Eterneon-384/480-Azide			
Eterneon-384/480-Azide MOLECULAR WEIGHT: 538,73 g/mole	DYB1060.0005	5 mg	€ 200,00
	DYB1060.0010	10 mg	€ 375,00

Spectral and other Properties:

- Absorption 384 nm
- Emission 480 nm
- Extinction coefficient 18.000 l/(mol*cm),
- Quantum Yield 42%

Soluble in:

- DMSO, DMF, DCM, Water/Tween, PBS



Prices are in EUR, net, exw Germany

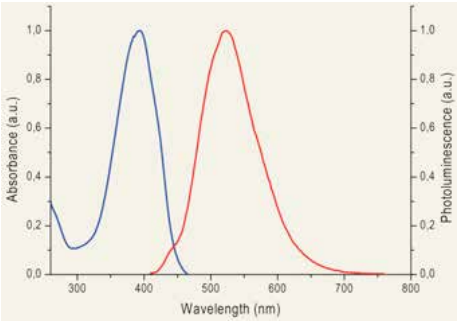
	Article No.	Quantity	Price
DYB1130 Eterneon-393/523-NHS	DYB1130.0005	5 mg	€ 200,00
Eterneon-393/523-NHS MOLECULAR WEIGHT: 479,62 g/mole	DYB1130.0010	10 mg	€ 375,00
DYB1070 Eterneon-393/523-Azide	DYB1070.0005	5 mg	€ 200,00
Eterneon-393/523-Azide MOLECULAR WEIGHT: 582,78 g/mole	DYB1070.0010	10 mg	€ 375,00

Spectral and other Properties:

- Absorption 393 nm
- Emission 523 nm
- Extinction coefficient 27.680 l/(mol*cm)
- Quantum Yield 75%

Soluble in:

- DMSO, DMF, DCM, Water/Tween, PBS



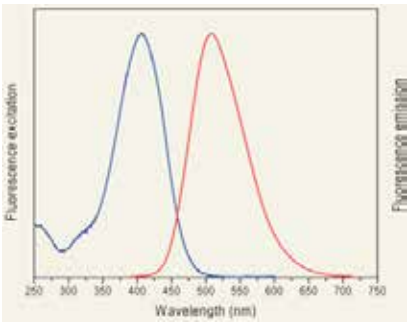
	Article No.	Quantity	Price
DYB1140 Eterneon-394/507-NHS	DYB1140.0005	5 mg	€ 200,00
Eterneon-394/507-NHS MOLECULAR WEIGHT: 435,56 g/mole	DYB1140.0010	10 mg	€ 375,00
DYB1080 Eterneon-394/507-Azide	DYB1080.0005	5 mg	€ 200,00
Eterneon-394/507-Azide MOLECULAR WEIGHT: 538,73 g/mole	DYB1080.0010	10 mg	€ 375,00

Spectral and other Properties:

- Absorption 394 nm
- Emission 507 nm
- Extinction coefficient 30.000 l/(mol*cm)
- Quantum Yield 37%

Soluble in:

- DMSO, DMF, DCM, Water/Tween, PBS



Prices are in EUR, net, exw Germany

11.2. Blue-Green Excitation (400-520 nm)

DYD1010 DY-405-NHS

DY-405 Succinimidyl Ester
FORMULA: $C_{28}H_{23}N_2O_{15}S_3Na_3$
MOLECULAR WEIGHT: 792,66 g/mole

Article No.	Quantity	Price
DYD1010.0001	1 mg	€ 185,00
DYD1010.0005	5 mg	€ 750,00

DYD1015 DY-405-Mal

DY-405 Maleinimide
FORMULA: $C_{30}H_{26}N_3O_{14}S_3Na_3$
MOLECULAR WEIGHT: 817,72 g/mole

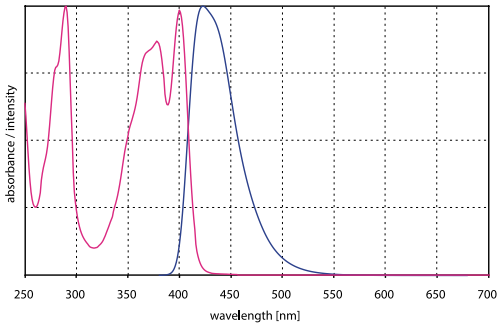
Article No.	Quantity	Price
DYD1015.0001	1 mg	€ 210,00
DYD1015.0005	5 mg	€ 950,00

Spectral and other Properties:

- Absorption 400 nm
- Emission 420 nm
- Extinction coefficient 32.000 l/(mol*cm)

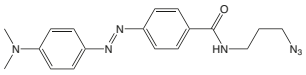
Soluble in:

- Water, MeOH



DYB1160 Dabcyl-Azide

Dabcyl-Azide N-(3-azidopropyl)-4-((4-(dimethylamino)phenyl) diazenyl)benzamide
FORMULA: $C_{18}H_{21}N_7O$
MOLECULAR WEIGHT: 351,41 g/mole



Article No.	Quantity	Price
DYB1160.0001	1 mg	€ 175,00
DYB1160.0005	5 mg	€ 475,00
DYB1160.0100	100 mg	€ 2250,00

Spectral and other Properties:

- Absorption 478 nm
- Extinction coefficient 32.000 l/(mol*cm)

Soluble in:

- DMSO, DMF, MeCN, AcOEt
- non flurorescent quencher

Prices are in EUR, net, exw Germany

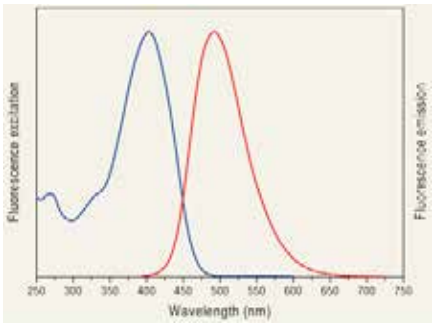
	Article No.	Quantity	Price
DYB1150 Eterneon-480/635-NHS	DYB1150.0005	5 mg	€ 225,00
Eterneon-480/635-NHS	DYB1150.0010	10 mg	€ 425,00
MOLECULAR WEIGHT: 523,63 g/mole			
DYB1090 Eterneon-480/635-Azide	DYB1090.0005	5 mg	€ 225,00
Eterneon-480/635-Azide	DYB1090.0010	10 mg	€ 425,00
MOLECULAR WEIGHT: 629,79 g/mole			

Spectral and other Properties:

- Absorption 480 nm
- Emission 635 nm
- Extinction coefficient 29.900 l/(mol*cm)
- Quantum Yield 34%

Soluble in:

