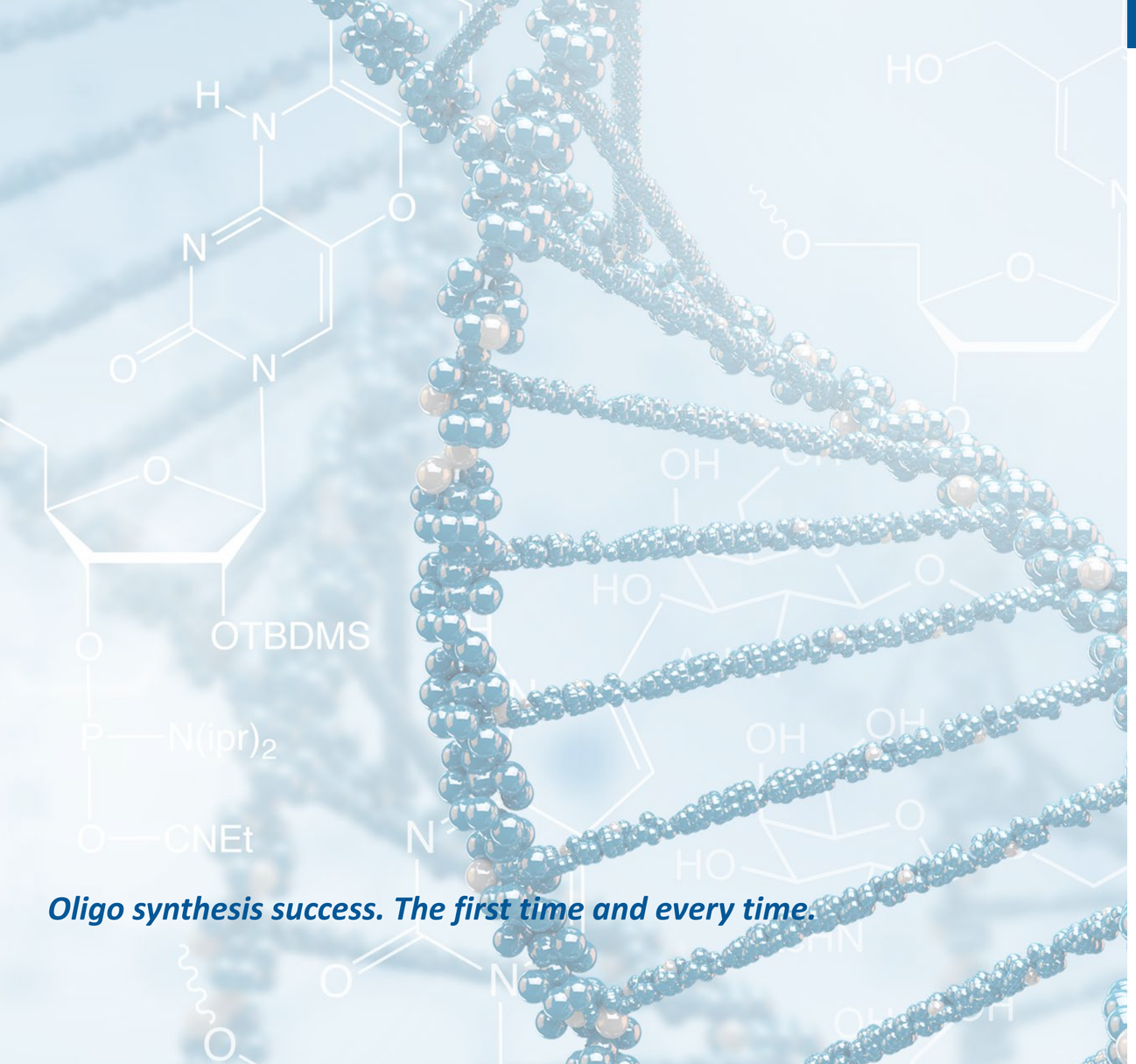

# Products for DNA Research

2019 Catalog of Modification and Labeling

GLEN RESEARCH

part of Maravai LifeSciences




*Oligo synthesis success. The first time and every time.*

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## ABOUT US

Glen Research develops, manufactures and markets reagents for oligonucleotide synthesis, modification, labeling and purification. The company serves customers worldwide involved in basic research, diagnostics and therapeutics. Although Glen Research's original mission was to provide state-of-the-art reagents to researchers, the company also began offering standard reagents for oligonucleotide synthesis but with the innovation that every batch was accompanied by a Certificate of Analysis. The analytical techniques and quality criteria used for the evaluation and acceptance of these reagents were to become an industry standard years later. The company is headquartered in Sterling, Virginia. A privately held company, Glen Research was acquired by Maravai LifeSciences in December 2017.

## OVER 30 YEARS OF ASSURED QUALITY FOR OLIGO SYNTHESIS

**1987**
Glen Research was incorporated in the Commonwealth of Virginia

**1991**
Company awarded SBIR grant for the investigation of large scale oligonucleotide synthesis using H-phosphonate chemistry

**1993**
Glen Research introduced the Sterling line of products, a new standard of quality for oligonucleotide synthesis

**1995**
Glen Research negotiated an exclusive agreement to supply 5'-biotin phosphoramidite worldwide

**1996**
Company negotiated an exclusive license with Gilead Sciences to supply C5-propynyl pyrimidine nucleosides and G-Clamp phosphoramidites

**1997**
Glen Research moves into a custom built building in Sterling, Virginia

**1999**
Company awarded patents for a chemical phosphorylation reagent compatible with DMT-ON purification

**2002**
Company made an agreement with Epoch Biosciences, Inc. to supply their proprietary dyes and nucleosides to the research market

**2003**
Glen Research negotiated an agreement with GE Healthcare Biosciences Corp. to supply Cyanine Dyes to the research market

**2004**
Company awarded patents for a truly universal support for oligonucleotide synthesis - US III.

**2006**
In collaboration with Berry & Associates, Inc., Glen Research awarded patents for pyrrolo-C analogues (fluorescent C analogues).

**2008**
Glen Research obtained a license for the sale of Glen UnySupport from Ionis Pharmaceuticals

**2013**
In collaboration with Nelson Biotechnologies, Inc., company awarded patent for serinol phosphoramidites and supports

**2017**
Glen Research is acquired by Maravai LifeSciences





### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

***(Please inquire for availability of vials and columns for other instrument types.)***

## CATALOG

Welcome to the Glen Research Catalog containing the most complete selection of products for DNA and RNA research. The Table of Contents at the beginning and the Index at the end of the Catalog are the most comprehensive we have produced. There are always limitations to printed catalogs in a fast-moving technology sector and a complete and up-to-date catalog is also maintained on our web site.

All minor bases, modifiers and RNA products are packaged for Applied Biosystems instruments. We can provide vials and columns for a wide variety of other instruments. As shown in the table to the left, we can accommodate catalog numbers for unusual products to fit all popular instruments. The table to the left is reproduced on all relevant spreads of this catalog.

We are unique in conducting a QC test for supports to show the length of oligo that can be prepared before a drop-off in coupling due to steric effects begins to occur. The drop-off point is recorded in the Certificate of Analysis or Analytical Report. Unless otherwise specified, our minor base and modification supports are 1000Å CPG, which results in improved performance and the ability to make much longer oligos. Polystyrene supports are also available for some of our most popular items.

For reasons of quality assurance, we do not transfer powders or oils from stock Applied Biosystems vials to vials for other instruments. Powders may be hygroscopic and electrostatic, making transfer difficult, and oils have to be dissolved and the solvent evaporated. For best performance, it is preferable for the customer to dissolve the product and immediately transfer the solution to the correct instrument vial. Consequently, the product will be delivered in an industry-standard septum-capped vial along with a clean dry vial for the appropriate instrument.

Glen Research's distributors cover a very significant percentage of countries where oligonucleotide synthesis is commonly practiced. Our vast selection of unusual products is really only comprehensively stocked here in Virginia and some of our web viewers have asked us to set up a direct shipping channel. For them, we offer the eGlen program which is described in the following web link: http://www.glenresearch.com/Reference/eGlen.html.

Authorized distributors for Glen Research products are listed below. Other countries not listed are covered by direct sales from our Sterling, USA office.

**UK and Ireland**
Cambio Ltd
Telephone Number: +44 (0) 1954 210200
Fax Number: +44 (0) 1954 210300
e-mail addresses: support@cambio.co.uk and orders@cambio.co.uk
Website: http://www.cambio.co.uk/

**Nordic and Baltic Countries**
BioNordika AS
Telephone Number: +47 23 03 58 00
Fax Number: +47 23 03 58 01
e-mail address: info@bionordika.no
Website: http://www.bionordika.no/

**Japan**
Nihon Techno Service Co., Ltd.
Telephone Number: +81 29 886 6811
Fax Number: +81 29 870 0210
e-mail address: info@ntsbio.com
Website: http://www.ntsbio.com/

**China**
Beijing LeBo Biotech Co.,Ltd
Telephone Number: +86-10-52405563
Fax Number: +86-10-58850899
email address: info@lab-bio.com
Website:http://www.lab-bio.com/

**Belgium**
Eurogentec S.A.
Telephone Number: +32 4 372 74 00
Fax Number: +32 4 372 75 00
e-mail address: info@eurogentec.com
Website: http://www.eurogentec.com/

**Israel**
Eisenberg Bros. Ltd.
Telephone Number: 972-3-9777000
Fax Number: 972-3-9777001
e-mail address: nicoles@eb1.co.il
Website: http://www.eisenbros.co.il/

**Netherlands**
Eurogentec b.v.
Telephone Number: +31 43 352 06 98
Fax Number: +31 43 354 19 65
e-mail address: info@eurogentec.com

**Germany**
Eurogentec GmbH
Telephone Number: +49 221 258 94 55
Fax Number: +49 221 258 94 54
e-mail address: info@eurogentec.com

**France**
Eurogentec s.a.
Telephone Number: +33 2 41 73 33 73
Fax Number: +33 2 41 73 10 26
e-mail address: info@eurogentec.com

**Republic of Korea**
Bosung Scientific Co., Ltd.
Telephone Number: +82-02-6105-5630
Fax Number: +82-02-6105-5680
email address: info@bosungsci.com
Website: https://bosungsci.com/

## TERMINUS MODIFIERS

### INTELLECTUAL PROPERTY

5′-Carboxy-Modifier C10 is offered for sale under license from TriLink BioTechnologies, Inc. It is intended for research and development purposes only, and may not be used for commercial, clinical, diagnostic or any other use. It is covered under US Patent No. 6,320,041.

### SEE ALSO

*PC modifiers on page 16*

### ABBREVIATIONS

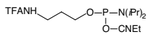
CNEt = Cyanoethyl
CPG = Controlled Pore Glass
DMT = 4,4′-Dimethoxytrityl
Fmoc = Fluorenylmethoxycarbonyl
iPr = Isopropyl
MMT = 4-Monomethoxytrityl
T = Trityl
TFA = Trifluroacetyl

Glen Research 5′-Modifiers are designed for use in DNA synthesizers to functionalize the 5′-terminus of the target oligonucleotide. The 5′-Amino-Modifiers are available with a variety of chain lengths to fit exactly the desired application.

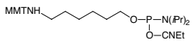
The DMS(O)MT-protected amino group is easier to deprotect compared to the MMT-protected one. The sulfoxy derivative survives conditions of oligonucleotide synthesis and can either be cleaved with standard deblock solution, or left intact for HPLC purification. At the same time, the DMS(O)MT group is fully compatible with cartridge purification. When detritylation on a cartridge is carried out, the DMS(O)MT+, which is more stable than MMT+, does not reattach itself to an amine. We now offer 5′-DMS(O)MT-Amino-Modifier C6 utilizing this new trityl based protecting group.

5′-Amino-Modifier TEG, a hydrophilic triethylene glycol ethylamine derivative, is 12 atoms in length and fully soluble in aqueous media.

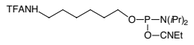
| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| 5′-Amino-Modifier C3-TFA | 10-1923-90 | 100 µmole | 50.00 |
| | 10-1923-02 | 0.25g | 175.00 |
| 5′-Amino-Modifier C6 | 10-1906-90 | 100 µmole | 60.00 |
| | 10-1906-02 | 0.25g | 200.00 |
| 5′-Amino-Modifier C6-TFA | 10-1916-90 | 100 µmole | 30.00 |
| | 10-1916-02 | 0.25g | 100.00 |
| 5′-Amino-Modifier C12 | 10-1912-90 | 100 µmole | 90.00 |
| | 10-1912-02 | 0.25g | 300.00 |
| 5′-Amino-Modifier 5 | 10-1905-90 | 100 µmole | 60.00 |
| | 10-1905-02 | 0.25g | 200.00 |
| 5′-DMS(O)MT-Amino-Modifier C6 | 10-1907-90 | 100 µmole | 60.00 |
| | 10-1907-02 | 0.25g | 200.00 |
| 5′-Amino-Modifier TEG | 10-1917-90 | 100 µmole | 115.00 |
| | 10-1917-02 | 0.25g | 500.00 |
| Methacrylate C6 Phosphoramidite | 10-1891-90 | 100 µmole | 110.00 |
| | 10-1891-02 | 0.25g | 650.00 |



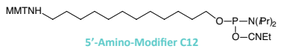
5′-Amino-Modifier C3-TFA



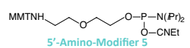
5′-Amino-Modifier C6



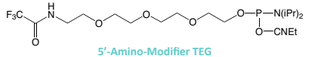
5′-Amino-Modifier C6-TFA



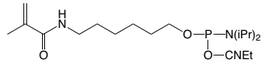
5′-Amino-Modifier C12



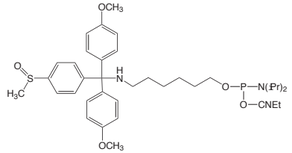
5′-Amino-Modifier 5



5′-Amino-Modifier TEG



Methacrylate C6 Phosphoramidite



5′-DMS(O)MT-Amino-Modifier C6





## TERMINUS MODIFIERS (CONT.)

Our more recent 5′-amino modifiers, protected by a novel phthalic acid diamide (PDA) protecting group, are stable solids. In contrast to the TFA protected amino modifiers, which are viscous oils, the analogous PDA protected compounds are granular powders. This important property of these compounds allows straightforward handling, storage and aliquoting and leads to a significant increase in stability.

Deprotection with methylamine in gas phase or aqueous solution or AMA leads to fast and complete removal of the PDA protecting group. However, ammonium hydroxide will not drive the equilibrium reaction to completion and only partial deprotection occurs - overnight deprotection with ammonium hydroxide will yield around 80% active amine.

We are offering three PDA Amino-Modifiers:

- 5′-Amino-Modifier C6-PDA
- Hydrophobic 5′-Amino-Modifier C12-PDA
- Hydrophilic 5′-Amino-Modifier-TEG-PDA

| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| 5′-Amino-Modifier C6-PDA | 10-1947-90 | 100 µmole | 30.00 |
| | 10-1947-02 | 0.25g | 100.00 |
| 5′-Amino-Modifier C12-PDA | 10-1948-90 | 100 µmole | 65.00 |
| | 10-1948-02 | 0.25g | 240.00 |
| 5′-Amino-Modifier-TEG-PDA | 10-1949-90 | 100 µmole | 105.00 |
| | 10-1949-02 | 0.25g | 420.00 |

### INTELLECTUAL PROPERTY

PDA amino-modifiers were eveloped by Stefan Pitsch and ReseaChem GmbH (S. Berger), Patent pending.

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

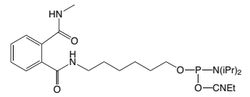
Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

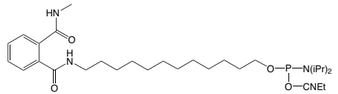
Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

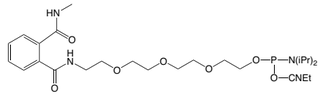
***(Please inquire for availability of vials and columns for other instrument types.)***



5′-Amino-Modifier C6-PDA



5′-Amino-Modifier C12-PDA



5′-Amino-Modifier-TEG-PDA

## TERMINUS MODIFIERS (CONT.)

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

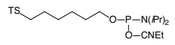
*(Please inquire for availability of vials and columns for other instrument types.)*

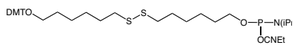
### INTELLECTUAL PROPERTY

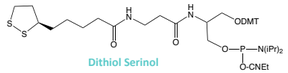
5′-Maleimide Modifier Phosphoramidite is protected by a patent application and is offered by Glen Research under a non-exclusive license agreement from the University of Barcelona.