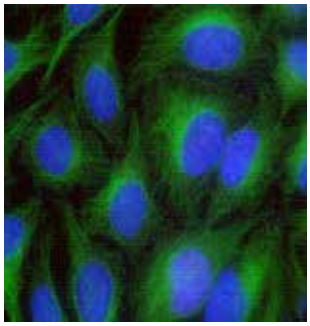
- DMSO, DMF, DCM, Water/Tween, PBS

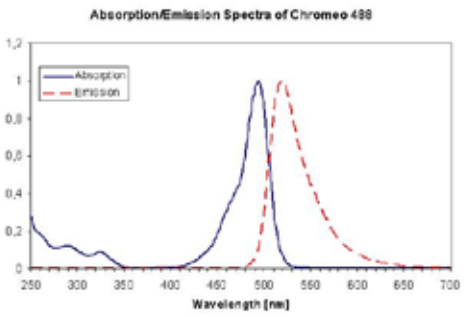


	Article No.	Quantity	Price
DYC1010 Chromeo 488-COOH	DYC1010.0001	1 mg	€ 140,00
Chromeo 488 Carboxylic Acid	DYC1010.0005	5 mg	€ 450,00
FORMULA: $C_{30}H_{31}NO_7$			
MOLECULAR WEIGHT: 517,58 g/mole			
DYC1020 Chromeo 488-NHS	DYC1020.0001	1 mg	€ 240,00
Chromeo 488 Succinimidyl Ester	DYC1020.0005	5 mg	€ 910,00
FORMULA: $C_{34}H_{34}N_2O_9$			
MOLECULAR WEIGHT: 614,66 g/mole			
DYC1030 Chromeo 488-Azide	DYC1030.0001	1 mg	€ 240,00
Chromeo 488 Azide	DYC1030.0005	5 mg	€ 940,00
FORMULA: $C_{33}H_{37}N_5O_6$			
MOLECULAR WEIGHT: 599,75 g/mole			
DYC1040 Chromeo 488-Alkyne	DYC1040.0001	1 mg	€ 240,00
Chromeo 488 Alkyne	DYC1040.0005	5 mg	€ 940,00
FORMULA: $C_{33}H_{34}N_2O_6$			
MOLECULAR WEIGHT: 554,6 g/mole			

Spectral and other Properties:

- Absorption 488 nm
- Emission 517 nm
- Extinction coefficient 73.000 l/(mol*cm)
- Quantum Yield 38%





Prices are in EUR, net, exw Germany

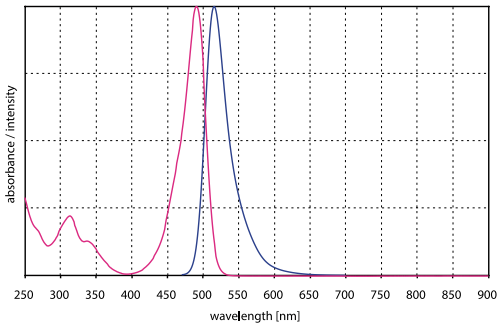
	Article No.	Quantity	Price
DYD1020 DY-490-NHS	DYD1020.0001	1 mg	€ 185,00
DY-490 Succinimidyl Ester FORMULA: $C_{28}H_{22}N_4O_{15}S_3$*$2C_8H_{20}N$ MOLECULAR WEIGHT: 1011,2 g/mole	DYD1020.0005	5 mg	€ 750,00
DYD1025 DY-490-Mal	DYD1025.0001	1 mg	€ 210,00
DY-490 Maleinimide FORMULA: $C_{30}H_{26}N_4O_{14}S_3Na$ MOLECULAR WEIGHT: 799,75 g/mole	DYD1025.0005	5 mg	€ 950,00

Spectral and other Properties:

- Absorption 490 nm
- Emission 515 nm
- Extinction coefficient 73.000 l/(mol*cm)

Soluble in:

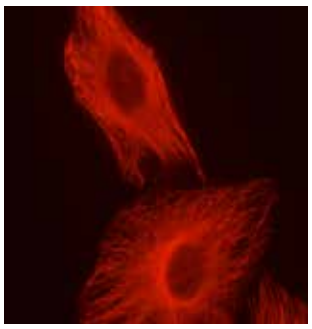
- Water, MeOH, pH-stable Emission, suitable for flow cytometry, FisH microscopy, gel electrophoresis

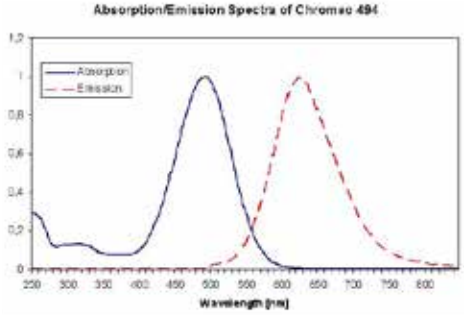


	Article No.	Quantity	Price
DYC2010 Chromeo 494-COOH	DYC2010.0001	1 mg	€ 140,00
Chromeo 494 Carboxylic Acid FORMULA: $C_{26}H_{32}N_2O_4$ MOLECULAR WEIGHT: 436,55 g/mole	DYC2010.0005	5 mg	€ 450,00
DYC2020 Chromeo 494-NHS	DYC2020.0001	1 mg	€ 240,00
Chromeo 494 Succinimidyl Ester FORMULA: $C_{30}H_{36}BrN_3O_6$ MOLECULAR WEIGHT: 614,54 g/mole	DYC2020.0005	5 mg	€ 910,00
DYC2030 Chromeo 494-Azide	DYC2030.0001	1 mg	€ 240,00
Chromeo 494 Azide FORMULA: $C_{29}H_{37}N_6O_3$*Br MOLECULAR WEIGHT: 597,62 g/mole	DYC2030.0005	5 mg	€ 940,00
DYC2040 Chromeo 494-Alkyne	DYC2040.0001	1 mg	€ 240,00
Chromeo 494 Alkyne FORMULA: $C_{29}H_{34}N_3O_3$ MOLECULAR WEIGHT: 472,6 g/mole	DYC2040.0005	5 mg	€ 940,00

Spectral and other Properties:

- Absorption 494 nm
- Emission 628 nm
- Extinction coefficient 55.000 L/(mol*cm)
- Quantum Yield 25%

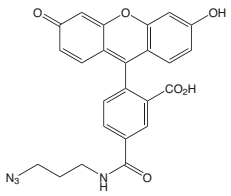




Prices are in EUR, net, exw Germany

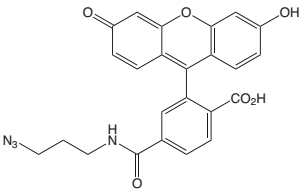
	Article No.	Quantity	Price
DYB1010 5-Carboxyfluoresceine-Azide	DYB1010.0001	1 mg	€ 200,00
	DYB1010.0005	5 mg	€ 600,00

5-(3-Azidopropylcarbamoyl)-2-(6-hydroxy-3-oxo-3H-xanthen-9-yl) benzoic acid
FORMULA: $C_{24}H_{18}N_4O_6$
MOLECULAR WEIGHT: 458,43 g/mole