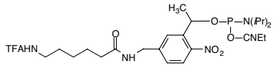
The disulfide thiol modifier may be used for introducing 3′- or 5′-thiol linkages. Dithiol Serinol, produced from lipoic acid and our patented serinol backbone, allows easy connection of multiply dithiol-labeled oligos to gold surfaces. 5′-Carboxy-Modifier C10 is a unique linker designed to be added at the terminus of an oligonucleotide synthesis. It generates an activated carboxylic acid N-hydroxysuccinimide (NHS) ester suitable for immediate conjugation on the synthesis column with molecules containing a primary amine, resulting in a stable amide linkage. An alternative carboxylate protecting group is the 2-chlorotrityl group, which is simply removed using the standard deblock cycle to generate a free carboxyl group on an otherwise fully protected oligonucleotide. The 2-chlorotrityl group is also removed during oligo deprotection with ammonium hydroxide or AMA and is incompatible with RP purification techniques. PC Amino-Modifier is a photocleavable C6 amino-modifier, part of our line of photocleavable (PC) modifiers. 5′-AminoOxy-Modifier 11 is based on a tetraethylene glycol linkage for improved solubility and for reducing the potential negative impact on hybridization of the oligo. The oxime formed from the reaction of alkyloxyamines with aldehydes creates a stable covalent bond. In comparison, the imine formed by the conjugation of primary amines with aldehydes is not stable to acidic or basic conditions and requires subsequent reduction with borohydride to form stable amine conjugates. 5′-Maleimide Modifier Phosphoramidite, developed at the University of Barcelona, incorporates a maleimide cycloadduct that is stable to ammonium hydroxide at room temperature. This phosphoramidite can be incorporated into DNA and RNA with both phosphate and phosphorothioate linkages. A retro–Diels-Alder reaction deprotects the maleimide immediately prior to conjugation.

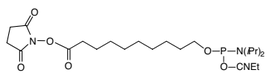
| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| 5′-Thiol-Modifier C6 | 10-1926-90 | 100 µmole | 60.00 |
| | 10-1926-02 | 0.25g | 200.00 |
| Thiol-Modifier C6 S-S | 10-1936-90 | 100 µmole | 150.00 |
| | 10-1936-02 | 0.25g | 360.00 |
| Dithiol Serinol Phosphoramidite | 10-1991-95 | 50 µmole | 120.00 |
| | 10-1991-90 | 100 µmole | 215.00 |
| | 10-1991-02 | 0.25g | 585.00 |
| PC Amino-Modifier Phosphoramidite | 10-4906-90 | 100 µmole | 135.00 |
| | 10-4906-02 | 0.25g | 395.00 |
| 5′-Carboxy-Modifier C10 | 10-1935-90 | 100 µmole | 65.00 |
| | 10-1935-02 | 0.25g | 265.00 |
| 5′-Carboxy-Modifier C5 | 10-1945-90 | 100 µmole | 95.00 |
| | 10-1945-02 | 0.25g | 330.00 |
| 5′-AminoOxy-Modifier 11 | 10-1919-95 | 50 µmole | 140.00 |
| | 10-1919-90 | 100 µmole | 265.00 |
| | 10-1919-02 | 0.25g | 895.00 |
| 5′-Maleimide-Modifier Phosphoramidite | 10-1938-90 | 100 µmole | 70.00 |
| | 10-1938-02 | 0.25g | 335.00 |

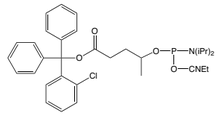

5′-Thiol-Modifier C6

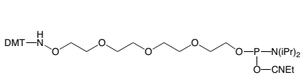

Thiol-Modifier C6 S-S

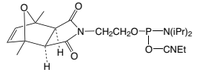

Dithiol Serinol


PC Amino-Modifier


5′-Carboxy-Modifier C10


5′-Carboxy-Modifier C5


5′-AminoOxy-Modifier 11


5′-Maleimide-Modifier

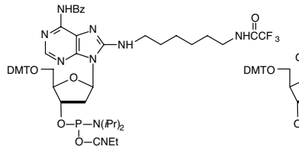


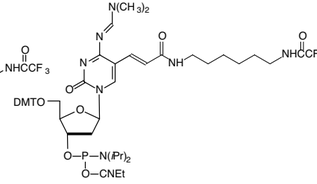


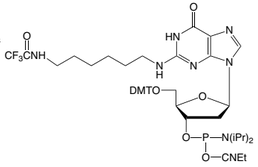
## SEQUENCE MODIFIERS

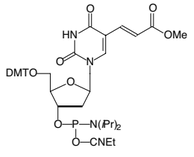
Sequence Modifiers are designed for use in automated synthesis. The carboxy-dT is hydrolyzed during deprotection and can be coupled directly to a molecule containing a primary amino group by a standard peptide coupling or via the intermediate N-hydroxysuccinimide (NHS) ester. Amino-Modifier dA, Amino-Modifier dC, N2-Amino-Modifier dG and both Amino-Modifier dT products can be added in place of a dA, dC, dG and dT residue, respectively, during oligonucleotide synthesis. Corresponding Amino-Modifier supports can replace their respective deoxynucleoside supports. After deprotection, the primary amine on the C6 analogues is separated from the oligonucleotide by a spacer arm with a total of 7 -10 atoms and can be labeled or attached to an enzyme. The C2 analogue is more suitable for the attachment of molecules designed to react with the oligonucleotide.

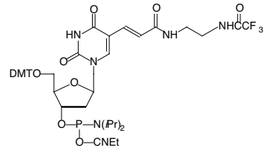
| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| Amino-Modifier C6 dA | 10-1089-90 | 100 µmole | 205.00 |
| | 10-1089-02 | 0.25g | 455.00 |
| Amino-Modifier C6 dC | 10-1019-90 | 100 µmole | 225.00 |
| | 10-1019-02 | 0.25g | 450.00 |
| N2-Amino-Modifier C6 dG | 10-1529-95 | 50 µmole | 240.00 |
| | 10-1529-90 | 100 µmole | 480.00 |
| | 10-1529-02 | 0.25g | 1100.00 |
| Carboxy-dT | 10-1035-90 | 100 µmole | 180.00 |
| | 10-1035-02 | 0.25g | 360.00 |
| Amino-Modifier C2 dT | 10-1037-90 | 100 µmole | 180.00 |
| | 10-1037-02 | 0.25g | 360.00 |
| | 10-1037-05 | 0.5g | 720.00 |
| Amino-Modifier C6 dT | 10-1039-90 | 100 µmole | 180.00 |
| | 10-1039-02 | 0.25g | 360.00 |
| | 10-1039-05 | 0.5g | 720.00 |

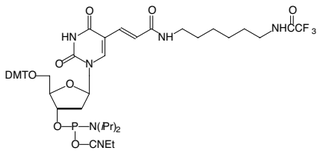

Amino-Modifier C6 dA


Amino-Modifier C6 dC


N2-Amino-Modifier C6 dG


Carboxy-dT


Amino-Modifier C2 dT


Amino-Modifier C6 dT

### SEE ALSO

*Amino-Modifier supports on page 9*

## SEQUENCE MODIFIERS (CONT.)

**SEE ALSO**

*Carboxy-Modifiers on page 6*

**OTHER INSTRUMENT TYPES**

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

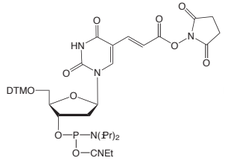
| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

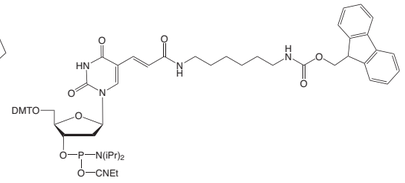
Our repertoire of NHS ester derivatives has been expanded to include the NHS-Carboxy-dT-CE Phosphoramidite. By making a dT analog of the Carboxy-Modifier C10, it is possible to label one or multiple sites within an oligonucleotide. This opens up the possibility to label any number of different dyes or molecules within an oligonucleotide when the phosphoramidite is unavailable. Doing so is straightforward and may be done manually off the synthesizer or even in a fully-automated manner on the DNA synthesizer.

We have never found conditions which allow the TFA group to be removed from an amino-modifier while the oligonucleotide remains attached to the support. We are able to solve this problem by using a 9-fluorenylmethoxycarbonyl (Fmoc) protecting group. The Fmoc group is removed using a two step procedure, the first to remove the cyanoethyl protection groups and flush the formed acrylonitrile from the synthesis column using 1% diisopropylamine in acetonitrile, and the second to remove the Fmoc group using 10% piperidine in DMF. The amino group so formed on the column can be reacted with a variety of activated esters. We offer Fmoc-Amino-Modifier C6 dT Phosphoramidite as a nucleosidic option and Amino-Modifier Serinol Phosphoramidite as a non-nucleosidic alternative. We also offer S-Bz-Thiol-Modifier C6-dT to join the ranks of thiol-modifiers for oligonucleotide synthesis. Thiol-Modifier C6-dT can be added as usual at the desired locations within a sequence.

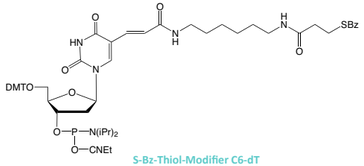
| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| NHS-Carboxy-dT | 10-1535-90 | 100 µmole | 210.00 |
| | 10-1535-02 | 0.25g | 550.00 |
| Fmoc-Amino-Modifier C6 dT | 10-1536-90 | 100 µmole | 180.00 |
| | 10-1536-02 | 0.25g | 360.00 |
| S-Bz-Thiol-Modifier C6-dT | 10-1538-95 | 50 µmole | 130.00 |
| | 10-1538-90 | 100 µmole | 245.00 |
| | 10-1538-02 | 0.25g | 550.00 |
| Amino-Modifier Serinol Phosphoramidite | 10-1997-95 | 50 µmole | 125.00 |
| | 10-1997-90 | 100 µmole | 225.00 |
| | 10-1997-02 | 0.25g | 595.00 |



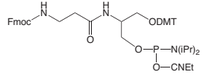

NHS-Carboxy-dT




Fmoc-Amino-Modifier C6 dT




S-Bz-Thiol-Modifier C6-dT




Amino-Modifier Serinol Phosphoramidite

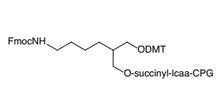




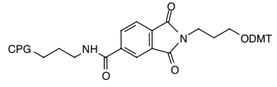
## 3'-MODIFIERS

3'-Amino-Modifier CPGs, containing amino groups protected with the base-labile Fmoc group, are designed to functionalize the 3'-terminus of the target oligonucleotide by the introduction of a primary amine. In an alternative approach, the nitrogen destined to become the 3'-amino group is included in a phthalimide (PT) group which is attached to the support through an amide group attached to the aromatic ring. This simple linkage is very stable to all conditions of oligonucleotide synthesis and contains no chiral center. Using an extended ammonium hydroxide treatment (55°C for 17 hours), the cleavage of the amine from the phthalimide is accomplished along with the deprotection of the oligonucleotide. ABI-style columns are supplied unless otherwise requested.

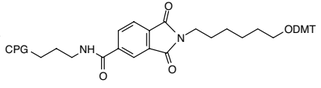
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3'-Amino-Modifier C7 CPG 1000 | 20-2958-01 | 0.1g | 95.00 |
| | 20-2958-10 | 1.0g | 675.00 |
| 1 µmole columns | 20-2958-41 | Pack of 4 | 140.00 |
| 0.2 µmole columns | 20-2958-42 | Pack of 4 | 85.00 |
| 10 µmole column (ABI) | 20-2958-13 | Pack of 1 | 250.00 |
| 15 µmole column (Expedite) | 20-2958-14 | Pack of 1 | 375.00 |
| 3'-Amino-Modifier Serinol CPG | 20-2997-01 | 0.1g | 95.00 |
| | 20-2997-10 | 1.0g | 675.00 |
| 0.2 µmole columns | 20-2997-42 | Pack of 4 | 85.00 |
| 1 µmole columns | 20-2997-41 | Pack of 4 | 140.00 |
| 10 µmole column (ABI) | 20-2997-13 | Pack of 1 | 250.00 |
| 15 µmole column (Expedite) | 20-2997-14 | Pack of 1 | 375.00 |
| 3'-PT-Amino-Modifier C3 CPG | 20-2954-01 | 0.1g | 95.00 |
| | 20-2954-10 | 1.0g | 675.00 |
| 1 µmole columns | 20-2954-41 | Pack of 4 | 140.00 |
| 0.2 µmole columns | 20-2954-42 | Pack of 4 | 85.00 |
| 10 µmole column (ABI) | 20-2954-13 | Pack of 1 | 250.00 |
| 15 µmole column (Expedite) | 20-2954-14 | Pack of 1 | 375.00 |
| 3'-PT-Amino-Modifier C6 CPG | 20-2956-01 | 0.1g | 95.00 |
| | 20-2956-10 | 1.0g | 675.00 |
| 1 µmole columns | 20-2956-41 | Pack of 4 | 140.00 |
| 0.2 µmole columns | 20-2956-42 | Pack of 4 | 85.00 |
| 10 µmole column (ABI) | 20-2956-13 | Pack of 1 | 250.00 |
| 15 µmole column (Expedite) | 20-2956-14 | Pack of 1 | 375.00 |
| 3'-PT-Amino-Modifier C6 PS | 26-2956-01 | 0.1g | 125.00 |
| | 26-2956-10 | 1.0g | 1025.00 |
| 200 nmole columns (AB 3900) | 26-2956-52 | Pack of 10 | 220.00 |
| 40 nmole columns (AB 3900) | 26-2956-55 | Pack of 10 | 220.00 |



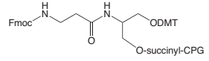

3'-Amino-Modifier C7 CPG




3'-PT Amino-Modifier C3 CPG




3'-PT Amino-Modifier C6 CPG




3'-Amino-Modifier Serinol CPG

## 3’-MODIFIERS (CONT.)

**SEE ALSO**

*Dithiol Serinol on page 6*

**OTHER INSTRUMENT TYPES**

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

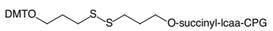
Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

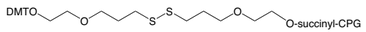
*(Please inquire for availability of vials and columns for other instrument types.)*

The 3’-Thiol-Modifier S-S CPG supports are used to introduce 3’-thiol linkages with three and six atom spacers into oligonucleotides. 3’-Dithiol Serinol CPG is used to introduce a dithiol group at the 3’-terminus. In conjunction with Dithiol Serinol Phosphoramidite, it is simple to produce oligonucleotides with multiple thiol groups at the 3’ terminus, which is ideal for conjugation to gold surfaces. With Glyceryl CPG the 3’-terminus of an oligonucleotide is readily oxidized by sodium periodate to form a 3’-phosphoglycaldehyde. The aldehyde may be further oxidized to the corresponding carboxylic acid. Either the aldehyde or the carboxylate may be used for subsequent conjugation to amine-containing products.

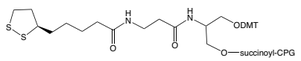
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3’-Thiol-Modifier C3 S-S CPG | 20-2933-01 | 0.1g | 85.00 |
| | 20-2933-10 | 1.0g | 600.00 |
| 1 µmole columns | 20-2933-41 | Pack of 4 | 125.00 |
| 0.2 µmole columns | 20-2933-42 | Pack of 4 | 75.00 |
| 10 µmole column (ABI) | 20-2933-13 | Pack of 1 | 225.00 |
| 15 µmole column (Expedite) | 20-2933-14 | Pack of 1 | 350.00 |
| 3’-Thiol-Modifier 6 S-S CPG | 20-2938-01 | 0.1g | 85.00 |
| | 20-2938-10 | 1.0g | 600.00 |
| 0.2 µmole columns | 20-2938-42 | Pack of 4 | 75.00 |
| 1 µmole columns | 20-2938-41 | Pack of 4 | 125.00 |
| 10 µmole column (ABI) | 20-2938-13 | Pack of 1 | 225.00 |
| 15 µmole column (Expedite) | 20-2938-14 | Pack of 1 | 350.00 |
| 3’-Dithiol Serinol CPG | 20-2991-01 | 0.1g | 120.00 |
| | 20-2991-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2991-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2991-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2991-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2991-14 | Pack of 1 | 450.00 |
| 3’-Glyceryl CPG | 20-2902-01 | 0.1g | 85.00 |
| | 20-2902-10 | 1.0g | 600.00 |
| 1 µmole columns | 20-2902-41 | Pack of 4 | 125.00 |
| 0.2 µmole columns | 20-2902-42 | Pack of 4 | 75.00 |
| 10 µmole column (ABI) | 20-2902-13 | Pack of 1 | 225.00 |
| 15 µmole column (Expedite) | 20-2902-14 | Pack of 1 | 350.00 |



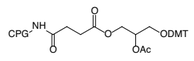

3’-Thiol-Modifier C3 S-S CPG




3’-Thiol-Modifier 6 S-S CPG




3’-Dithiol Serinol CPG




3’-Glyceryl CPG

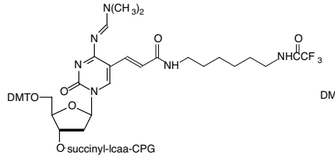




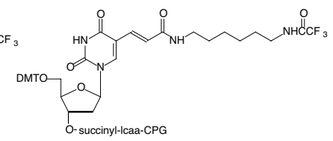
## 3’-MODIFIERS (CONT.)

3’-Amino-Modifier C6 dC CPG and 3’-Amino-Modifier C6 dT CPG replace a dC and T, respectively, at the 3’-terminus. These products allow convenient labeling at the 3’ without blocking the terminus from desired enzymatic activity.