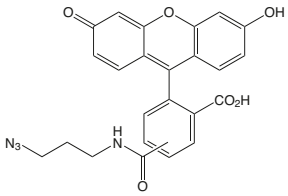
	Article No.	Quantity	Price
DYB1000 6-Carboxyfluoresceine-Azide	DYB1000.0001	1 mg	€ 200,00
	DYB1000.0005	5 mg	€ 600,00
	DYB1000.0100	100 mg	€ 2500,00

6-(3-Azidopropylcarbamoyl)-2-(6-hydroxy-3-oxo-3H-xanthen-9-yl) benzoic acid
FORMULA: $C_{24}H_{18}N_4O_6$
MOLECULAR WEIGHT: 458,43 g/mole



	Article No.	Quantity	Price
DYB1020 5/6-Carboxyfluoresceine-Azide	DYB1020.0001	1 mg	€ 175,00
	DYB1020.0005	5 mg	€ 450,00

5/6-(3-Azidopropylcarbamoyl)-2-(6-hydroxy-3-oxo-3H-xanthen-9-yl) benzoic acid
FORMULA: $C_{24}H_{18}N_4O_6$
MOLECULAR WEIGHT: 458,43 g/mole



Spectral and other Properties:

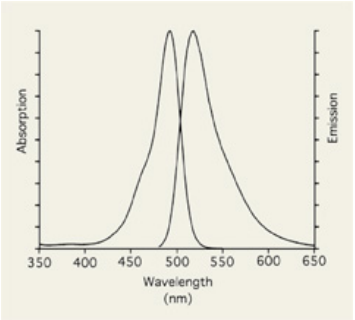
- Absorption 496 nm
- Emission 519 nm

Soluble in:

- DMSO, DMF, MeOH

References:

- *Angew. Chem. Int. Ed.* 2008; **47**: 3442 -3444;
- *Angew. Chem. Int. Ed.* 2008; **47**: 8350-8358;
- *Tetrahedron Lett.* 2005; **46**: 1691-1695.



11.3. Green Excitation (520-570 nm)

	Article No.	Quantity	Price
DYD1030 DY-530-NHS	DYD1030.0001	1 mg	€ 185,00
	DYD1030.0005	5 mg	€ 750,00

DY-530 Succinimidyl Ester
FORMULA: $C_{35}H_{37}N_4O_{12}S_2Na$
MOLECULAR WEIGHT: 792,82 g/mole

	Article No.	Quantity	Price
DYD1035 DY-530-Mal	DYD1035.0001	1 mg	€ 210,00
	DYD1035.0005	5 mg	€ 950,00

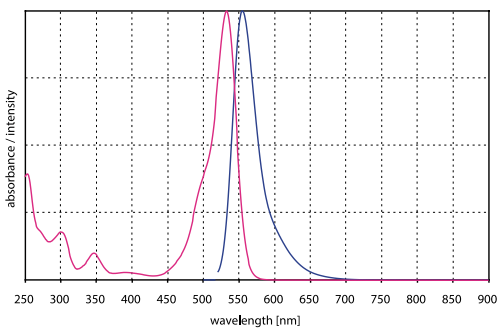
DY-530 Maleinimide
FORMULA: $C_{37}H_{40}N_5O_{11}S_2Na$
MOLECULAR WEIGHT: 817,88 g/mole

Spectral and other Properties:

- Absorption 539 nm
- Emission 561 nm
- Extinction coefficient 100.000 l/(mol*cm)

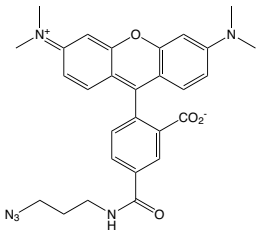
Soluble in:

- Water, MeOH, EtOH, DMF, DMSO



Prices are in EUR, net, exw Germany

	Article No.	Quantity	Price
DYB1030 5-TAMRA-Azide	DYB1030.0001	1 mg	€ 235,00
5-Carboxytetramethylrhodamine-Azide FORMULA: $C_{28}H_{28}N_6O_4$ MOLECULAR WEIGHT: 512,56 g/mole	DYB1030.0005	5 mg	€ 725,00



Spectral and other Properties:

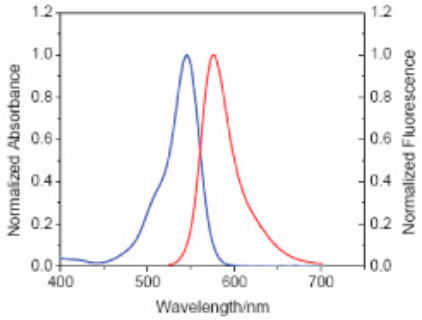
- Absorption 546 nm
- Emission 579 nm
- Extinction coefficient 91.000 l/(mol*cm)

Soluble in:

- DMSO, DMF, MeOH

References:

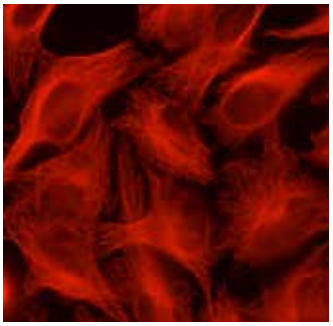
- *Angew. Chem. Int. Ed.* 2008; **47**: 3442-3444.
- *Angew. Chem. Int. Ed.* 2008; **47**: 8350-8358.

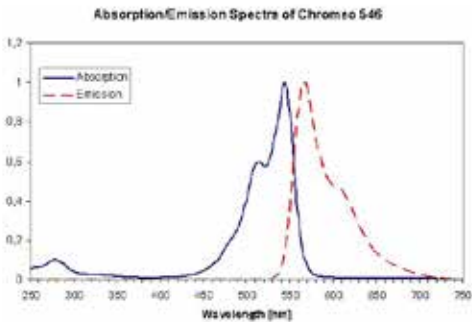


	Article No.	Quantity	Price
DYC3010 Chromeo 546-COOH	DYC3010.0001	1 mg	€ 140,00
Chromeo 546 Carboxylic Acid FORMULA: $C_{35}H_{47}N_2O_5P$ MOLECULAR WEIGHT: 606,74 g/mole	DYC3010.0005	5 mg	€ 450,00
DYC3020 Chromeo 546-NHS	DYC3020.0001	1 mg	€ 240,00
Chromeo 546 Succinimidyl Ester FORMULA: $C_{39}H_{50}N_3O_7P$ MOLECULAR WEIGHT: 703,82 g/mole	DYC3020.0005	5 mg	€ 910,00
DYC3030 Chromeo 546-Azide	DYC3030.0001	1 mg	€ 240,00
Chromeo 546 Azide FORMULA: $C_{38}H_{54}N_6O_4P^*Br$ MOLECULAR WEIGHT: 689,95 g/mole	DYC3030.0005	5 mg	€ 940,00
DYC3040 Chromeo 546-Alkyne	DYC3040.0001	1 mg	€ 240,00
Chromeo 546 Alkyne FORMULA: $C_{38}H_{51}N_3O_4P$ MOLECULAR WEIGHT: 644,8 g/mole	DYC3040.0005	5 mg	€ 940,00

Spectral and other Properties:

- Absorption 545 nm
- Emission 561 nm
- Extinction coefficient 98.800 L/(mol*cm)
- Quantum Yield 10%





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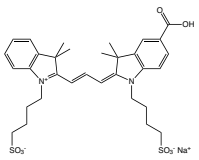
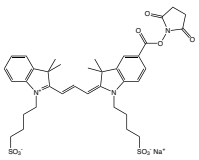
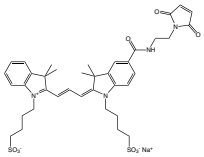
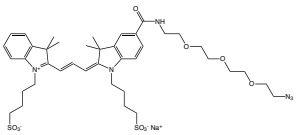
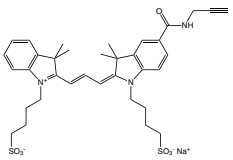
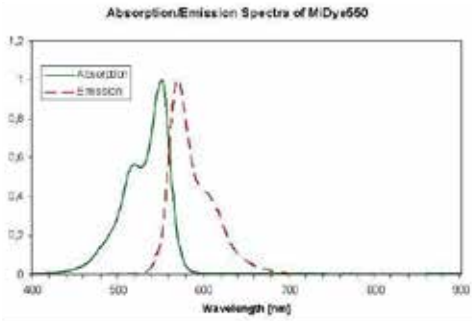
		Article No.	Quantity	Price
DYM1010 MiDye550 Carboxylic Acid $MiDye_{550}$ Carboxylic Acid FORMULA: $C_{32}H_{39}N_2NaO_8S_2$ MOLECULAR WEIGHT: 666,78 g/mole		DYM1010.0001 DYM1010.0005	1 mg 5 mg	€ 175,00 € 450,00
DYM1020 MiDye550 Succinimidyl Ester $MiDye_{550}$ Succinimidyl Ester FORMULA: $C_{36}H_{42}N_3NaO_{10}S_2$ MOLECULAR WEIGHT: 763,85 g/mole		DYM1020.0001 DYM1020.0005	1 mg 5 mg	€ 250,00 € 850,00
DYM1030 MiDye550 Maleiimide $MiDye_{550}$ Maleinimide FORMULA: $C_{38}H_{45}N_4NaO_9S_2$ MOLECULAR WEIGHT: 788,91 g/mole		DYM1030.0001 DYM1030.0005	1 mg 5 mg	€ 280,00 € 950,00
DYM1250 MiDye550-Azide $MiDye_{550}$ amido(ethoxy(ethoxy(ethoxy(ethylazide)))) FORMULA: $C_{40}H_{55}N_6O_{12}S_2$*Na MOLECULAR WEIGHT: 867,02 g/mole		DYM1250.0001 DYM1250.0005	1 mg 5 mg	€ 280,00 € 950,00
DYM1040 MiDye550 Propargylamide $MiDye_{550}$ Propargylamide FORMULA: $C_{35}H_{42}N_3NaO_7S_2$ MOLECULAR WEIGHT: 703,84 g/mole		DYM1040.0001 DYM1040.0005	1 mg 5 mg	€ 280,00 € 950,00

Spectral and other Properties:

- Absorption 550 nm
- Emission 580 nm
- Extinction coefficient 150.000 l/(mol*cm)
- Quantum Yield 15%



The MiDye Chromophore System
has several predominant properties:

- Readily applicable to biolabelling, click conjugation protocols and peptide synthesis.
- Stable under buffer conditions (pH 4-8) and in solid phase peptide synthesis.
- Broadly applied in cell and animal imaging, tested in FRET systems.
- Available in larger quantities compared to e.g. Alexa, Cy-Dyes etc.
- Purities > 85%, supplied as freeze-dried solid powder.

Find more details about MiDye properties and applications in literature:

- Sisson A.L: *et al.*, Biocompatible Functionalized Polyglycerol Microgels with Cell Penetrating Properties. *Angew. Chem. Int. Ed.* 2009; **48**: 7540-7545; DOI: 10.1002/anie.200901583.
- Licha K. *et al.*, Synthesis, Characterization, and Biological Properties of Cyanine-Labeled Somatostatin Analogues as Receptor-Targeted Fluorescent Probes. *Bioconjugate Chem.* 2001; **12**: 44-50.
- Licha K. *et al.*, Optical molecular imaging of lymph nodes using a targeted vascular contrast agent. *Journal of Biomedical Optics* 2005; **10(4)**: 041205.
- Bhargava S. *et al.*, A complete substitutional analysis of VIP for better tumor imaging properties. *J. Mol. Recognit.* 2002; **15**: 145–153; DOI:10.1002/jmr.565.
- Klohs J. *et al.*, Near-infrared fluorescence imaging with fluorescently labeled albumin: A novel method for non-invasive optical imaging of blood-brain barrier impairment after focal cerebral ischemia in mice. *Journal of Neuroscience Methods* 2009; **180(1)**:126-32.
- Becker A. *et al.*, Receptor-targeted optical imaging of tumors with near-infrared fluorescent ligands. *nature biotechnology* 2001; **19(4)**: 327-331.

Prices are in EUR, net, exw Germany

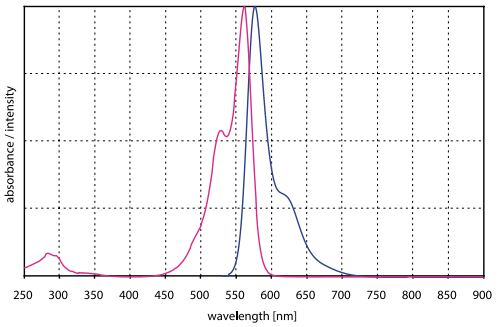
	Article No.	Quantity	Price
DYD1040 DY-549-NHS			
DY-549 Succinimidyl Ester FORMULA: $C_{37}H_{42}N_3O_{16}S_4Na_3$ MOLECULAR WEIGHT: 981,98 g/mole	DYD1040.0001	1 mg	€ 185,00
	DYD1040.0005	5 mg	€ 750,00
DYD1045 DY-549-Mal			
DY-549 Maleinimide FORMULA: $C_{39}H_{45}N_4O_{15}S_4Na_3$ MOLECULAR WEIGHT: 1007,04 g/mole	DYD1045.0001	1 mg	€ 210,00
	DYD1045.0005	5 mg	€ 950,00

Spectral and other Properties:

- Absorption 560 nm
- Emission 575 nm
- Extinction coefficient 150.000 l/(mol*cm)

Soluble in:

- Water, MeOH, very hydrophilic

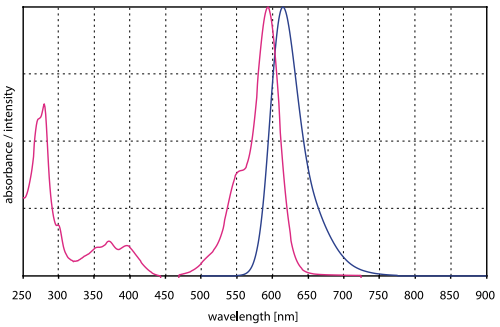


11.4. Orange-Red Excitation (570-660 nm)

	Article No.	Quantity	Price
DYD1050 DY-594-NHS			
DY-594 Succinimidyl Ester FORMULA: $C_{43}H_{45}N_5O_{17}S_4Na_2$ MOLECULAR WEIGHT: 1078,1 g/mole	DYD1050.0001	1 mg	€ 185,00
	DYD1050.0005	5 mg	€ 750,00
DYD1055 DY-594-Mal			
DY-594 Maleinimide FORMULA: $C_{45}H_{50}N_6O_{16}S_4$ MOLECULAR WEIGHT: 1059,19 g/mole	DYD1055.0001	1 mg	€ 210,00
	DYD1055.0005	5 mg	€ 950,00

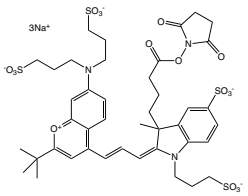
Spectral and other Properties:

- Absorption 594 nm
- Emission 615 nm
- Extinction coefficient 92.000 l/(mol*cm)

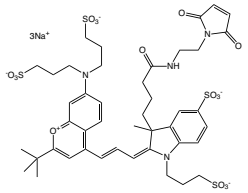


Prices are in EUR, net, exw Germany

	Article No.	Quantity	Price
DYD1060 DY-634-NHS	DYD1060.0001	1 mg	€ 185,00
DY-634 Succinimidyl Ester	DYD1060.0005	5 mg	€ 750,00
FORMULA: $C_{42}H_{50}N_3O_{17}S_4Na_3$			
MOLECULAR WEIGHT: 1066,1 g/mole			



	Article No.	Quantity	Price
DYD1065 DY-634-Mal	DYD1065.0001	1 mg	€ 210,00
DY-634 Maleinimide	DYD1065.0005	5 mg	€ 950,00
FORMULA: $C_{44}H_{53}N_4O_{16}S_4Na_3$			
MOLECULAR WEIGHT: 1091,16 g/mole			

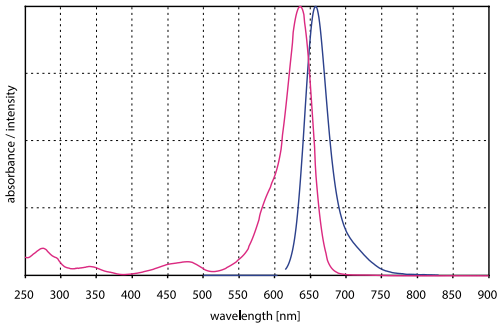


Spectral and other Properties:

- Absorption 635 nm
- Emission 658 nm
- Extinction coefficient 200.000 l/(mol*cm)

Soluble in:

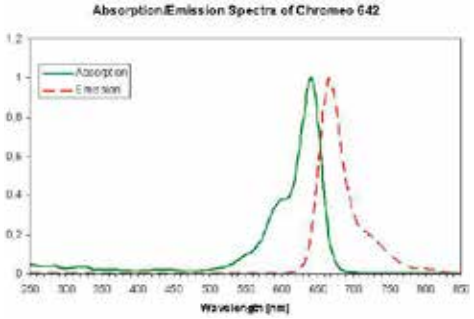
- Water, MeOH, DMF, DMSO



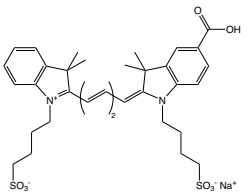
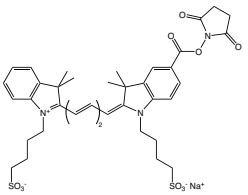
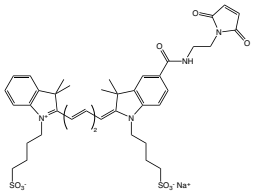
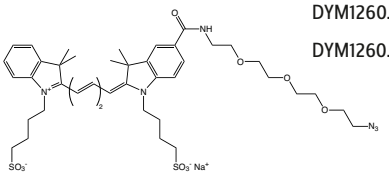
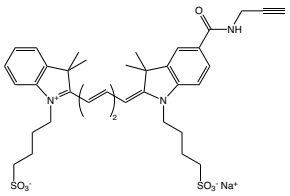
	Article No.	Quantity	Price
DYC4010 Chromeo 642-COOH	DYC4010.0001	1 mg	€ 140,00
Chromeo 642 Carboxylic Acid	DYC4010.0005	5 mg	€ 450,00
FORMULA: $C_{35}H_{45}N_2O_5P$			
MOLECULAR WEIGHT: 604,73 g/mole			
DYC4020 Chromeo 642-NHS	DYC4020.0001	1 mg	€ 240,00
Chromeo 642 Succinimidyl Ester	DYC4020.0005	5 mg	€ 910,00
FORMULA: $C_{39}H_{48}N_3O_7P$			
MOLECULAR WEIGHT: 701,8 g/mole			
DYC4030 Chromeo 642-Azide	DYC4030.0001	1 mg	€ 240,00
Chromeo 642 Azide	DYC4030.0005	5 mg	€ 940,00
FORMULA: $C_{38}H_{52}N_6O_4P^*Br$			
MOLECULAR WEIGHT: 767,83 g/mole			
DYC4040 Chromeo 642-Alkyne	DYC4040.0001	1 mg	€ 240,00
Chromeo 642 Alkyne	DYC4040.0005	5 mg	€ 940,00
FORMULA: $C_{38}H_{48}N_3O_4P$			
MOLECULAR WEIGHT: 641,8 g/mole			

Spectral and other Properties:

- Absorption 642 nm
- Emission 660 nm
- Extinction coefficient 180.000 L/(mol*cm)
- Quantum Yield 15%

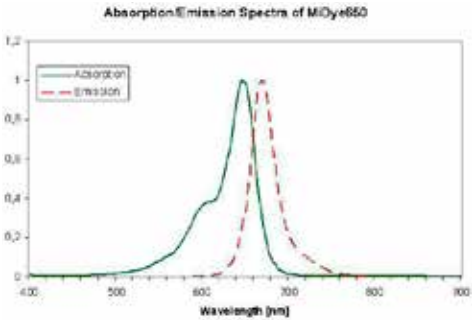


Prices are in EUR, net, exw Germany

		Article No.	Quantity	Price
DYM1110 MiDye650 Carboxylic Acid		DYM1110.0001	1 mg	€ 175,00
MiDye$_{650}$ Carboxylic Acid FORMULA: $C_{34}H_{41}N_2NaO_8S_2$ MOLECULAR WEIGHT: 692,82 g/mole		DYM1110.0005	5 mg	€ 450,00
DYM1120 MiDye650 Succinimidyl Ester		DYM1120.0001	1 mg	€ 250,00
MiDye$_{650}$ Succinimidyl Ester FORMULA: $C_{38}H_{44}N_3NaO_{10}S_2$ MOLECULAR WEIGHT: 789,89 g/mole		DYM1120.0005	5 mg	€ 850,00
DYM1130 MiDye650 Maleiimide		DYM1130.0001	1 mg	€ 280,00
MiDye$_{650}$ Maleinimide FORMULA: $C_{40}H_{47}N_4NaO_9S_2$ MOLECULAR WEIGHT: 814,94 g/mole		DYM1130.0005	5 mg	€ 950,00
DYM1260 MiDye650-Azide		DYM1260.0001	1 mg	€ 280,00
MiDye$_{650}$ amido(ethoxy(ethoxy(ethoxy(ethylazide)))) FORMULA: $C_{42}H_{57}N_6O_{12}S_2$*Na MOLECULAR WEIGHT: 893,06 g/mole		DYM1260.0005	5 mg	€ 950,00
DYM1140 MiDye650 Propargylamide		DYM1140.0001	1 mg	€ 280,00
MiDye$_{650}$ Propargylamide FORMULA: $C_{37}H_{44}N_3NaO_7S_2$ MOLECULAR WEIGHT: 729,88 g/mole		DYM1140.0005	5 mg	€ 950,00