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3’-Amino-Modifier C6 dC CPG | 20-2019-01 | 0.1g | 120.00 |
| | 20-2019-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-2019-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-2019-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-2019-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2019-14 | Pack of 1 | 450.00 |
| 3’-Amino-Modifier C6 dT CPG | 20-2039-01 | 0.1g | 96.00 |
| | 20-2039-10 | 1.0g | 800.00 |
| 1 µmole columns | 20-2039-41 | Pack of 4 | 160.00 |
| 0.2 µmole columns | 20-2039-42 | Pack of 4 | 96.00 |
| 10 µmole column (ABI) | 20-2039-13 | Pack of 1 | 240.00 |
| 15 µmole column (Expedite) | 20-2039-14 | Pack of 1 | 360.00 |




Amino-Modifier C6 dC CPG




Amino-Modifier C6 dT CPG

## CHEMICAL PHOSPHORYLATION

### INTELLECTUAL PROPERTY

Solid Chemical Phosphorylation Reagent II and related supports are covered by European Patent: EP0816368.

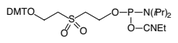
(1) A. Guzaev, H.Salo, A. Azhayev, and H. Lonnberg, *Tetrahedron*, 1995, **51**, 9375-9384.

### SEE ALSO

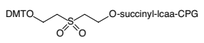
*High load supports on page 4*

Chemical Phosphorylation Reagent is most commonly used to phosphorylate the 5′-terminus of an oligonucleotide. Although this product is also successful in 3′-phosphorylation, 3′-Phosphate CPG allows direct preparation of oligonucleotides with a 3′-phosphate group. Chemical Phosphorylation Reagent II contains a DMT group on a side chain which is stable to base cleavage and can be left on the oligonucleotide for use in RP purification. The DMT group is later removed with aqueous acid and the side chain is eliminated after brief treatment with aqueous ammonium hydroxide to yield the 5′-phosphate.[1] Solid CPR II is similar in performance to CPR II but it is easier to prepare aliquots since it is a powder. Many researchers treat synthesis supports with a hindered base (e.g., diethylamine, diisopropylethylamine, or DBU) post-synthesis to eliminate and remove the cyanoethyl phosphate groups. In this way, the acrylonitrile formed in situ is removed from the support and is not available to alkylate dT residues at the N3 position in the oligos. Since the sulfonylethyl group in 3′-Phosphate CPG is also susceptible to ß-elimination leading to oligo cleavage, this technique is not compatible with 3′-phosphate CPG. Using CPR II CPG, which is base labile but does not support ß-elimination, the cyanoethyl groups can be removed from the oligo prior to cleavage and base deprotection. ABI-style vials and columns are supplied unless otherwise requested.

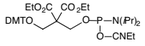
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Chemical Phosphorylation Reagent | 10-1900-90 | 100 µmole | 50.00 |
| | 10-1900-02 | 0.25g | 160.00 |
| 3′-Phosphate CPG | 20-2900-01 | 0.1g | 70.00 |
| | 20-2900-10 | 1.0g | 480.00 |
| 1 µmole columns | 20-2900-41 | Pack of 4 | 100.00 |
| 0.2 µmole columns | 20-2900-42 | Pack of 4 | 60.00 |
| 10 µmole column (ABI) | 20-2900-13 | Pack of 1 | 180.00 |
| 15 µmole column (Expedite) | 20-2900-14 | Pack of 1 | 280.00 |
| 3'-Phosphate PS | 26-2900-01 | 0.1g | 75.00 |
| | 26-2900-10 | 1.0g | 510.00 |
| 200 nmole columns (AB 3900) | 26-2900-52 | Pack of 10 | 150.00 |
| 40 nmole columns (AB 3900) | 26-2900-55 | Pack of 10 | 150.00 |
| 3′-Phosphate CPG (High Load) | 25-2900-01 | 0.1g | 85.00 |
| | 25-2900-10 | 1.0g | 600.00 |
| 2.5 µmole columns | 25-2900-46 | Pack of 4 | 120.00 |
| Chemical Phosphorylation Reagent II (CPR II) | 10-1901-90 | 100 µmole | 60.00 |
| | 10-1901-02 | 0.25g | 200.00 |
| Solid Chemical Phosphorylation Reagent II (Solid CPR II) | 10-1902-90 | 100 µmole | 60.00 |
| | 10-1902-02 | 0.25g | 200.00 |
| 3′-CPR II CPG | 20-2903-01 | 0.1g | 70.00 |
| | 20-2903-10 | 1.0g | 480.00 |
| 0.2 µmole columns | 20-2903-42 | Pack of 4 | 60.00 |
| 1 µmole columns | 20-2903-41 | Pack of 4 | 100.00 |
| 10 µmole column (ABI) | 20-2903-13 | Pack of 1 | 180.00 |
| 15 µmole column (Expedite) | 20-2903-14 | Pack of 1 | 280.00 |



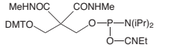
Chemical Phosphorylation Reagent



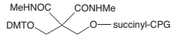
3′-Phosphate CPG



Chemical Phosphorylation Reagent II



Solid Chemical Phosphorylation Reagent II



3′-CPR II CPG





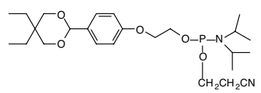
## ALDEHYDE MODIFICATION

Aldehyde modifiers would be attractive electrophilic substitutions in oligonucleotides since they are able to react with amino groups to form a Schiff's base, with hydrazino groups to form hydrazones, and with semicarbazides to form semi-carbazones. The Schiff's base is unstable and must be reduced with sodium borohydride to form a stable linkage but hydrazones and semicarbazides are very stable linkages.

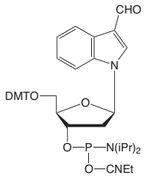
Our collaboration with ELITechGroup, formerly Epoch Biosciences, has allowed us to offer 5'-Aldehyde-Modifier C2 Phosphoramidite. The acetal protecting group is sufficiently hydrophobic for use in RP HPLC and cartridge purification and is readily removed after oligonucleotide synthesis under standard oligonucleotide detritylation conditions with 80% acetic acid / 20% water or 2% aqueous trifluoroacetic acid during cartridge purification.

A formylindole nucleoside analogue has been used to introduce aldehyde groups within an oligonucleotide or at the 5′ terminus. This product has no protecting group on the aldehyde, which means that deprotection of the modified oligonucleotide can be done without changing preferred conditions.

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 5'-Aldehyde-Modifier C2 Phosphoramidite | 10-1933-90 | 100 µmole | 85.00 |
| | 10-1933-02 | 0.25g | 325.00 |
| Formylindole CE Phosphoramidite | 10-1934-90 | 100 µmole | 85.00 |
| | 10-1934-02 | 0.25g | 325.00 |



5'-Aldehyde-Modifier C2



Formylindole

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A simple agreement must be signed before end-users and custom oligo services may purchase these products for use as defined above. http://www.glenresearch.com/Reference/ELITechGroupProducts.pdf

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

***(Please inquire for availability of vials and columns for other instrument types.)***

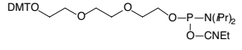
## SPACER MODIFIERS

**SEE ALSO**

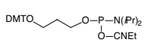
*PC Modifiers on page 16*
*Pyrrolidine on page 4*

The spacer phosphoramidites C3, 9, C12 and 18 are used to insert a spacer arm in an oligonucleotide. The compounds may be added in multiple additions when a longer spacer is required. 3'-Spacer C3 CPG may also act as a blocker of exonuclease and polymerase activity at the 3'-terminus. dSpacer is used to introduce a stable abasic site within an oligonucleotide. PC Spacer is a photocleavable C3 spacer modifier, part of our line of photocleavable (PC) modifiers.

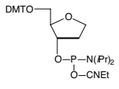
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Spacer Phosphoramidite 9 | 10-1909-90 | 100 µmole | 75.00 |
| | 10-1909-02 | 0.25g | 240.00 |
| Spacer Phosphoramidite C3 | 10-1913-90 | 100 µmole | 75.00 |
| | 10-1913-02 | 0.25g | 240.00 |
| dSpacer CE Phosphoramidite | 10-1914-90 | 100 µmole | 85.00 |
| | 10-1914-02 | 0.25g | 295.00 |
| Spacer Phosphoramidite 18 | 10-1918-90 | 100 µmole | 95.00 |
| | 10-1918-02 | 0.25g | 240.00 |
| Spacer C12 CE Phosphoramidite | 10-1928-90 | 100 µmole | 95.00 |
| | 10-1928-02 | 0.25g | 240.00 |
| 3'-Spacer C3 CPG | 20-2913-01 | 0.1g | 70.00 |
| | 20-2913-10 | 1.0g | 480.00 |
| 1 µmole columns | 20-2913-41 | Pack of 4 | 100.00 |
| 0.2 µmole columns | 20-2913-42 | Pack of 4 | 60.00 |
| 10 µmole column (ABI) | 20-2913-13 | Pack of 1 | 180.00 |
| 15 µmole column (Expedite) | 20-2913-14 | Pack of 1 | 280.00 |
| PC Spacer Phosphoramidite | 10-4913-90 | 100 µmole | 135.00 |
| | 10-4913-02 | 0.25g | 395.00 |



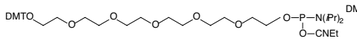
Spacer 9



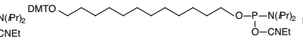
Spacer C3



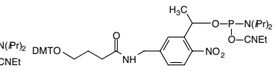
dSpacer



Spacer 18



Spacer C12



PC Spacer





## DENDRIMERS

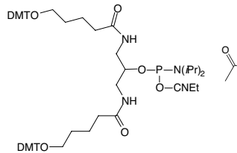
Dendrimers are discrete, highly branched, monodispersed polymers that possess patterns reminiscent of the branching of trees. Plain and mixed oligonucleotide dendrimers can be synthesized using novel doubling and trebling phosphoramidite synthons.[1,2] Dendrimers offer the following advantages. Incorporation of label using $\gamma$-$^{32}$P-ATP and polynucleotide kinase increases in proportion to the number of 5'-ends. Fluorescent signal also increases in proportion to the number of 5'-ends, if spacers are incorporated between the labels and the ends of the branches. When using a dendrimeric oligonucleotide as a PCR primer, the strand bearing the dendrimer is resistant to degradation by T7 Gene 6 exonuclease making it easy to convert the double-stranded product of the PCR to a multiply labeled, single-stranded probe. Enhanced stability of DNA dendrimers makes them useful as building blocks for the 'bottom up' approach to nano-assembly. These features also suggest applications in DNA chip technology when higher temperatures are required, for example, to melt secondary structure in the target.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| Symmetric Doubler Phosphoramidite | 10-1920-90 | 100 µmole | 150.00 |
| | 10-1920-02 | 0.25g | 240.00 |
| Asymmetric Doubler (LEV) Phosphoramidite | 10-1981-90 | 100 µmole | 105.00 |
| | 10-1981-02 | 0.25g | 250.00 |
| Trebler Phosphoramidite | 10-1922-90 | 100 µmole | 180.00 |
| | 10-1922-02 | 0.25g | 300.00 |
| Long Trebler Phosphoramidite | 10-1925-90 | 100 µmole | 200.00 |
| | 10-1925-02 | 0.25g | 300.00 |

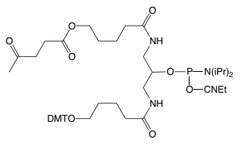
## BRANCHING PHOSPHORAMIDITE

A branching monomer is required to construct comb-like oligonucleotide probes. The developers of the comb system from Chiron Corporation evaluated[3] several protecting groups for the branch point and chose levulinyl (LEV), which is specifically removed using a reagent containing hydrazine hydrate, acetic acid and pyridine.

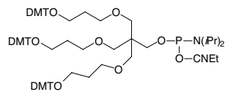
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 5-Me-dC Brancher Phosphoramidite | 10-1018-90 | 100 µmole | 205.00 |
| | 10-1018-02 | 0.25g | 505.00 |



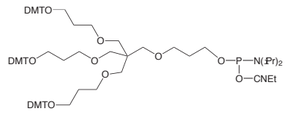
Symmetric Doubler



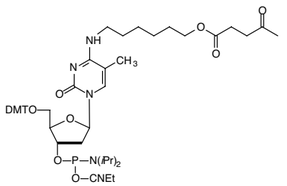
Asymmetric Doubler (LEV)



Trebler



Long Trebler



5-Me-dC Brancher

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

**Monomers**

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

**Columns**

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

### REFERENCES

(1) M.S. Shchepinov, I.A. Udalova, A.J. Bridgman, and E.M. Southern, ***Nucleic Acids Res***, 1997, **25**, 4447-4454.
(2) M.S. Shchepinov, K.U. Mir, J.K. Elder, M.D. Frank-Kamenetskii, and E.M. Southern, ***Nucleic Acids Res***, 1999, **27**, 3035-41.
(3) T. Horn, C.A. Chang, and M.S. Urdea, ***Nucleic Acids Res***, 1997, **25**, 4842-4849.

## OTHER INSTRUMENT TYPES

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Monomers

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|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

***(Please inquire for availability of vials and columns for other instrument types.)***

## INTELLECTUAL PROPERTY

Glen Research offers PC Biotin, PC Amino-Modifier and PC Spacer products in association with AmberGen, Inc. and Link Technologies, Ltd. For a commercial application license, please contact AmberGen, Inc., +617-923-9990, (sales@ambergen.com), http://www.ambergen.com/.

PC Linker phosphoramidite is available from Glen Research in association with Link Technologies Ltd (Scotland).

## SEE ALSO

*5'-Biotin on page 29*

## REFERENCES

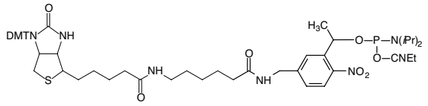

(1) P. Ordoukhanian and J-S. Taylor, ***J. Am. Chem. Soc.***, **117**, 9570-9571, 1995.
(2a) F. Hausch and A. Jäschke, Nucleic Acids Research, 2000, **28**, e35.
(2b) F. Hausch and A. Jäschke, ***Tetrahedron***, 2001, **57**, 1261-1268.
(3) T. Wenzel, T. Elssner, K. Fahr, J. Bimmler, S. Richter, I. Thomas, and M. Kostrzewa, ***Nucleosides, Nucleotides & Nucleic Acids***, 2003, **22**, 1579-1581.


# PHOTOCLEAVABLE MONOMERS

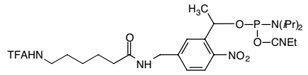
PC Biotin Phosphoramidite can be used to prepare 5'-biotinylated oligonucleotides suitable for capture by streptavidin in a mode similar to our popular 5' Biotin Phosphoramidite. Amino- and thiol-modified oligonucleotides have proven to be very useful for the attachment of a variety of haptens and fluorophores, as well as for the tethering of the oligonucleotides to a diversity of beads and surfaces. PC Amino-Modifier Phosphoramidite is used to prepare 5'-amino-modified oligonucleotides suitable for subsequent photocleavage. PC Spacer Phosphoramidite can be used as an intermediary to attach any modification reagent, available as a phosphoramidite, to the terminus of oligonucleotides. After photocleavage, a 5'-phosphate is generated on the DNA, rendering it suitable for further biological transformations, such as gene construction and cloning after ligation.

A versatile photocleavable DNA building block has been described by researchers in Washington University, Missouri and used in phototriggered hybridization.[1] This reagent has also been used in the design of multifunctional DNA and RNA conjugates[2] for the in vitro selection of new molecules catalyzing biomolecular reactions. Researchers at Bruker Daltonik in Germany have also developed genoSNIP, a method for single-nucleotide polymorphism (SNP) genotyping by MALDI-TOF mass spectrometry.[3] This method uses size reduction of primer extension products by incorporation of the photocleavable linker for phototriggering strand breaks near to the 3' end of the extension primer. PC Linker can be incorporated into oligonucleotides at any position by standard automated DNA synthesis methodology. PC Linker Phosphoramidite has the added advantage in that photocleavage results in monophosphate fragments at both the 3'- and 5'-termini of the oligonucleotide fragments.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| PC Biotin Phosphoramidite | 10-4950-95 | 50 µmole | 145.00 |
| | 10-4950-90 | 100 µmole | 280.00 |
| | 10-4950-02 | 0.25g | 675.00 |
| PC Amino-Modifier Phosphoramidite | 10-4906-90 | 100 µmole | 135.00 |
| | 10-4906-02 | 0.25g | 395.00 |
| PC Spacer Phosphoramidite | 10-4913-90 | 100 µmole | 135.00 |
| | 10-4913-02 | 0.25g | 395.00 |
| PC Linker Phosphoramidite | 10-4920-90 | 100 µmole | 255.00 |
| | 10-4920-02 | 0.25g | 795.00 |




PC Biotin

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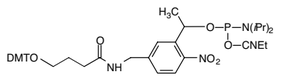
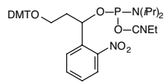



PC Spacer




PC Linker



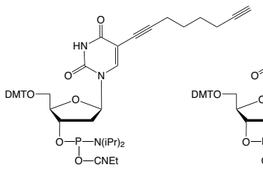


# CONJUGATION USING CLICK CHEMISTRY

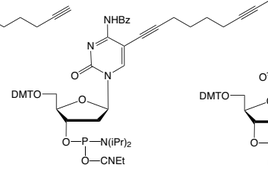
The copper(I)-catalyzed azide-alkyne cycloaddition (CuAAC) reaction between azides and alkynes to form 1,2,3-triazoles, as reported[1] by Sharpless, was found to be so exquisitely regioselective and efficient at even the most mild conditions that Sharpless coined the term 'Click Chemistry' to describe it. The use of this method for DNA modification has been somewhat delayed by the fact that copper ions damage DNA, typically yielding strand breaks.[2] As these problems have now been overcome by the use of copper(I)-stabilizing ligands (e.g., tris(benzyltriazolylmethyl)amine, TBTA[3]), Carell et al. and Seela et al. discovered that the CuAAC reaction can be used to functionalize alkyne-modified DNA nucleobases with extremely high efficiency.[4]

Oligonucleotides bearing a single nucleosidic alkyne group can be prepared using a C8-Alkyne-dC or dT-CE Phosphoramidite. Purified oligonucleotides are usually modified with 2-5 equivalents of the corresponding marker-azide (e.g., fluorescent-dye azides). After the addition of precomplexed Cu(I), complete conversion to the labeled oligo is observed in a time span between 30 min and 4 hours. After a simple precipitation step, labeled oligonucleotides can be recovered in near quantitative yields. Using a combination of C8-Alkyne, C8-TIPS-Alkyne and C8-TMS-Alkyne, it is possible to label oligonucleotides in up to three separate click reactions. The alkyne groups on the last two monomers are protected, respectively, with triisopropylsilyl (TIPS) and trimethylsilyl (TMS) protecting groups.[5,6] The first click reaction on solid phase on a C8-Alkyne yields the singly modified oligonucleotide with full retention of the TIPS and/or TMS protecting group. For double click, a C8-TIPS-Alkyne is used as the second nucleoside and the TIPS protecting group is cleaved with tetrabutylammonium fluoride (TBAF) without causing any damage to the DNA. The second click reaction in solution yields the doubly modified oligonucleotide in excellent yield. For the introduction of three different labels, all three nucleosides are introduced into oligonucleotides. The first click reaction is performed directly on the resin. The singly modified oligonucleotide is subsequently cleaved from the support with concomitant cleavage of the TMS group and retention of the TIPS protecting group. The second click reaction is performed in solution. Precipitation of the doubly modified oligonucleotide, cleavage of the TIPS group with TBAF, and a subsequent third click reaction in solution furnishes the desired triply modified oligonucleotide in excellent overall yield.

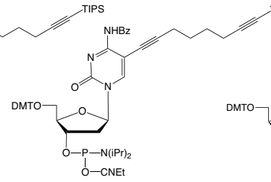
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| C8-Alkyne-dT-CE Phosphoramidite | 10-1540-95 | 50 µmole | 165.00 |
| | 10-1540-90 | 100 µmole | 315.00 |
| | 10-1540-02 | 0.25g | 900.00 |
| C8-TIPS-Alkyne-dC-CE Phosphoramidite | 10-1541-95 | 50 µmole | 295.00 |
| | 10-1541-90 | 100 µmole | 575.00 |
| | 10-1541-02 | 0.25g | 1275.00 |
| C8-TMS-Alkyne-dC-CE Phosphoramidite | 10-1542-95 | 50 µmole | 270.00 |
| | 10-1542-90 | 100 µmole | 525.00 |
| | 10-1542-02 | 0.25g | 1275.00 |
| C8-Alkyne-dC-CE Phosphoramidite | 10-1543-95 | 50 µmole | 225.00 |
| | 10-1543-90 | 100 µmole | 435.00 |
| | 10-1543-02 | 0.25g | 1125.00 |



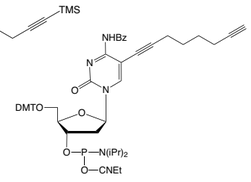

C8-Alkyne-dT




C8-TIPS-Alkyne-dC




C8-TMS-Alkyne-dC




C8-Alkyne-dC

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[2] C. J. Burrows, J. G. Muller, ***Chem. Rev.*** 1998, **98**, 1109 – 1151.
[3] T. R. Chan, R. Hilgraf, K. B. Sharpless, V. V. Fokin, ***Org. Lett.*** 2004, **6**, 2853 – 2855.
[4] J. Gierlich, G. A. Burley, P. M. E. Gramlich, D. M. Hammond, T. Carell, ***Org. Lett.*** 2006, **8**, 3639-3642. F. Seela, V. R. Sirivolu, ***Chem. Biodiversity*** 2006, **3**, 509-514.
[5] P. M. E. Gramlich, S. Warncke, J. Gierlich, T. Carell, ***Angew. Chem.*** 2008, **120**, 3491–3493; ***Angew. Chem. Int. Ed.*** 2008, **47**, 3442– 3444.
[6] P. M. E. Gramlich, C. T. Wirges, A. Manetto, T. Carell, ***Angew. Chem. Int. Ed.*** 2008, **47**, 8350-8358.


## INTELLECTUAL PROPERTY

baseclick GmbH has been granted the following patents (1-3) besides its further patent applications (4-5).

1. WO 2006/117161 (New labeling strategies for the sensitive detection of analytes)
2. WO 2008/952775 (Click chemistry for the production of reporter molecules)
3. WO 2010/115957 (Click Chemistry on heterogeneous catalysts)
4. PCT/EP 2013/064610 (Anandamide-modified nucleic molecules)
5. PCT/EP 2015/056007 (Self-assembly of DNA Origami: a diagnostic tool)

baseclick GmbH holds a worldwide exclusive license for granted patent application WO 03/101972 (Copper-catalysed ligation of azides and acetylenes for the nucleic acid field) in the area of diagnostics and research.

As Glen Research and baseclick are partners, Glen Research is now able to help in sublicensing this outstanding technology.

## CONJUGATION USING CLICK CHEMISTRY (CONT.)

5-Ethynyl-dU offers convenient click conjugation with an azide to generate a label rigidly attached to one of the oligonucleotide bases. 5-Ethynyl-dU is subject to base-catalyzed hydration during cleavage and deprotection, especially when using a strong base or heat. Hydration of an ethynyl group forms a methyl ketone which subsequently blocks potential click reactions. Mild deprotection conditions are necessary when using 5-Ethynyl-dU-CE Phosphoramidite to prevent this side reaction. TIPS-5-Ethynyl-dU-CE Phosphoramidite, containing a protected alkyne, offers broader compatibility with oligonucleotide synthesis and deprotection. Protecting the 5-ethynyl group with a triisopropylsilyl (TIPS) protecting group prevents acid or base catalyzed hydration during oligonucleotide synthesis and workup. A quick treatment with TBAF removes the TIPS protecting group.

### SEE ALSO

*3'-Propargyl-5-Me-dC CPG on page 4*

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

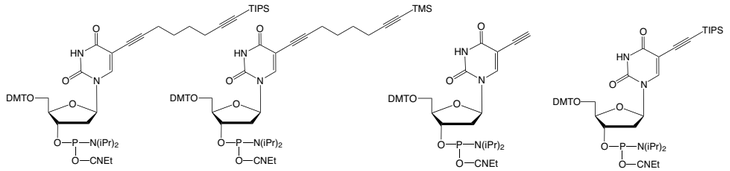
| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| C8-TIPS-Alkyne-dT-CE Phosphoramidite | 10-1544-95 | 50 µmole | 220.00 |
| | 10-1544-90 | 100 µmole | 425.00 |
| | 10-1544-02 | 0.25g | 1020.00 |
| C8-TMS-Alkyne-dT-CE Phosphoramidite | 10-1545-95 | 50 µmole | 205.00 |
| | 10-1545-90 | 100 µmole | 395.00 |
| | 10-1545-02 | 0.25g | 1050.00 |
| 5-Ethynyl-dU-CE Phosphoramidite | 10-1554-95 | 50 µmole | 130.00 |
| | 10-1554-90 | 100 µmole | 245.00 |
| | 10-1554-02 | 0.25g | 775.00 |
| TIPS-5-Ethynyl-dU-CE Phosphoramidite | 10-1555-95 | 50 µmole | 195.00 |
| | 10-1555-90 | 100 µmole | 370.00 |
| | 10-1555-02 | 0.25g | 975.00 |
| THPTA Ligand (Water soluble) | 50-1004-92 | 25 µmole | 50.00 |
| | 50-1004-90 | 100 µmole | 180.00 |
| Click-Solution (DMSO/t-BuOH) | 50-1002-11 | 10 x 1.0mL | 185.00 |




C8-TIPS-Alkyne-dT | C8-TMS-Alkyne-dT | 5-Ethynyl-dU | TIPS-5-Ethynyl-dU

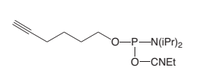




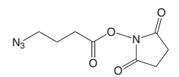
## CONJUGATION USING CLICK CHEMISTRY (CONT.)

Oligonucleotides prepared using 5'-Hexynyl Phosphoramidite are stable to standard deprotection conditions and exhibit a slightly increased retention time on RP HPLC. Azides are not compatible with oligonucleotide synthesis using phosphoramidites so a post-synthesis reaction is required. Azidobutyrate NHS Ester is used[1] for azido-modification of amines at either the 3'-end or the 5'-end of an oligo and it can even be used for internal modification on an Amino-Modifier-C6 dX residue within the sequence. Specific to the 5'-terminus, 5'-Bromohexyl Phosphoramidite is added in the last cycle. This modifier can then be easily transformed into a 5'-azido group by displacement of bromide using sodium azide.[2] Alkyne NHS ester allows the functionalization of an amino moiety in a variety of molecules, including DNA and RNA oligonucleotides as well as peptides or proteins. We also offer two products for use in Click Chemistry based upon our 1,3-diol product portfolio with the serinol backbone - a phosphoramidite for adding an alkyne group at the 5' terminus or within the sequence, and a synthesis support for labeling the 3' terminus of oligonucleotides with an alkyne group.

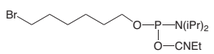
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 5'-Hexynyl Phosphoramidite | 10-1908-90 | 100 µmole | 60.00 |
| | 10-1908-02 | 0.25g | 200.00 |
| Azidobutyrate NHS Ester | 50-1904-23 | 2.3mg | 60.00 |
| (Dissolve 2.3mg in 60µL of DMSO) | 50-1904-24 | 23mg | 300.00 |
| 5'-Bromohexyl Phosphoramidite | 10-1946-90 | 100 µmole | 60.00 |
| | 10-1946-02 | 0.25g | 200.00 |
| Alkyne-NHS Ester | 50-1905-23 | 2.3mg | 60.00 |
| (Dissolve 2.3mg in 60µL of DMSO) | 50-1905-24 | 23mg | 300.00 |
| Alkyne-Modifier Serinol Phosphoramidite | 10-1992-95 | 50 µmole | 100.00 |
| | 10-1992-90 | 100 µmole | 185.00 |
| | 10-1992-02 | 0.25g | 575.00 |
| 3'-Alkyne-Modifier Serinol CPG | 20-2992-01 | 0.1g | 105.00 |
| | 20-2992-10 | 1.0g | 800.00 |
| 0.2 µmole columns | 20-2992-42 | Pack of 4 | 100.00 |
| 1 µmole columns | 20-2992-41 | Pack of 4 | 175.00 |
| 10 µmole column (ABI) | 20-2992-13 | Pack of 1 | 260.00 |
| 15 µmole column (Expedite) | 20-2992-14 | Pack of 1 | 390.00 |



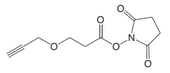

5'-Hexynyl Phosphoramidite



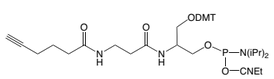

Azidobutyrate NHS Ester



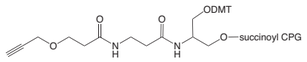

5'-Bromohexyl Phosphoramidite




Alkyne-NHS Ester




Alkyne-Modifier Serinol Phosphoramidite




3'-Alkyne-Modifier Serinol CPG

### REFERENCES

(1) R. Kumar, et al., *Journal of the American Chemical Society*, 2007, **129**, 6859-6864.
(2) J. Lietard, A. Meyer, J.J. Vasseur, and F. Morvan, *Tetrahedron Letters*, 2007, **48**, 8795-8798.

### SEE ALSO

*Serinol Products on page 24*

## CONJUGATION USING CLICK CHEMISTRY (CONT.)

**1**-Ethynyl-dSpacer CE Phosphoramidite can be used in any position within an oligonucleotide while still retaining the high efficiency of click chemistry. The modifier is efficiently incorporated into oligonucleotides using standard phosphoramidite chemistry, is stable to common deprotection conditions, and is compatible with Glen-Pak™ purification. 1-Ethynyl-dSpacer generates a substituted 1,2,3-triazole pseudo-nucleobase after click chemistry conjugation with an azide The 1-ethynyl-dSpacer modification exhibits similar duplex stability to the standard dSpacer (10-1914) and destabilizes the duplex when internally incorporated. Upon cycloaddition, the duplex stability is moderated by the resulting structure of the modification. Simple 1,2,3-triazoles were destabilizing, as were modifications that incorporated TEG linkers (6-FAM-TEG and Amino-TEG). Modifications that incorporated aromatic functional groups restored duplex stability to varying degrees with coumarin and psoralen significantly restoring stability. A 5′-iodo-modified oligonucleotide (prepared using 5′-Iodo-dT) can be quantitatively converted to the corresponding 5′-azide.

**SEE ALSO**

*dSpacer on page 14*

**STABILITY NOTES**

Oligonucleotides containing a 5′-iodo group are prepared conventionally with the exception that deprotection is carried out in ammonium hydroxide at room temperature for 24 hours. Under these conditions, degradation of the iodo group was less than 2%.

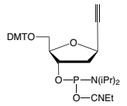
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 1-Ethynyl-dSpacer CE Phosphoramidite | 10-1910-95 | 50 µmole | 180.00 |
| | 10-1910-90 | 100 µmole | 340.00 |
| | 10-1910-02 | 0.25g | 1250.00 |
| 5′-I-dT-CE Phosphoramidite | 10-1931-90 | 100 µmole | 85.00 |
| | 10-1931-02 | 0.25g | 295.00 |

## OLIGO-CLICK KITS

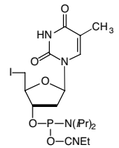
Oligo-Click Kits contain an air-stable, insoluble Cu(I) source in pellet form in a pre-loaded and ready-to-use vial. Within the kit, the TBTA ligand is replaced by an activator which is compatible with both aqueous and organic solvents. This innovative combination of catalyst and ligand/activator results in a much easier labeling work-flow of only three simple steps. The preparation of the oligonucleotide labeling via CuAAC now requires only a minimal hands-on time of a few minutes or even less and can be carried out in air without any additional precautions. Glen Research is offering the following kits in collaboration with baseclick GmbH.

- Oligo-Kit M Reload: This kit has sufficient reagents for conjugating up to nine alkyne-containing oligonucleotides on a 100 nmole scale or a single oligonucleotide on a 1 µmole scale. ***The user must supply the azide and a solvent such as DMSO for dissolving the azide.***
- Oligo-Kit M Biotin, Oligo-Kit M Fluorescein and Oligo-Kit M TAMRA: Each kit has sufficient reagents for conjugating up to seven alkyne-containing oligonucleotides on a 100 nmole scale or a single oligonucleotide on a 1 µmole scale. ***Each kit contains all of the ingredients necessary, including the azide and DMSO solvent.***

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| baseclick Oligo-Click-M-Reload | 50-2100-01 | each | 120.00 |
| baseclick Oligo-Click-M-Biotin | 50-2101-01 | each | 200.00 |
| baseclick Oligo-Click-M-Fluorescein | 50-2102-01 | each | 240.00 |
| baseclick Oligo-Click-M-TAMRA | 50-2103-01 | each | 270.00 |




1-Ethynyl-dSpacer




5′-I-dT





## COPPER-FREE CLICK CHEMISTRY

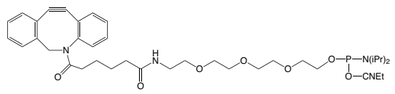
At Glen Research, our goal was to offer a copper-free click phosphoramidite reagent with the following properties:

- Simple to use
- Stable in solution on the synthesizer
- Stable to ammonium hydroxide and AMA
- Excellent click performance in 17 hours or less at room temperature

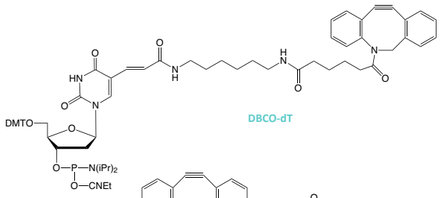
From the variety of cyclooctyne-based copper-free click reagents so far described, we have chosen to offer compounds based on a dibenzo-cyclooctyne (DBCO) structure. We are offering 5′-DBCO-TEG Phosphoramidite for preparing oligos with a 5′-DBCO modification and DBCO-dT-CE Phosphoramidite for inserting a DBCO group at any position within the oligonucleotide. In addition, we offer a further DBCO phosphoramidite – DBCO-Serinol Phosphoramidite. Using our proprietary serinol backbone as a non-nucleosidic spacer allows the DBCO group to be placed at any location within a sequence with multiple additions clearly possible. DBCO-sulfo-NHS Ester is also offered for post-synthesis conjugation reactions. DBCO-modified oligos may be conjugated with azides in organic solvents, such as DMSO, or aqeous buffers. Depending on the azide used, the reaction will go to completion in 4-17 hours at room temperature. Simple desalting on a Glen Gel-Pak™ leads to a product with virtually quantitative conjugation efficiency.