Spectral and other Properties:

- Absorption 647 nm
- Emission 673 nm
- Extinction coefficient 255.000 l/(mol*cm)
- Quantum Yield 30%



Prices are in EUR, net, exw Germany

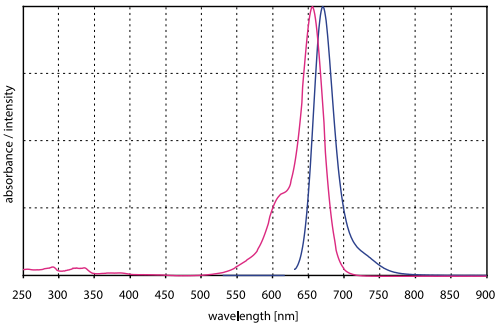
	Article No.	Quantity	Price
DYD1070 DY-649-NHS	DYD1070.0001	1 mg	€ 185,00
DY-649 Succinimidyl Ester FORMULA: $C_{39}H_{44}N_3O_{16}S_4Na_3$ MOLECULAR WEIGHT: 1008,02 g/mole	DYD1070.0005	5 mg	€ 750,00
DYD1075 DY-649-Mal	DYD1075.0001	1 mg	€ 210,00
DY-649 Maleinimide FORMULA: $C_{41}H_{47}N_4O_{15}S_4Na_3$ MOLECULAR WEIGHT: 1033,08 g/mole	DYD1075.0005	5 mg	€ 950,00

Spectral and other Properties:

- Absorption 655 nm
- Emission 676 nm
- Extinction coefficient 250.000 l/(mol*cm)

Soluble in:

- Water, MeOH



11.5. NIR Excitation (> 660 nm)

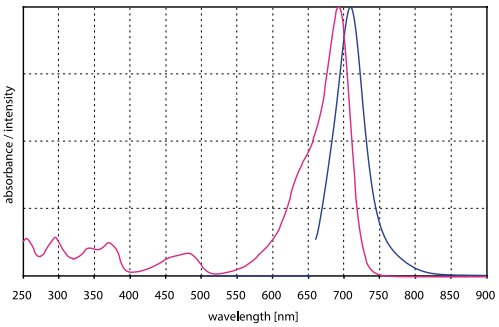
	Article No.	Quantity	Price
DYD1080 DY-682-NHS	DYD1080.0001	1 mg	€ 185,00
DY-682 Succinimidyl Ester FORMULA: $C_{41}H_{49}N_3O_{14}S_3Na_2$ MOLECULAR WEIGHT: 950,03 g/mole	DYD1080.0005	5 mg	€ 750,00
DYD1085 DY-682-Mal	DYD1085.0001	1 mg	€ 210,00
DY-682 Maleinimide FORMULA: $C_{43}H_{52}N_4O_{13}S_3Na_2$ MOLECULAR WEIGHT: 975,08 g/mole	DYD1085.0005	5 mg	€ 950,00

Spectral and other Properties:

- Absorption 692 nm (in EtOH)
- Emission 709 nm (in EtOH)
- Extinction coefficient 140.000 l/(mol*cm)

Soluble in:

- Water, MeOH, DMF, DMSO



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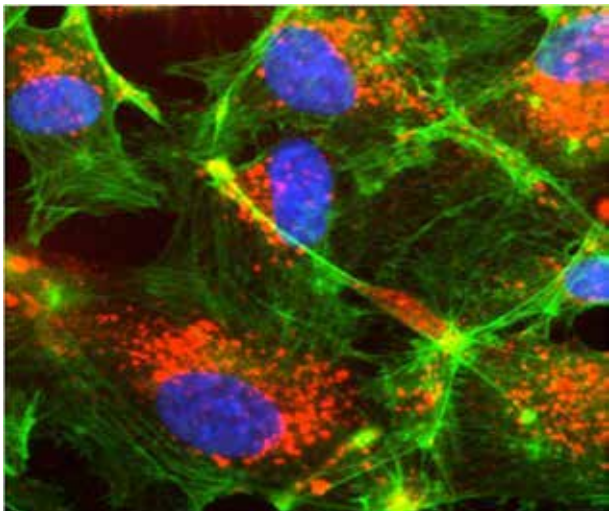
The MiDye Chromophore System



The MiDye Chromophore System has several predominant properties:

- ✔ Readily applicable to biolabelling, click conjugation protocols and peptide synthesis.
- ✔ Stable under buffer conditions (pH 4-8) and in solid phase peptide synthesis.
- ✔ Broadly applied in cell and animal imaging, tested in FRET systems.
- ✔ Available in larger quantities compared to e.g. Alexa, Cy-Dyes etc.
- ✔ Purities > 85%, supplied as freeze-dried solid powder.

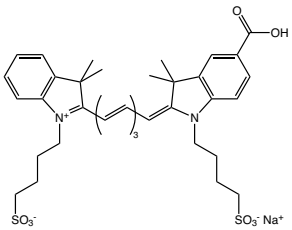
Find more details about MiDye properties and applications in literature:

- Sisson A.L: *et al.*, Biocompatible Functionalized Polyglycerol Microgels with Cell Penetrating Properties. *Angew. Chem. Int. Ed.* 2009; **48**: 7540–7545; DOI: 10.1002/anie.200901583.
- Licha K. *et al.*, Synthesis, Characterization, and Biological Properties of Cyanine-Labeled Somatostatin Analogues as Receptor-Targeted Fluorescent Probes. *Bioconjugate Chem.* 2001; **12**: 44-50.
- Licha K. *et al.*, Optical molecular imaging of lymph nodes using a targeted vascular contrast agent. *Journal of Biomedical Optics* 2005; **10(4)**: 041205.
- Bhargava S. *et al.*, A complete substitutional analysis of VIP for better tumor imaging properties. *J. Mol. Recognit.* 2002; **15**: 145–153; DOI:10.1002/jmr.565.
- Klohs J. *et al.*, Near-infrared fluorescence imaging with fluorescently labeled albumin: A novel method for non-invasive optical imaging of blood-brain barrier impairment after focal cerebral ischemia in mice. *Journal of Neuroscience Methods* 2009; **180(1)**:126-32.
- Becker A. *et al.*, Receptor-targeted optical imaging of tumors with near-infrared fluorescent ligands. *nature biotechnology* 2001; **19(4)**: 327-331.