Note: We now recommend that synthesis of oligos containing DBCO-dT be completed using 0.5 M CSO in anhydrous acetonitrile (40-4632-xx). Acceptable results can be achieved with iodine oxidation if DBCO-dT is subjected to no more than 8-10 cycles.

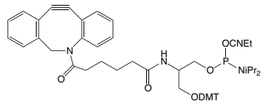
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 5′-DBCO-TEG Phosphoramidite | 10-1941-95 | 50 µmole | 125.00 |
| | 10-1941-90 | 100 µmole | 230.00 |
| | 10-1941-02 | 0.25g | 775.00 |
| DBCO-dT-CE Phosphoramidite | 10-1539-95 | 50 µmole | 250.00 |
| | 10-1539-90 | 100 µmole | 485.00 |
| | 10-1539-02 | 0.25g | 975.00 |
| DBCO-sulfo-NHS Ester | 50-1941-23 | 5.2mg | 60.00 |
| (Dissolve 5.2mg in 60µL water or DMSO) | 50-1941-24 | 52mg | 300.00 |
| DBCO-Serinol Phosphoramidite | 10-1998-95 | 50 µmole | 180.00 |
| | 10-1998-90 | 100 µmole | 340.00 |
| | 10-1998-02 | 0.25g | 895.00 |



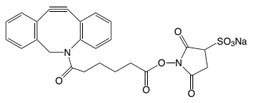

5′-DBCO-TEG




DBCO-dT




DBCO-Serinol




DBCO-sulfo-NHS Ester

**OTHER INSTRUMENT TYPES**

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

**SEE ALSO**

*0.5M CSO on page 4*
*Serinol Products on page 24*

## CONJUGATION USING CLICK CHEMISTRY (CONT.)

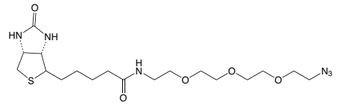
Glen Research is offering first our most popular labels for general interest and, subsequently, we will add azide products that are not compatible with phosphoramidite chemistry.

Biotin is still our most commonly used label and biotinTEG, with its hydrophilic triethylene glycol spacer, is the most popular biotin product. Desthiobiotin is a biotin analogue that is well captured by streptavidin but the captured product can be easily released by applying a biotin solution to the streptavidin beads. 6-FAM is our most popular fluorescein derivative and we offer azides of both 6-FAM and pivaloyl-protected 6-FAM for situations where subsequent reactions require the 6-FAM to be protected. In both 6-FAM products, the hydrophilic TEG spacer is again used. The azides are offered in 25 and 100 µmole packs for convenient oligonucleotide labeling.

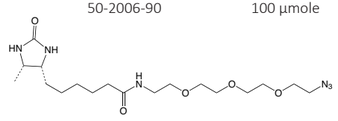
7-Hydroxycoumarin, also known as umbelliferone, is a highly fluorescent, pH-sensitive fluorophore that emits in the blue region of the spectrum. However, its fluorescence is strongly quenched if the hydroxyl is alkylated or phosphorylated, making it useful in high-throughput screening for phosphatases and lipases. Interestingly, it was found that the 3-azido derivative is also highly quenched but, upon reaction with an alkyne in the presence of copper to form the triazole, the fluorescence is restored.[1] The clicked coumarin emits at a lambda max of 480 nm and absorbs at 358 nm.

HEX and TET are two of our most popular fluorescein-based dyes for labeling oligonucleotides. We are happy to offer 6-HEX and 6-TET Azides for use in click conjugations.

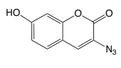
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| BiotinTEG Azide | 50-2000-92 | 25 µmole | 150.00 |
| | 50-2000-90 | 100 µmole | 450.00 |
| DesthiobiotinTEG Azide | 50-2001-92 | 25 µmole | 135.00 |
| | 50-2001-90 | 100 µmole | 400.00 |
| Dipivaloyl 6-FAM-TEG Azide | 50-2002-92 | 25 µmole | 230.00 |
| | 50-2002-90 | 100 µmole | 690.00 |
| 6-FAM-TEG Azide | 50-2003-92 | 25 µmole | 180.00 |
| | 50-2003-90 | 100 µmole | 540.00 |
| Coumarin Azide | 50-2004-92 | 25 µmole | 115.00 |
| | 50-2004-90 | 100 µmole | 350.00 |
| 6-HEX Azide | 50-2005-92 | 25 µmole | 150.00 |
| | 50-2005-90 | 100 µmole | 450.00 |
| 6-TET Azide | 50-2006-92 | 25 µmole | 150.00 |
| | 50-2006-90 | 100 µmole | 450.00 |



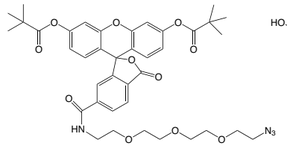
BiotinTEG Azide



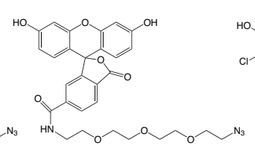
DesthiobiotinTEG Azide



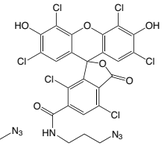
Coumarin Azide



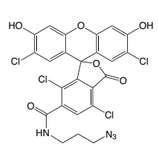
Dipivaloyl 6-FAM-TEG Azide



6-FAM-TEG Azide



6-HEX Azide



6-TET Azide

### REFERENCE

(1) J. Gierlich, G.A. Burley, P.M. Gramlich, D.M. Hammond, and T. Carell, ***Org Lett***, 2006, **8**, 3639-42.





## CONJUGATION USING CLICK CHEMISTRY (CONT.)

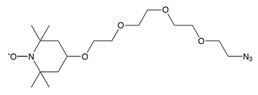
Two nitroxide spin labels, TEMPO Azide and TEMPO-TEG Azide, for site directed spin labeling (SDSL) are now offered.

Click Chemistry with psoralen azide and one of our many nucleosidic and non-nucleosidic alkyne derivatives has the potential to generate a variety of practical cross-linkers. The well known reversible cross-linking behavior of psoralen with an adjacent thymidine residue could be very useful.

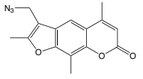
To better address applications in near-infrared (NIR) imaging, Glen Research is offering a water soluble Disulfo-Cyanine 7 azide that can be easily conjugated to DNA and RNA through standard click chemistry. This long wavelength dye offers the benefits of improved solubility, reduced aggregation, and improved stability in the near-infrared spectrum along with the convenience of click chemistry.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| TEMPO Azide | 50-2007-92 | 25 µmole | 115.00 |
| | 50-2007-90 | 100 µmole | 350.00 |
| TEMPO-TEG Azide | 50-2008-92 | 25 µmole | 135.00 |
| | 50-2008-90 | 100 µmole | 400.00 |
| Psoralen Azide | 50-2009-92 | 25 µmole | 115.00 |
| | 50-2009-90 | 100 µmole | 350.00 |
| Disulfo-Cyanine 7 Azide | 50-2010-92 | 25 µmole | 325.00 |
| | 50-2010-90 | 100 µmole | 975.00 |

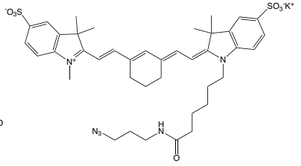
TEMPO Azide



TEMPO-TEG Azide



Psoralen Azide



Disulfo-Cyanine 7 Azide

## SERINOL REAGENTS FOR MODIFICATION AND LABELING

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

***(Please inquire for availability of vials and columns for other instrument types.)***

### INTELLECTUAL PROPERTY

Serinol Reagents for Modification and Labeling are covered by US Patent No.: 8,394,948.

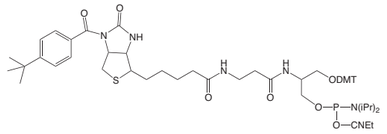
Most popular non-nucleosidic phosphoramidites for modification and labeling are based on two structural types: 1,2-diols and 1,3-diols. Products based on a 1,2-diol backbone were first described to allow amino-modification and biotin labeling. Technically, the 1,2-diol backbone has some drawbacks relative to the 1,3-diol backbone. The 1,2-diol backbone can participate in a dephosphorylation reaction since the 1,2-diol can form a favored 5-membered cyclic phosphate intermediate. This reaction is competitive with simple hydrolysis of the protecting groups and leads to some loss of label. However, the degree of loss at the 3′ terminus can be limited by the removal of the cyanoethyl protecting group using DBU or diethylamine prior to the cleavage and deprotection steps. Similarly, loss at the 5′ terminus can be eliminated by retaining the DMT group until the oligo is fully deprotected. Fortunately, the elimination reaction is virtually non-existent in the 1,3-diol backbone since the cyclic intermediate would be a 6-membered ring which is not favored for a cyclic phosphate intermediate.

IVD customers have requested a new backbone based on a 1,3-diol that would overcome any technical or IP issues surrounding our current products. We now offer a line of products based on the serinol backbone, which have been developed in close collaboration between Glen Research and Nelson Biotechnologies. Protected Biotin Serinol Phosphoramidite and CPG are protected with a *t*-butylbenzoyl group on the biotin ring. This group is designed to stop any phosphoramidite reactions at this active position in biotin. This protection avoids branching when using nucleophilic activators like DCI. The protecting group is easily removed during oligonucleotide cleavage and deprotection. The BiotinLC versions are similarly protected and should be useful for the synthesis of highly sensitive biotinylated probes. 6-Fluorescein Serinol Phosphoramidite and CPG are designed to prepare oligonucleotides containing one or several 6-Fluorescein (6-FAM) residues. Amino-Modifier Serinol Phosphoramidite and CPG are used to add amino groups into one or several positions in oligonucleotides. The amino group is protected with Fmoc, which may be removed on the synthesis column prior to solid-phase conjugation to the amino groups, or which may be removed during deprotection for subsequent solution phase conjugation to the amino groups.

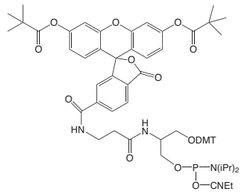
Combining lipoic acid and our patented serinol backbone, we now offer Dithiol Serinol Phosphoramidite and the related 3′-Dithiol Serinol CPG. This unique architecture moves the bulky dithiol away from the phosphate backbone, making it suitable for conjugation to gold surfaces. The long spacer arm of Dithiol Serinol also allows multiple consecutive incorporations of the modifier without the need for intermediate spacer phosphoramidite additions to achieve optimal stepwise coupling efficiency.

We offer three products for use in Click Chemistry based upon our 1,3-diol product portfolio with the serinol backbone - a phosphoramidite for adding an alkyne group at the 5′ terminus or within the sequence, a synthesis support for labeling the 3′ terminus of oligonucleotides with an alkyne group, and DBCO-Serinol phosphoramidite as a copper-free click reagent .

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| Protected Biotin Serinol Phosphoramidite | 10-1993-95 | 50 µmole | 165.00 |
| | 10-1993-90 | 100 µmole | 295.00 |
| | 10-1993-02 | 0.25g | 675.00 |
| 6-Fluorescein Serinol Phosphoramidite | 10-1994-95 | 50 µmole | 165.00 |
| | 10-1994-90 | 100 µmole | 295.00 |
| | 10-1994-02 | 0.25g | 595.00 |




Protected Biotin Serinol Phosphoramidite




6-Fluorescein Serinol Phosphoramidite



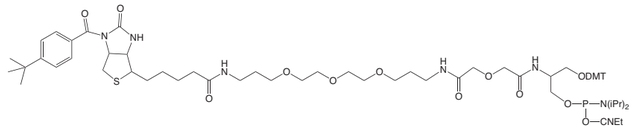


## SERINOL REAGENTS FOR MODIFICATION AND LABELING (CONT.)

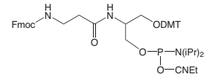
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| Protected BiotinLC Serinol Phosphoramidite | 10-1995-95 | 50 µmole | 205.00 |
| | 10-1995-90 | 100 µmole | 365.00 |
| | 10-1995-02 | 0.25g | 675.00 |
| Amino-Modifier Serinol Phosphoramidite | 10-1997-95 | 50 µmole | 125.00 |
| | 10-1997-90 | 100 µmole | 225.00 |
| | 10-1997-02 | 0.25g | 595.00 |
| Dithiol Serinol Phosphoramidite | 10-1991-95 | 50 µmole | 120.00 |
| | 10-1991-90 | 100 µmole | 215.00 |
| | 10-1991-02 | 0.25g | 585.00 |
| Alkyne-Modifier Serinol Phosphoramidite | 10-1992-95 | 50 µmole | 100.00 |
| | 10-1992-90 | 100 µmole | 185.00 |
| | 10-1992-02 | 0.25g | 575.00 |
| DBCO-Serinol Phosphoramidite | 10-1998-95 | 50 µmole | 180.00 |
| | 10-1998-90 | 100 µmole | 340.00 |
| | 10-1998-02 | 0.25g | 895.00 |

### SEE ALSO

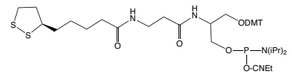
*DBCO on page 21*



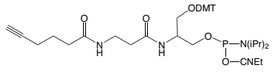

Protected BiotinLC Serinol Phosphoramidite



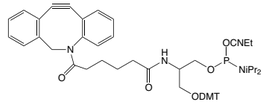

Amino-Modifier Serinol Phosphoramidite




Dithiol Serinol




Alkyne-Modifier Serinol Phosphoramidite




DBCO-Serinol

## SERINOL REAGENTS FOR MODIFICATION AND LABELING (CONT.)

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 3′-Protected Biotin Serinol CPG | 20-2993-01 | 0.1g | 120.00 |
| | 20-2993-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2993-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2993-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2993-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2993-14 | Pack of 1 | 450.00 |
| 3′-6-Fluorescein Serinol CPG | 20-2994-01 | 0.1g | 120.00 |
| | 20-2994-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2994-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2994-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2994-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2994-14 | Pack of 1 | 450.00 |
| 3′-Protected BiotinLC Serinol CPG | 20-2995-01 | 0.1g | 120.00 |
| | 20-2995-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2995-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2995-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2995-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2995-14 | Pack of 1 | 450.00 |
| 3′-Amino-Modifier Serinol CPG | 20-2997-01 | 0.1g | 95.00 |
| | 20-2997-10 | 1.0g | 675.00 |
| 0.2 µmole columns | 20-2997-42 | Pack of 4 | 85.00 |
| 1 µmole columns | 20-2997-41 | Pack of 4 | 140.00 |
| 10 µmole column (ABI) | 20-2997-13 | Pack of 1 | 250.00 |
| 15 µmole column (Expedite) | 20-2997-14 | Pack of 1 | 375.00 |

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

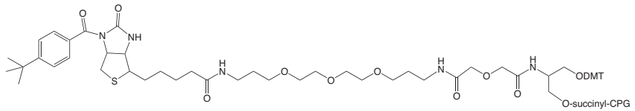
Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

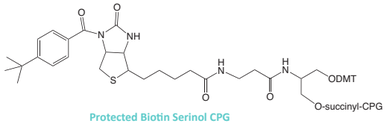
Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*




Protected BiotinLC Serinol CPG

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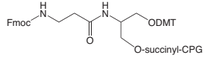
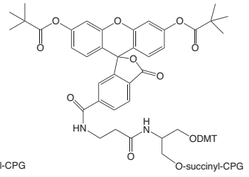



Amino-Modifier Serinol CPG




6-Fluorescein Serinol CPG





## SERINOL REAGENTS FOR MODIFICATION AND LABELING (CONT.)

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 3′-Dithiol Serinol CPG | 20-2991-01 | 0.1g | 120.00 |
| | 20-2991-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2991-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2991-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2991-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2991-14 | Pack of 1 | 450.00 |
| 3′-Alkyne-Modifier Serinol CPG | 20-2992-01 | 0.1g | 105.00 |
| | 20-2992-10 | 1.0g | 800.00 |
| 0.2 µmole columns | 20-2992-42 | Pack of 4 | 100.00 |
| 1 µmole columns | 20-2992-41 | Pack of 4 | 175.00 |
| 10 µmole column (ABI) | 20-2992-13 | Pack of 1 | 260.00 |
| 15 µmole column (Expedite) | 20-2992-14 | Pack of 1 | 390.00 |

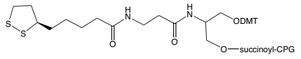
## COT SERINOL PHOSPHORAMIDITE

**B**right, long-lasting and non-phototoxic organic fluorophores are essential for the continued optimization of a diverse range of imaging applications. However, all currently available technologies remain susceptible to undesirable transitions to dark states. Dark states arise from non-fluorescent triplet electronic configurations from which the rate of return to the ground state is slow. When in the triplet state, the fluorophore is susceptible to photobleaching and fluorescence applications are compromised by unpredictably reducing the signal-to-noise ratio (SNR), as well as limiting the total duration of time over which information can be gathered. The direct conjugation of small-molecule protective agents (PAs) has enabled significant improvements through intra-molecular triplet quenching. Through a partnership with Lumidyne Technologies, Glen Research has created a novel PA-linked phosphoramidite using cyclooctatetraene (COT). COT Serinol Phosphoramidite provides a means to improve the photostability of virtually any fluorophore in a modular fashion. Our spectrofluorometric studies show that the presence of COT limited the amount of photobleaching of an oligo containing the cyanine 5 dye.