		Article No.	Quantity	Price
DYM1210	**MiDye750 Carboxylic Acid**	DYM1210.0001	1 mg	€ 175,00
		DYM1210.0005	5 mg	€ 450,00
DYM1220	**MiDye750 Succinimidyl Ester**	DYM1220.0001	1 mg	€ 250,00
		DYM1220.0005	5 mg	€ 850,00
DYM1230	**MiDye750 Maleiimide**	DYM1230.0001	1 mg	€ 280,00
		DYM1230.0005	5 mg	€ 950,00

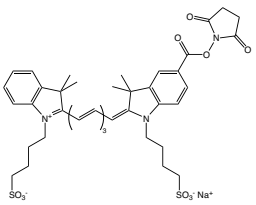
DYM1210 MiDye750 Carboxylic Acid

$MiDye_{750}$ Carboxylic Acid
FORMULA: $C_{36}H_{43}N_2NaO_8S_2$
MOLECULAR WEIGHT: 718,85 g/mole



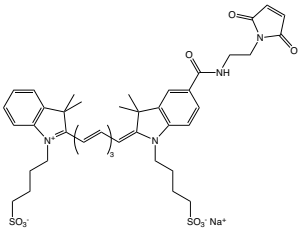
DYM1220 MiDye750 Succinimidyl Ester

$MiDye_{750}$ Succinimidyl Ester
FORMULA: $C_{40}H_{46}N_3NaO_{10}S_2$
MOLECULAR WEIGHT: 815,93 g/mole



DYM1230 MiDye750 Maleiimide

$MiDye_{750}$ Maleinimide
FORMULA: $C_{42}H_{49}N_4NaO_9S_2$
MOLECULAR WEIGHT: 840,98 g/mole



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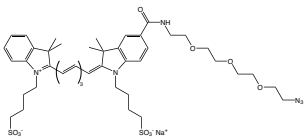
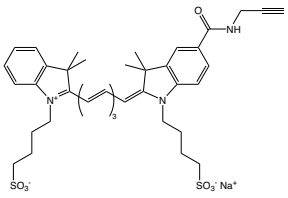
	Article No.	Quantity	Price
DYM1270 MiDye750-Azide	DYM1270.0001	1 mg	€ 280,00
	DYM1270.0005	5 mg	€ 950,00

$MiDye_{750}$ amido(ethoxy(ethoxy(ethoxy(ethylazide))))
FORMULA: $C_{44}H_{59}N_6O_{12}S_2{}^*Na$
MOLECULAR WEIGHT: 919,09 g/mole



	Article No.	Quantity	Price
DYM1240 MiDye750 Propargylamide	DYM1240.0001	1 mg	€ 280,00
	DYM1240.0005	5 mg	€ 950,00

$MiDye_{750}$ Propargylamide
FORMULA: $C_{39}H_{46}N_3NaO_7S_2$
MOLECULAR WEIGHT: 755,92 g/mole

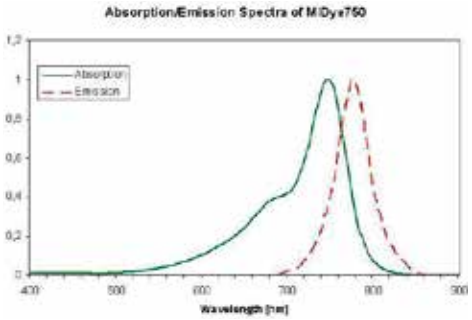


Spectral and other Properties:

- Absorption 747 nm
- Emission 782 nm
- Extinction coefficient 190.000 l/(mol*cm)
- Quantum Yield 9%

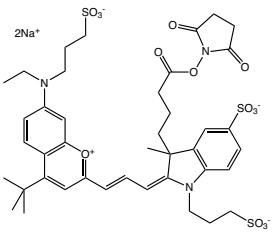
Soluble in:

- DMF, DMSO



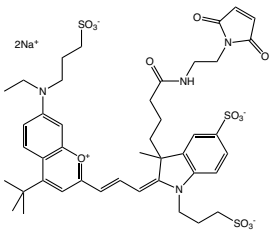
	Article No.	Quantity	Price
DYD1090 DY-782-NHS	DYD1090.0001	1 mg	€ 185,00
	DYD1090.0005	5 mg	€ 750,00

DY-782 Succinimidyl Ester
FORMULA: $C_{43}H_{51}N_3O_{14}S_3Na_2$
MOLECULAR WEIGHT: 976,07 g/mole



	Article No.	Quantity	Price
DYD1095 DY-782-Mal	DYD1095.0001	1 mg	€ 210,00
	DYD1095.0005	5 mg	€ 950,00

DY-782 Maleinimide
FORMULA: $C_{45}H_{54}N_4O_{13}S_3Na_2$
MOLECULAR WEIGHT: 1001,12 g/mole

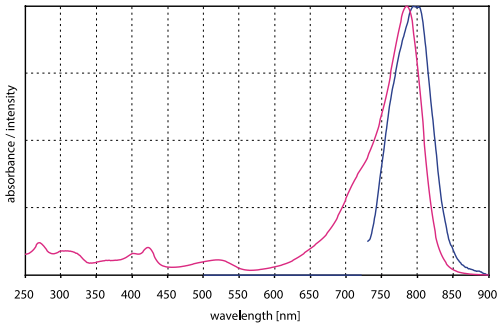


Spectral and other Properties:

- Absorption 785 nm
- Emission 794 nm
- Extinction coefficient 170.000 l/(mol*cm)

Soluble in:

- Water, MeOH



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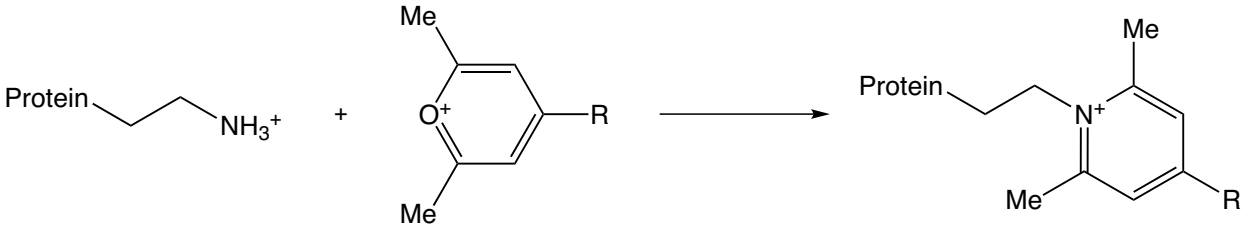
11.6. Py-Dyes

Py-Dyes (pyrylium dyes) have certain advantages compared to other dyes:

- They change their color and become fluorescent upon reacting with primary amines. This shift in absorption and large increase in fluorescence quantum yield upon binding eliminates background effects from unbound dye.
- These dyes are supplied ready to label in a fast, simple procedure with no need to purify the conjugated protein afterwards.
- Py-Dyes are small in size and do not change the net charge of the protein, making them ideal for any electrophoretic application.