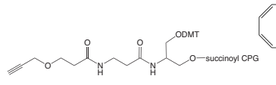
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| COT Serinol Phosphoramidite | 10-1996-95 | 50 µmole | 310.00 |
| | 10-1996-90 | 100 µmole | 600.00 |
| | 10-1996-02 | 0.25g | 1800.00 |

### INTELLECTUAL PROPERTY

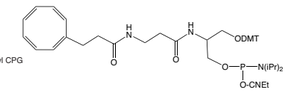
This product is covered under US Patent 8,945,515 B2.




3′-Dithiol Serinol CPG




3′-Alkyne-Modifier Serinol CPG

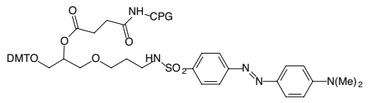



COT Serinol

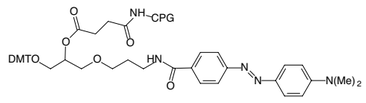
## DABCYL LABELING

A molecular beacon probe[1] has its natural fluorescence quenched in solution unless it is hybridized to the target sequence. Consequently, the design of a molecular beacon requires a fluorophore to be in one part of the sequence and the quencher molecule to be in another, with both molecules being separated from the oligonucleotide by a hydrocarbon spacer. The Dabcyl group has been found to be a universal quencher. 3′-Dabsyl CPG and 3′-Dabcyl CPG are used to prepare probes with the quencher blocking the 3′-terminus. 5′-Dabcyl Phosphoramidite locates the quencher at the 5′-terminus and Dabcyl-dT places it within the sequence, leaving the 3′-terminus available for polymerase extension.

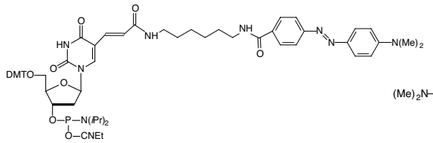
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 3′-Dabsyl CPG | 20-5911-01 | 0.1g | 120.00 |
| | 20-5911-10 | 1.0g | 975.00 |
| 1 µmole columns | 20-5911-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-5911-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-5911-13 | Pack of 1 | 350.00 |
| 15 µmole column (Expedite) | 20-5911-14 | Pack of 1 | 500.00 |
| 3′-Dabcyl CPG | 20-5912-01 | 0.1g | 120.00 |
| | 20-5912-10 | 1.0g | 975.00 |
| 1 µmole columns | 20-5912-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-5912-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-5912-13 | Pack of 1 | 350.00 |
| 15 µmole column (Expedite) | 20-5912-14 | Pack of 1 | 500.00 |
| 3'-Dabcyl PS | 26-5912-01 | 0.1g | 125.00 |
| | 26-5912-10 | 1.0g | 1025.00 |
| 200 nmole columns (AB 3900) | 26-5912-52 | Pack of 10 | 300.00 |
| 40 nmole columns (AB 3900) | 26-5912-55 | Pack of 10 | 300.00 |
| Dabcyl-dT | 10-1058-95 | 50 µmole | 180.00 |
| | 10-1058-90 | 100 µmole | 325.00 |
| | 10-1058-02 | 0.25g | 675.00 |
| 5′-Dabcyl Phosphoramidite | 10-5912-95 | 50 µmole | 125.00 |
| | 10-5912-90 | 100 µmole | 225.00 |
| | 10-5912-02 | 0.25g | 650.00 |



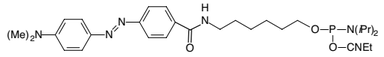

Dabsyl CPG




Dabcyl CPG




Dabcyl-dT

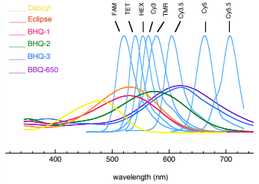



5′-Dabcyl Phosphoramidite

### REFERENCE

(1) S. Tyagi and F.R. Kramer, *Nature Biotechnology*, 1996, **4**, 303-308.

### DYE QUENCHER PLOT




http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf



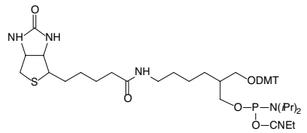


## BIOTIN LABELING

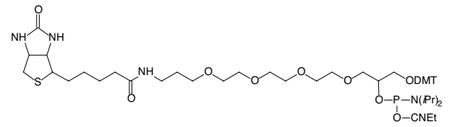
Glen Research biotin phosphoramidites for direct labeling of synthetic oligonucleotides exhibit the following features:

1. All are soluble in acetonitrile at concentrations useful for DNA synthesis.
2. All include a DMT group for cartridge purifications which is essential for the preparation of biotinylated PCR primers because of the potential for cross contamination in HPLC purifications.
3. For the development of diagnostic probes, biotin phosphoramidite is capable of branching to allow multiple biotins to be introduced at the 3′- or 5′-terminus. BiotinTEG Phosphoramidite contains a 15 atom mixed polarity spacer arm based on a triethylene glycol.
4. Protected Biotin Serinol Phosphoramidite and CPG are protected with a *t*-butylbenzoyl group on the biotin ring. This group is designed to stop any phosphoramidite reactions at this active position in biotin. This protection avoids branching when using nucleophilic activators like DCI. The protecting group is easily removed during oligonucleotide cleavage and deprotection. The BiotinLC versions are similarly protected and should be useful for the synthesis of highly sensitive biotinylated probes.

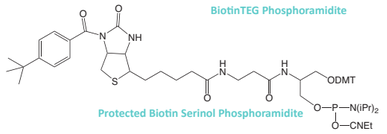
| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| Biotin Phosphoramidite | 10-1953-95 | 50 µmole | 165.00 |
| | 10-1953-90 | 100 µmole | 295.00 |
| | 10-1953-02 | 0.25g | 675.00 |
| BiotinTEG Phosphoramidite | 10-1955-95 | 50 µmole | 165.00 |
| | 10-1955-90 | 100 µmole | 295.00 |
| | 10-1955-02 | 0.25g | 675.00 |
| Protected Biotin Serinol Phosphoramidite | 10-1993-95 | 50 µmole | 165.00 |
| | 10-1993-90 | 100 µmole | 295.00 |
| | 10-1993-02 | 0.25g | 675.00 |
| Protected BiotinLC Serinol Phosphoramidite | 10-1995-95 | 50 µmole | 205.00 |
| | 10-1995-90 | 100 µmole | 365.00 |
| | 10-1995-02 | 0.25g | 675.00 |



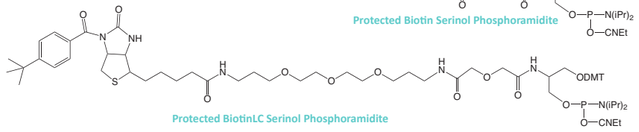

Biotin Phosphoramidite




BiotinTEG Phosphoramidite




Protected Biotin Serinol Phosphoramidite




Protected BiotinLC Serinol Phosphoramidite

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

## BIOTIN LABELING (CONT.)

Biotin-dT can replace dT residues within the oligonucleotide sequence. 5′-Biotin phosphoramidite can be added ONLY ONCE to the 5′-terminus of an oligonucleotide. However, the DMT group on the biotin can be used in RP cartridge and HPLC purification techniques. PC Biotin is a photocleavable 5′-biotin phosphoramidite. BiotinTEG CPG and Protected BiotinLC Serinol CPG are designed for the direct synthesis of oligonucleotides containing biotin at the 3′ terminus.

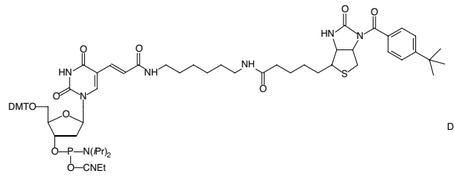
Desthiobiotin is a biotin analogue that exhibits lower binding to biotin-binding proteins such as streptavidin. This biotin analogue is lacking the sulfur group from the molecule and has a dissociation constant (Kd) several orders of magnitude less than biotin/streptavidin. As a result, biomolecules containing desthiobiotin are dissociated from streptavidin simply in the presence of buffered solutions of biotin. We offer desthiobiotinTEG phosphoramidite and the corresponding CPG.

ABI-style vials and columns are supplied unless otherwise requested (see note box).

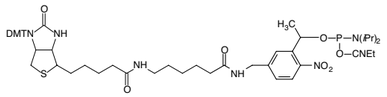
**SEE ALSO**

*PC Biotin on page 16*

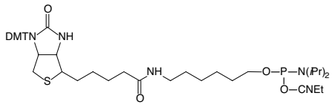
| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| 5′-Biotin Phosphoramidite | 10-5950-95 | 50 µmole | 125.00 |
| | 10-5950-90 | 100 µmole | 225.00 |
| | 10-5950-02 | 0.25g | 650.00 |
| Biotin-dT | 10-1038-95 | 50 µmole | 167.50 |
| | 10-1038-90 | 100 µmole | 325.00 |
| | 10-1038-02 | 0.25g | 625.00 |
| PC Biotin Phosphoramidite | 10-4950-95 | 50 µmole | 145.00 |
| | 10-4950-90 | 100 µmole | 280.00 |
| | 10-4950-02 | 0.25g | 675.00 |
| DesthiobiotinTEG Phosphoramidite | 10-1952-95 | 50 µmole | 185.00 |
| | 10-1952-90 | 100 µmole | 335.00 |
| | 10-1952-02 | 0.25g | 775.00 |



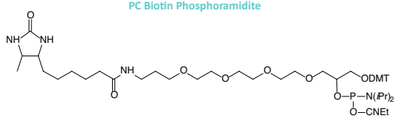

Biotin-dT




PC Biotin Phosphoramidite




5′-Biotin Phosphoramidite




DesthiobiotinTEG Phosphoramidite





## BIOTIN LABELING (CONT.)

| Item | Catalog No. | Pack | Price ($) |
|---|---|---|---|
| 3′-BiotinTEG CPG | 20-2955-01 | 0.1g | 120.00 |
| | 20-2955-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2955-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2955-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2955-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2955-14 | Pack of 1 | 450.00 |
| 3′-BiotinTEG PS | 26-2955-01 | 0.1g | 125.00 |
| | 26-2955-10 | 1.0g | 1025.00 |
| 200 nmole columns (AB 3900) | 26-2955-52 | Pack of 10 | 300.00 |
| 40 nmole columns (AB 3900) | 26-2955-55 | Pack of 10 | 300.00 |
| 3′-Protected Biotin Serinol CPG | 20-2993-01 | 0.1g | 120.00 |
| | 20-2993-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2993-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2993-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2993-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2993-14 | Pack of 1 | 450.00 |
| 3′-Protected BiotinLC Serinol CPG | 20-2995-01 | 0.1g | 120.00 |
| | 20-2995-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2995-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2995-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2995-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2995-14 | Pack of 1 | 450.00 |
| DesthiobiotinTEG CPG | 20-2952-01 | 0.1g | 140.00 |
| | 20-2952-10 | 1.0g | 1150.00 |
| 0.2 µmole columns | 20-2952-42 | Pack of 4 | 140.00 |
| 1 µmole columns | 20-2952-41 | Pack of 4 | 230.00 |
| 10 µmole column (ABI) | 20-2952-13 | Pack of 1 | 345.00 |
| 15 µmole column (Expedite) | 20-2952-14 | Pack of 1 | 450.00 |

**OTHER INSTRUMENT TYPES**

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

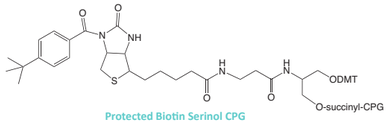
Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

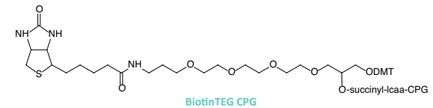
Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

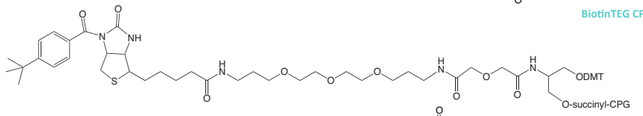
***(Please inquire for availability of vials and columns for other instrument types.)***



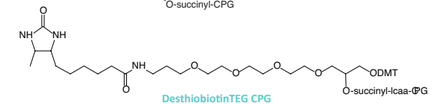

Protected Biotin Serinol CPG




BiotinTEG CPG




Protected BiotinLC Serinol CPG




DesthiobiotinTEG CPG

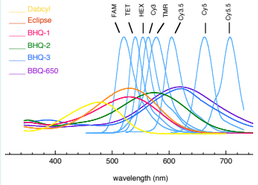
## FLUORESCEIN LABELING

5′-Fluorescein phosphoramidite contains no 4,4′-dimethoxytrityl (DMT) group and can be added only once at the 5′-terminus, thereby terminating synthesis. This product is prepared using the 6-carboxyfluorescein derivative. The tetrachloro-, hexachloro-and dichloro-dimethoxy-fluorescein (TET, HEX and JOE, respectively) phosphoramidites are designed to take advantage of the multicolor detection capability of modern DNA sequencers and genetic analyzers. Fluorescein phosphoramidite is designed to produce the same fluorescein-type structure as had been previously prepared using fluorescein isothiocyanate (FITC). Our fluorescein phosphoramidite also contains a DMT group to allow quantification of coupling. The analogous structure, 6-Fluorescein Phosphoramidite, prepared using 6-FAM, is also available, along with 6-Fluorescein Serinol Phosphoramidite. Fluorescein-dT can be inserted into the desired sequence as a replacement for a dT residue.

We offer five fluorescein supports. Fluorescein CPG has traditionally been used to add the fluorescein label at the 3′-terminus. The analogous structure, 3′-(6-Fluorescein) CPG, prepared using 6-FAM, is now also available, along with 6-Fluorescein Serinol CPG. We also offer 3′-(6-FAM) CPG and Fluorescein-dT CPG, both derivatives of 6-carboxyfluorescein (6-FAM). Both are single isomers and use an amide linkage which is stable during cleavage and deprotection and does not allow isomer formation. 3′-(6-FAM) CPG allows effective blockage of the 3′-terminus from polymerase extension as well as exonuclease digestion. Fluorescein-dT CPG allows both of these enzymatic activities to proceed. Normal cleavage and deprotection with ammonium hydroxide readily generates the fluorescein labeled oligos.

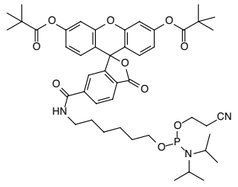
The spectral characteristics of these dyes are detailed on the following page.

### DYE QUENCHER PLOT

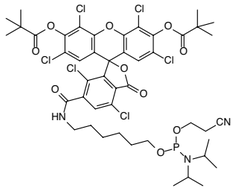



http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf

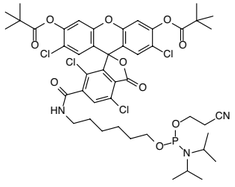
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 5′-Fluorescein Phosphoramidite (6-FAM) | 10-5901-95 | 50 µmole | 110.00 |
| | 10-5901-90 | 100 µmole | 215.00 |
| | 10-5901-02 | 0.25g | 575.00 |
| 5′-Hexachloro-Fluorescein Phosphoramidite (HEX) | 10-5902-95 | 50 µmole | 190.00 |
| | 10-5902-90 | 100 µmole | 375.00 |
| | 10-5902-02 | 0.25g | 875.00 |
| 5′-Tetrachloro-Fluorescein Phosphoramidite (TET) | 10-5903-95 | 50 µmole | 180.00 |
| | 10-5903-90 | 100 µmole | 350.00 |
| | 10-5903-02 | 0.25g | 875.00 |
| 5′-Dichloro-dimethoxy-Fluorescein Phosphoramidite II (JOE) | 10-5906-95 | 50 µmole | 105.00 |
| | 10-5906-90 | 100 µmole | 198.00 |
| | 10-5906-02 | 0.25g | 495.00 |



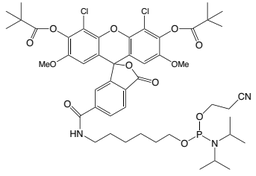
5′-Fluorescein Phosphoramidite



5′-Hexachloro-Fluorescein Phosphoramidite



5′-Tetrachloro-Fluorescein Phosphoramidite



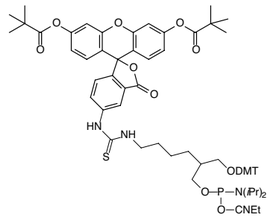
5′-Dichloro-dimethoxy-Fluorescein Phosphoramidite II



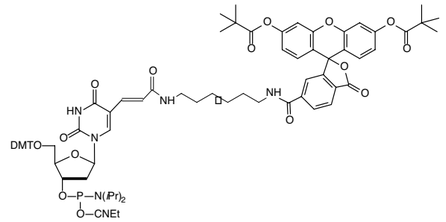


## FLUORESCEIN LABELING (CONT.)

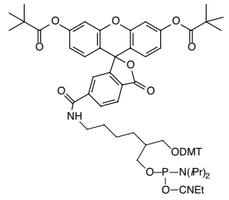
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Fluorescein Phosphoramidite | 10-1963-95 | 50 µmole | 165.00 |
| | 10-1963-90 | 100 µmole | 295.00 |
| | 10-1963-02 | 0.25g | 595.00 |
| 6-Fluorescein Phosphoramidite | 10-1964-95 | 50 µmole | 165.00 |
| | 10-1964-90 | 100 µmole | 295.00 |
| | 10-1964-02 | 0.25g | 595.00 |
| 6-Fluorescein Serinol Phosphoramidite | 10-1994-95 | 50 µmole | 165.00 |
| | 10-1994-90 | 100 µmole | 295.00 |
| | 10-1994-02 | 0.25g | 595.00 |
| Fluorescein-dT Phosphoramidite | 10-1056-95 | 50 µmole | 180.00 |
| | 10-1056-90 | 100 µmole | 325.00 |
| | 10-1056-02 | 0.25g | 675.00 |



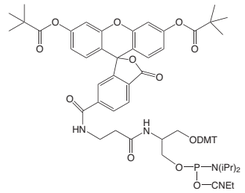
Fluorescein Phosphoramidite



Fluorescein dT



6-Fluorescein Phosphoramidite



6-Fluorescein Serinol Phosphoramidite

### FLUORESCENT DYES

| | Absorbance Maximum | Emission Maximum | Color |
|---|---|---|---|
| Fluorescein | 494nm | 525nm | Green |
| Tetrachloro-Fluorescein | 521nm | 536nm | Orange |
| Hexachloro-Fluorescein | 535nm | 556nm | Pink |
| SIMA (HEX) | 538nm | 551nm | Pink |
| Dichloro-dimethoxy-Fluorescein | 525nm | 548nm | Orange/Pink |
| TAMRA | 565nm | 580nm | Rose |
| Cy3 | 546nm | 563nm | Red |
| Cy3.5 | 588nm | 604nm | Purple |
| Cy5 | 646nm | 662nm | Violet |
| Cy5.5 | 683nm | 707nm | Dark Blue |
| Yakima Yellow | 530nm | 549nm | Yellow |
| Redmond Red | 579nm | 595nm | Red |

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

**Monomers**

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

**Columns**

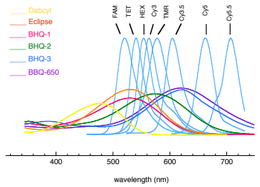
| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

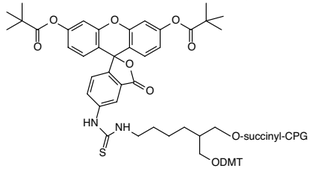
## FLUORESCEIN LABELING (CONT.)

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3′-Fluorescein CPG | 20-2963-01 | 0.1g | 120.00 |
| | 20-2963-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-2963-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-2963-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-2963-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2963-14 | Pack of 1 | 450.00 |
| 3′-(6-Fluorescein) CPG | 20-2964-01 | 0.1g | 120.00 |
| | 20-2964-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-2964-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-2964-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-2964-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2964-14 | Pack of 1 | 450.00 |
| 3′-(6-FAM) CPG | 20-2961-01 | 0.1g | 120.00 |
| | 20-2961-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-2961-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-2961-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-2961-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2961-14 | Pack of 1 | 450.00 |
| 3′-(6-FAM) PS | 26-2961-01 | 0.1g | 130.00 |
| | 26-2961-10 | 1.0g | 1045.00 |
| 200 nmole columns (AB 3900) | 26-2961-52 | Pack of 10 | 300.00 |
| 40 nmole columns (AB 3900) | 26-2961-55 | Pack of 10 | 300.00 |
| 3′-6-Fluorescein Serinol CPG | 20-2994-01 | 0.1g | 120.00 |
| | 20-2994-10 | 1.0g | 995.00 |
| 0.2 µmole columns | 20-2994-42 | Pack of 4 | 120.00 |
| 1 µmole columns | 20-2994-41 | Pack of 4 | 200.00 |
| 10 µmole column (ABI) | 20-2994-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2994-14 | Pack of 1 | 450.00 |

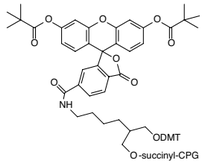
### DYE QUENCHER PLOT



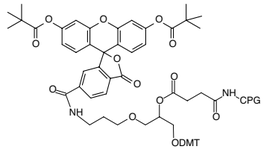

http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf



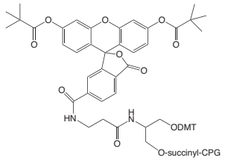

3′-Fluorescein CPG




3′-(6-Fluorescein) CPG




3′-(6-FAM) CPG




3′-6-Fluorescein Serinol CPG





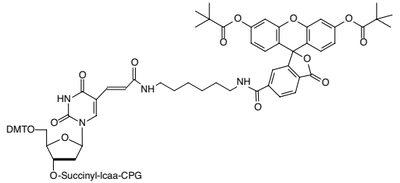
## FLUORESCEIN LABELING (CONT.)

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3′-Fluorescein-dT CPG | 20-2056-01 | 0.1g | 120.00 |
| | 20-2056-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-2056-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-2056-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-2056-13 | Pack of 1 | 300.00 |
| 15 µmole column (Expedite) | 20-2056-14 | Pack of 1 | 450.00 |

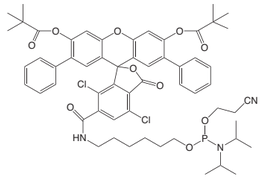
## FLUORESCEIN LABELING (SIMA)

Dichloro-diphenyl-fluorescein, SIMA (HEX) exhibits virtually identical absorbance and emission spectra to HEX. SIMA (HEX) is much more stable to basic deprotection conditions than HEX and oligonucleotides can be deprotected using ammonium hydroxide at elevated temperatures and even ammonium hydroxide/methylamine (AMA) at room temperature or 65°C for 10 minutes. SIMA absorption maximum was 3 nm blue-shifted compared to HEX at pH 7. The absorbance is broader, so the extinction coefficient is smaller than that of HEX, but when exciting at 500 nm where the absorbance was normalized, the emission was still 90% of HEX and the emission was red-shifted by 5 nm. A second SIMA (HEX) product, SIMA (HEX)-dT, can be used to introduce SIMA (HEX) in the synthetic oligonucleotide sequence, usually as a replacement for the native dT linkage. Again, this product is fully compatible with deprotection schemes using ammonium hydroxide at elevated temperatures or AMA at room temperature and 65°C.

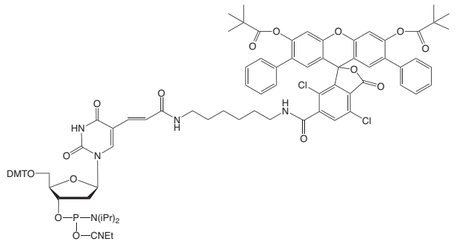
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| SIMA (HEX) Phosphoramidite | 10-5905-95 | 50 µmole | 90.00 |
| | 10-5905-90 | 100 µmole | 175.00 |
| | 10-5905-02 | 0.25g | 400.00 |
| SIMA (HEX)-dT Phosphoramidite | 10-5945-95 | 50 µmole | 345.00 |
| | 10-5945-90 | 100 µmole | 675.00 |
| | 10-5945-02 | 0.25g | 995.00 |




3′-Fluorescein-dT CPG




SIMA (HEX) Phosphoramidite




SIMA (HEX)-dT Phosphoramidite

### OTHER INSTRUMENT TYPES

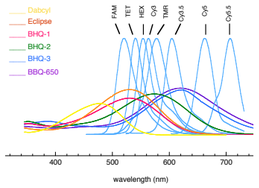
All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

| Monomers<br>*For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

| Columns<br>*For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

***(Please inquire for availability of vials and columns for other instrument types.)***

### DYE QUENCHER PLOT




http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf

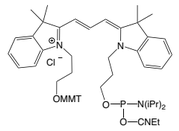
## CYANINE LABELING

Two cyanine derivatives, Cyanine 3 and Cyanine 5, which differ in structure simply by the number of carbons in the conjugated poly-ene linkage, are joined by the closely related analogues, Cyanine 3.5 and Cyanine 5.5, and are available as phosphoramidites. Cyanine dyes are normally added once at the 5'-terminus and the MMT group should be removed on the synthesizer. The absorbance of the MMT cation (yellow) is noticeably different from the DMT cation (orange), and so, absorbance-based trityl monitors will detect it incorrectly as a low coupling. On the other hand, conductivity detectors will interpret the release more correctly. Cyanine dye phosphoramidites have also been used successfully adjacent to the 3'-terminus. Cyanine 3 and Cyanine 5 supports are also offered to allow simpler production of 3' cyanine dye-labeled oligonucleotides.

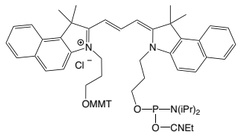
Deprotection of oligos containing Cyanine dyes may be carried out with ammonium hydroxide at room temperature, regardless of the base protecting groups on the monomers used. If there is a need to use ammonium hydroxide at elevated temperature, Cyanine 3 and Cyanine 3.5 are more stable than Cyanine 5 and Cyanine 5.5. However, it is always prudent to use monomers with base labile protecting groups to limit the exposure time to 2 hours or less at 65°C during deprotection.

To better address applications in near-infrared (NIR) imaging, Glen Research is offering a water soluble Disulfo-Cyanine 7 azide that can be easily conjugated to DNA and RNA through standard click chemistry. This long wavelength dye offers the benefits of improved solubility, reduced aggregation, and improved stability in the near-infrared spectrum along with the convenience of click chemistry.

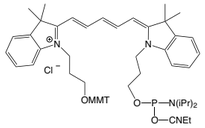
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Cyanine 3 Phosphoramidite | 10-5913-95 | 50 µmole | 205.00 |
| | 10-5913-90 | 100 µmole | 375.00 |
| | 10-5913-02 | 0.25g | 925.00 |
| Cyanine 3.5 Phosphoramidite | 10-5914-95 | 50 µmole | 220.00 |
| | 10-5914-90 | 100 µmole | 400.00 |
| | 10-5914-02 | 0.25g | 925.00 |
| Cyanine 5 Phosphoramidite | 10-5915-95 | 50 µmole | 205.00 |
| | 10-5915-90 | 100 µmole | 375.00 |
| | 10-5915-02 | 0.25g | 925.00 |
| Cyanine 5.5 Phosphoramidite | 10-5916-95 | 50 µmole | 245.00 |
| | 10-5916-90 | 100 µmole | 450.00 |
| | 10-5916-02 | 0.25g | 925.00 |



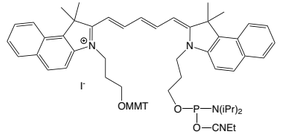
Cyanine 3 Phosphoramidite



Cyanine 3.5 Phosphoramidite



Cyanine 5 Phosphoramidite



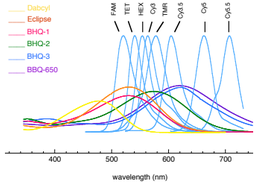
Cyanine 5.5 Phosphoramidite

### SPECTRAL DATA FOR CYANINE DYES

| | *Absorbance Maximum* | *Emission Maximum* | *Color* |
|---|---|---|---|
| Cyanine 3 | 546nm | 563nm | Red |
| Cyanine 3.5 | 588nm | 604nm | Purple |
| Cyanine 5 | 646nm | 662nm | Violet |
| Cyanine 5.5 | 683nm | 707nm | Dark Blue |
| Cyanine 7 | 750nm | 773nm | Dark Green |

*(Measured in an oligo in 0.1M TEAA buffer, pH7.)*

### DYE QUENCHER PLOT



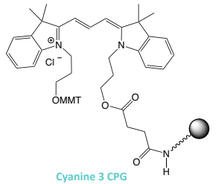

http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf



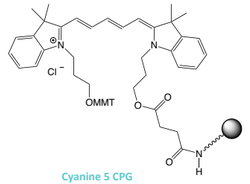


## CYANINE LABELING (CONT.)

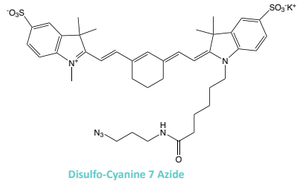
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Cyanine 3 CPG | 20-5913-01 | 0.1g | 160.00 |
| | 20-5913-10 | 1.0g | 1250.00 |
| 1 µmole columns (TWIST format only) | 20-5913-41 | Pack of 4 | 250.00 |
| 0.2 µmole columns | 20-5913-42 | Pack of 4 | 70.00 |
| Cyanine 5 CPG | 20-5915-01 | 0.1g | 160.00 |
| | 20-5915-10 | 1.0g | 1250.00 |
| 1 µmole columns (TWIST format only) | 20-5915-41 | Pack of 4 | 250.00 |
| 0.2 µmole columns | 20-5915-42 | Pack of 4 | 70.00 |
| Disulfo-Cyanine 7 Azide | 50-2010-92 | 25 µmole | 325.00 |
| | 50-2010-90 | 100 µmole | 975.00 |



Cyanine 3 CPG



Cyanine 5 CPG



Disulfo-Cyanine 7 Azide

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

**Monomers**

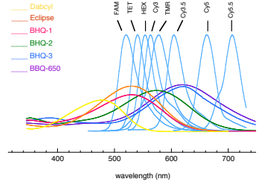
| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

**Columns**

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

### DYE QUENCHER PLOT




http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf

## ELITECHGROUP DYES AND QUENCHER

### SEE ALSO

*PPG on page 4*
*5′-Aldehyde-Modifier C2 on page 13*

### FLUORESCENT DYES

| | Absorbance Maximum | Emission Maximum | Color |
|---|---|---|---|
| Yakima Yellow | 530nm | 549nm | Yellow |
| Redmond Red | 579nm | 595nm | Red |
| AquaPhluor 593 | 593nm | 613nm | Red |

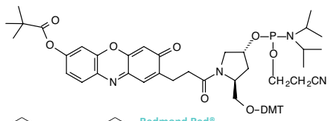
### INTELLECTUAL PROPERTY



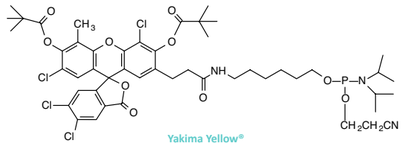
Glen Research's agreement with ELITechGroup, formerly Epoch Biosciences, allows us to offer several of their proprietary products designed for the synthesis of novel DNA probes. We are pleased to offer products based on ELITechGroup's Redmond Red®, Yakima Yellow® and AquaPhluor® 593 fluorophores and Eclipse® non-fluorescent quencher. Under our agreement we also supply PPG, a modified nucleoside, and 5′-Aldehyde-Modifier C2 Phosphoramidite. The fluorescent dyes, Yakima Yellow, Redmond Red and AquaPhluor 593, are available as phosphoramidites and supports. Yakima Yellow has an absorbance maximum at 530 nm and emission maximum at 549 nm, Redmond Red's absorbance and emission maxima are at 579 nm and 595 nm, respectively, and AquaPhluor 593 has an absorbance maximum at 593 nm and emission maximum at 613 nm.

The Eclipse quencher from ELITechGroup solves most of the problems inherent in the synthesis of molecular beacon and FRET probes. The Eclipse molecule is highly stable and can be used safely in all common oligo deprotection schemes. The absorbance maximum for Eclipse Quencher is at 522 nm, compared to 479 nm for dabcyl. In addition, the structure of the Eclipse Quencher is substantially more electron deficient than that of dabcyl and this leads to better quenching over a wider range of dyes, especially those with emission maxima at longer wavelengths (red shifted) such as Redmond Red and Cyanine 5. In addition, with an absorption range from 390 nm to 625 nm, the Eclipse Quencher is capable of effective performance in a wide range of colored FRET probes.