			Article No.	Quantity	Price
DYP1010	**Py-Dye 429**	▶ Absorption 429 nm ▶ Emission 536 nm ▶ Extinction coefficient 75.000 l/(mol*cm) ▶ Quantum Yield 10%	DYP1010.0001	1 mg	€ 280,00
Py-Dye 429 FORMULA: $C_{16}H_{16}ClNO_5S$ MOLECULAR WEIGHT: 369,82 g/mole			DYP1010.0005	5 mg	€ 810,00
DYP1050	**Py-Dye 465**	▶ Absorption 465 nm ▶ Emission 630 nm ▶ Extinction coefficient 25.000 l/(mol*cm) ▶ Quantum Yield 14%	DYP1050.0001	1 mg	€ 280,00
Py-Dye 465 FORMULA: $C_{19}H_{22}NO*BF_4$ MOLECULAR WEIGHT: 367,19 g/mole			DYP1050.0005	5 mg	€ 810,00
DYP1110	**Py-Dye 503**	▶ Absorption 503 nm ▶ Emission 600 nm ▶ Extinction coefficient 24.000 l/(mol*cm) ▶ Quantum Yield 50%	DYP1110.0001	1 mg	€ 280,00
Py-Dye 503 FORMULA: $C_{21}H_{24}NO*BF_4$ MOLECULAR WEIGHT: 393,29 g/mole			DYP1110.0005	5 mg	€ 810,00
DYP1150	**Py-Dye 540**	▶ Absorption 533 nm ▶ Emission 627 nm ▶ Extinction coefficient 50.000 l/(mol*cm) ▶ Quantum Yield 20%	DYP1150.0001	1 mg	€ 280,00
Py-Dye 540 FORMULA: $C_{25}H_{26}NO*BF_4$ MOLECULAR WEIGHT: 433,29 g/mole			DYP1150.0005	5 mg	€ 810,00
DYP1210	**Py-Dye 543**	▶ Absorption 543 nm ▶ Emission 590 nm ▶ Extinction coefficient 57.000 l/(mol*cm) ▶ Quantum Yield 15%	DYP1210.0001	1 mg	€ 280,00
Py-Dye 543 FORMULA: $C_{18}H_{18}NOS*BF_4$ MOLECULAR WEIGHT: 383,41 g/mole			DYP1210.0005	5 mg	€ 810,00

References:

- Hoffmann K. *et al.*, Monitoring of Amino Functionalities on Plasma-Chemically Modified Polypropylene Supports with a Chromogenic and Fluorogenic Pyrylium Reporter. *Langmuir* 2007; **23**: 8411-16.
- Lauren M. *et al.*., Attomole protein analysis by CIEF with LIF Detection. *Electrophoresis* 2009; **30**: 297-302.
- Oluwatosin O. *et al.*., Capillary array isoelectric focusing with laser-induced fluorescence detection: milli-pH unit resolution and yoctomole mass detection limits in a 32-channel system. *Anal. Bioanal. Chem.* 2010 ;**397(8)**:3305-10

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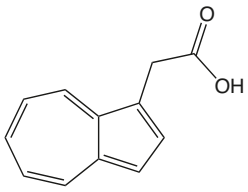
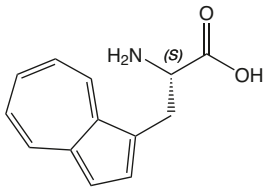
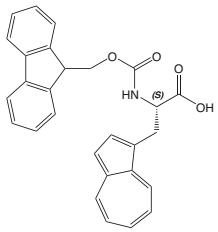
11.7. Azulene-Label

Azulene is an isomer of naphthalene. Whereas naphthalene is colorless, azulene is dark blue. In order to achieve a stable aromatic sextet in both rings, one electron from the seven-membered ring is transferred to the five-membered ring. The dipolar nature of the ground state is reflected in its deep color, which is unusual for small unsaturated aromatic compounds. Azulene is the only known example of a compound in which the fluorescence transition originates from the second electronically excited singlet state ($S_2 \rightarrow S_0$) rather than from the lowest one ($S_1 \rightarrow S_0$), thus violating Kasha's rule.

		Article No.	Quantity	Price
RL-2015 **AzAcOH** Azulene-1-yl-acetic acid FORMULA: $C_{12}H_{10}O_2$ MOLECULAR WEIGHT: 186,21		RL-2015.0250 RL-2015.0001	250 mg 1 g	€ 525,00 € 1500,00
HAA2016 **H-L-Ala(Azulene)-OH** beta-(1-Azulenyl)-L-Alanine FORMULA: $C_{13}H_{13}NO_2$ MOLECULAR WEIGHT: 215,25 g/mole		HAA2016.0250 HAA2016.0001	250 mg 1 g	€ 450,00 € 1250,00
FAA3195 **Fmoc-L-Ala(Azulene)-OH** N-alpha-(9-Fluorenylmethyloxycarbonyl)-beta-(1-azulenyl)-L-alanine FORMULA: $C_{28}H_{23}NO_4$ MOLECULAR WEIGHT: 437,49 g/mole		FAA3195.0100 FAA3195.0500 FAA3195.1000	100 mg 500 mg 1 g	€ 375,00 € 1250,00 € 1950,00

References:

- Binsch G. *et al.*, On the fluorescence anomaly of azulene. *Chemical Physics Letters* 1967; **1(4)**: 135-138.
- Abou-Zied O.K. *et al.*, S2–S0Spectroscopy of Azulene and Its 2-Chloro, 2-Methyl, and 1,3-Dimethyl Derivatives. *J. Mol. Spectroscopy* 1997; **183 (1)**: 42-56.

Need dyes for different wavelengths, alternative functional modifications, DNA stains, protein stains or quenchers? Do not hesitate to inquire via info@iris-biotech.de.

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12. Index

12.1. Code Index

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12.2. Name Index

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13. Terms and Conditions of Sales

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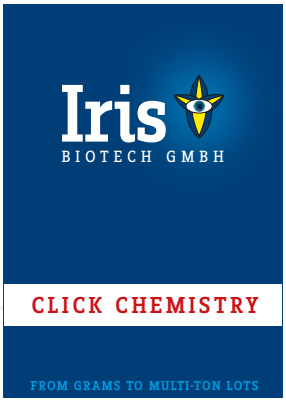

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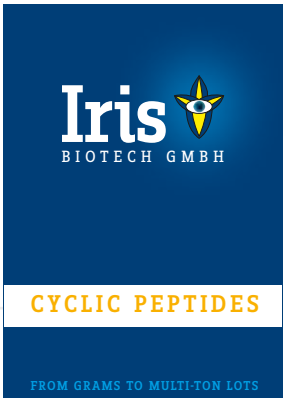

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