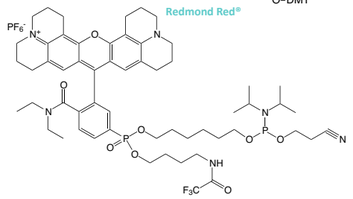
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Redmond Red® Phosphoramidite | 10-5920-95 | 50 µmole | 220.00 |
| | 10-5920-90 | 100 µmole | 420.00 |
| | 10-5920-02 | 0.25g | 1045.00 |
| Yakima Yellow® Phosphoramidite | 10-5921-95 | 50 µmole | 230.00 |
| | 10-5921-90 | 100 µmole | 440.00 |
| | 10-5921-02 | 0.25g | 1045.00 |
| 5′-AquaPhluor® 593 Phosphoramidite | 10-5923-95 | 50 µmole | 405.00 |
| | 10-5923-90 | 100 µmole | 795.00 |
| | 10-5923-02 | 0.25g | 1575.00 |
| Eclipse® Quencher Phosphoramidite | 10-5925-95 | 50 µmole | 250.00 |
| | 10-5925-90 | 100 µmole | 480.00 |
| | 10-5925-02 | 0.25g | 1185.00 |



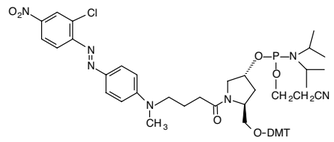
Redmond Red®



Yakima Yellow®



5′-AquaPhluor® 593



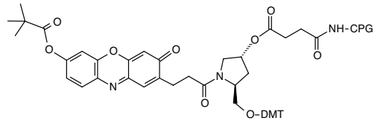
Epoch Eclipse™ Quencher



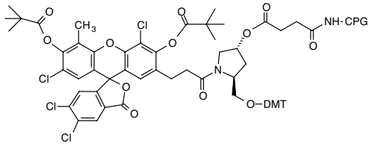


## ELITECHGROUP DYES AND QUENCHER (CONT.)

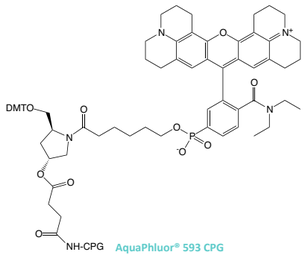
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Redmond Red® CPG | 20-5920-01 | 0.1g | 180.00 |
| | 20-5920-10 | 1.0g | 1500.00 |
| 1 µmole columns | 20-5920-41 | Pack of 4 | 300.00 |
| 0.2 µmole columns | 20-5920-42 | Pack of 4 | 150.00 |
| 10 µmole column (ABI) | 20-5920-13 | Pack of 1 | 750.00 |
| 15 µmole column (Expedite) | 20-5920-14 | Pack of 1 | 1125.00 |
| Yakima Yellow® CPG | 20-5921-01 | 0.1g | 180.00 |
| | 20-5921-10 | 1.0g | 1500.00 |
| 1 µmole columns | 20-5921-41 | Pack of 4 | 300.00 |
| 0.2 µmole columns | 20-5921-42 | Pack of 4 | 150.00 |
| 10 µmole column (ABI) | 20-5921-13 | Pack of 1 | 750.00 |
| 15 µmole column (Expedite) | 20-5921-14 | Pack of 1 | 1125.00 |
| AquaPhluor® 593 CPG | 20-5923-01 | 0.1g | 215.00 |
| | 20-5923-10 | 1.0g | 1800.00 |
| 1 µmole columns | 20-5923-41 | Pack of 4 | 325.00 |
| 0.2 µmole columns | 20-5923-42 | Pack of 4 | 165.00 |
| 10 µmole column (ABI) | 20-5923-13 | Pack of 1 | 925.00 |
| 15 µmole column (Expedite) | 20-5923-14 | Pack of 1 | 1395.00 |
| Eclipse® Quencher CPG | 20-5925-01 | 0.1g | 230.00 |
| | 20-5925-10 | 1.0g | 1925.00 |
| 1 µmole columns | 20-5925-41 | Pack of 4 | 350.00 |
| 0.2 µmole columns | 20-5925-42 | Pack of 4 | 175.00 |
| 10 µmole column (ABI) | 20-5925-13 | Pack of 1 | 995.00 |
| 15 µmole column (Expedite) | 20-5925-14 | Pack of 1 | 1495.00 |



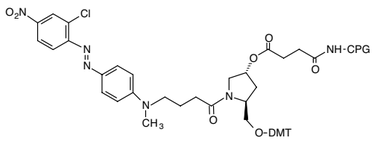
Redmond Red® CPG



Yakima Yellow® CPG



AquaPhluor® 593 CPG



Eclipse® Quencher CPG

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

**Monomers**

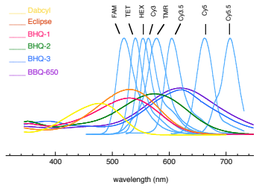
| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

**Columns**

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

### DYE QUENCHER PLOT




http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf

## BLACK HOLE QUENCHER DYES

With the growing popularity of red and near-infrared dyes, we are offering the Black Hole Quencher™ dyes (BHQs), whose physical properties are detailed in Table 1. BHQ dyes are robust dark quenchers that very nicely complement our existing product line. They are compatible with ammonium hydroxide deprotection, exhibit excellent coupling efficiencies, have large extinction coefficients and are completely non-fluorescent. Their absorbances are well-tuned to quench a variety of popular fluorophores – even those far into the red, such as Cy3 and Cy5. The dark quencher most typically used in a Molecular Beacon is Dabcyl. Because the quenching does not involve FRET, there is little, if any, dependence upon donor-acceptor spectral overlap. In a comprehensive paper by Marras, Kramer and Tyagi,[1] the ability of BHQ-1 and BHQ-2 to quench 22 different fluorophores was evaluated. For shorter wavelength fluorophores such as fluorescein, the quenching efficiency was roughly the same as Dabcyl (91% – 93%). However, for dyes emitting in the far red, such as Cy5, the BHQ dyes were far superior – quenching the Cy5 with 96% efficiency, compared to 84% with Dabcyl. This may reflect the BHQ's ability to form stable, non-fluorescent complexes which can be a plus even in FRET probes. Indeed, recent work suggests that these non-fluorescent complexes will form even in the absence of a hairpin stem structure used by Molecular Beacons.[2]

### TABLE 1: BLACK HOLE QUENCHERS

| Quencher | λmax (nm) | E260 (L/mol.cm) | Emax (L/mol.cm) |
|---|---|---|---|
| BHQ-1 | 534 | 8,000 | 34,000 |
| BHQ-2 | 579 | 8,000 | 38,000 |
| BHQ-3 | 672 | 13,000 | 42,700 |

### REFERENCES


(1) S.A.E. Marras, F.R. Kramer, and S. Tyagi, *Nucleic Acids Res.*, 2002, **30**, E122.
(2) M.K. Johansson, H. Fidder, D. Dick, and R.M. Cook, *J Am Chem Soc*, 2002, **124**, 6950-6956.

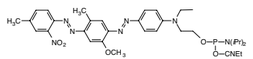

### SEE OTHER QUENCHERS

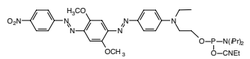

*Dabcyl on page 28*
*Eclipse™ on page 39*
*BBQ-650® on page 42*

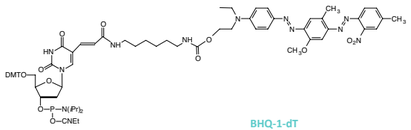

### INTELLECTUAL PROPERTY

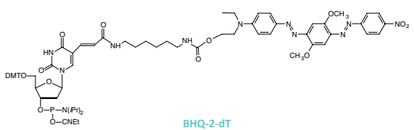


| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 5'-BHQ-1 Phosphoramidite | 10-5931-95 | 50 µmole | 100.00 |
| | 10-5931-90 | 100 µmole | 200.00 |
| | 10-5931-02 | 0.25g | 700.00 |
| 5'-BHQ-2 Phosphoramidite | 10-5932-95 | 50 µmole | 100.00 |
| | 10-5932-90 | 100 µmole | 200.00 |
| | 10-5932-02 | 0.25g | 700.00 |
| BHQ-1-dT | 10-5941-95 | 50 µmole | 265.00 |
| | 10-5941-90 | 100 µmole | 525.00 |
| | 10-5941-02 | 0.25g | 925.00 |
| BHQ-2-dT | 10-5942-95 | 50 µmole | 265.00 |
| | 10-5942-90 | 100 µmole | 525.00 |
| | 10-5942-02 | 0.25g | 925.00 |


5'-BHQ-1


5'-BHQ-2


BHQ-1-dT

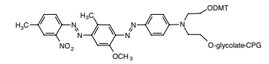

BHQ-2-dT

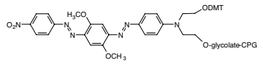


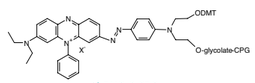


## BLACK HOLE QUENCHER DYES (CONT.)

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3'-BHQ-1 CPG | 20-5931-01 | 0.1g | 190.00 |
| | 20-5931-10 | 1.0g | 1500.00 |
| 1 µmole columns | 20-5931-41 | Pack of 4 | 300.00 |
| 0.2 µmole columns | 20-5931-42 | Pack of 4 | 80.00 |
| 10 µmole column (ABI) | 20-5931-13 | Pack of 1 | 575.00 |
| 15 µmole column (Expedite) | 20-5931-14 | Pack of 1 | 825.00 |
| 3'-BHQ-2 CPG | 20-5932-01 | 0.1g | 190.00 |
| | 20-5932-10 | 1.0g | 1500.00 |
| 1 µmole columns | 20-5932-41 | Pack of 4 | 300.00 |
| 0.2 µmole columns | 20-5932-42 | Pack of 4 | 80.00 |
| 10 µmole column (ABI) | 20-5932-13 | Pack of 1 | 575.00 |
| 15 µmole column (Expedite) | 20-5932-14 | Pack of 1 | 825.00 |
| 3'-BHQ-3 CPG | 20-5933-01 | 0.1g | 190.00 |
| | 20-5933-10 | 1.0g | 1500.00 |
| 1 µmole columns | 20-5933-41 | Pack of 4 | 300.00 |
| 0.2 µmole columns | 20-5933-42 | Pack of 4 | 80.00 |
| 10 µmole column (ABI) | 20-5933-13 | Pack of 1 | 575.00 |
| 15 µmole column (Expedite) | 20-5933-14 | Pack of 1 | 825.00 |


3'-BHQ-1 CPG


3'-BHQ-2 CPG


3'-BHQ-3 CPG

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

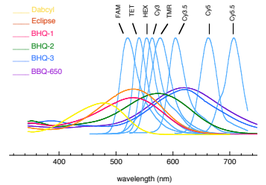
| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

### Dye Quencher Plot



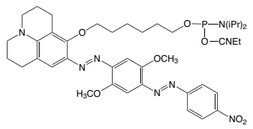

http://www.glenresearch.com/ProductFiles/Dye_Quencher_Plot.pdf

## BLACKBERRY® QUENCHER (BBQ-650®)

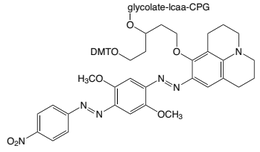
We are happy to offer several products containing the BlackBerry® Quencher (BBQ-650®), which exhibits a broad absorption profile from 550nm to 750nm, centered at 650nm. This range offers more effective quenching of some of our popular long wavelength dyes like TAMRA, Redmond Red, Cy dyes and DyLight dyes. We offer BBQ-650 products for the 3′ and 5′ termini, as well as BBQ-650-dT for inclusion within the oligonucleotide sequence, with the following properties:

- Quenches the fluorescence of long wavelength dyes
- Quenches in FRET and contact mode
- Absorbance maximum at ~650nm
- Quenching range – 550-750nm
- Compatible with standard oligo synthesis chemistry
- Compatible with regular deprotection but requires mild deprotection with AMA at room temperature
- Available for 3′, 5′, and internal substitution
- More stable than BHQ-3

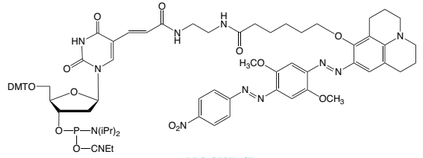
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 5′-BBQ-650® Phosphoramidite | 10-5934-95 | 50 µmole | 160.00 |
| | 10-5934-90 | 100 µmole | 305.00 |
| | 10-5934-02 | 0.25g | 925.00 |
| BBQ-650®-dT | 10-5944-95 | 50 µmole | 280.00 |
| | 10-5944-90 | 100 µmole | 545.00 |
| | 10-5944-02 | 0.25g | 925.00 |
| 3′-BBQ-650® CPG | 20-5934-01 | 0.1g | 190.00 |
| | 20-5934-10 | 1.0g | 1500.00 |
| 1 µmole columns | 20-5934-41 | Pack of 4 | 300.00 |
| 0.2 µmole columns | 20-5934-42 | Pack of 4 | 80.00 |
| 10 µmole column (ABI) | 20-5934-13 | Pack of 1 | 575.00 |
| 15 µmole column (Expedite) | 20-5934-14 | Pack of 1 | 825.00 |




5′-BBQ-650™




3′-BBQ™-650™ CPG




BBQ-650™-dT

### INTELLECTUAL PROPERTY

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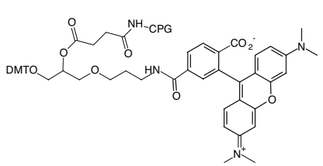
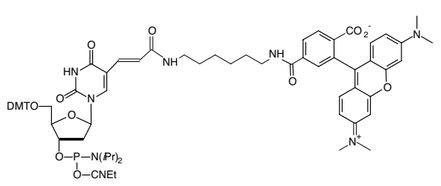
## RHODAMINE (TAMRA) LABELING

Rhodamine derivatives are not sufficiently stable to survive conventional deprotection and these must be attached to amino-modified oligonucleotides using post-synthesis labeling techniques. Because Tetramethyl Rhodamine (TAMRA) is not base stable, the procedure to cleave and deprotect the labeled oligonucleotide must be carefully considered. Using the UltraMILD monomers and deprotection with potassium carbonate in methanol, TAMRA oligonucleotides can be fairly conveniently isolated. To streamline the preparation of TAMRA oligos, we offer 3′-TAMRA CPG for 3′ labeling and TAMRA-dT for labeling within the sequence. We also offer TAMRA NHS ester for labeling amino-modified oligonucleotides.

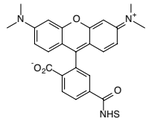
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3′-TAMRA CPG | 20-5910-01 | 0.1g | 120.00 |
| | 20-5910-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-5910-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-5910-42 | Pack of 4 | 120.00 |
| 3'-TAMRA PS | 26-5910-01 | 0.1g | 130.00 |
| | 26-5910-10 | 1.0g | 1045.00 |
| 200 nmole columns (AB 3900) | 26-5910-52 | Pack of 10 | 300.00 |
| 40 nmole columns (AB 3900) | 26-5910-55 | Pack of 10 | 300.00 |
| TAMRA-dT | 10-1057-95 | 50 µmole | 250.00 |
| | 10-1057-90 | 100 µmole | 495.00 |
| | 10-1057-02 | 0.25g | 975.00 |
| TAMRA NHS Ester (Solution in anhydrous DMSO) | 50-5910-66 | 60 µL | 240.00 |




TAMRA CPG




TAMRA-dT




TAMRA NHS Ester

### SEE ALSO

*UltraMILD monomers on page 4*

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| For Instrument type | Add |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| For Instrument type | Add |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*

## ACRIDINE LABELING

Acridine phosphoramidite is designed to produce an oligonucleotide containing acridine at any position in the molecule. Acridine CPG is used to label the 3′-terminus. Acridine is an effective intercalating agent.

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Acridine Phosphoramidite | 10-1973-95 | 50 µmole | 165.00 |
| | 10-1973-90 | 100 µmole | 295.00 |
| | 10-1973-02 | 0.25g | 675.00 |
| 3′-Acridine CPG | 20-2973-01 | 0.1g | 120.00 |
| | 20-2973-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-2973-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-2973-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-2973-13 | Pack of 1 | 300.00 |
| 15 µmole cloumn (Expedite) | 20-2973-14 | Pack of 1 | 450.00 |

## DNP LABELING

An analytical test based on detection of 2,4-dinitrophenyl (DNP) labeled oligonucleotides with anti-DNP antibodies has been proposed. We have chosen the branched triethylene glycol (TEG) spacer in our version of DNP phosphoramidite since it can be added once or several times to the 3′ or 5′ terminus.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| DNP-TEG Phosphoramidite | 10-1985-95 | 50 µmole | 165.00 |
| | 10-1985-90 | 100 µmole | 295.00 |
| | 10-1985-02 | 0.25g | 675.00 |

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

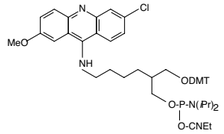
Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

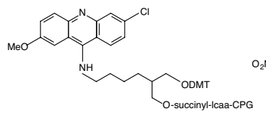
Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

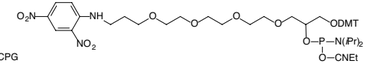
*(Please inquire for availability of vials and columns for other instrument types.)*



Acridine



Acridine CPG



DNP-TEG





## CHOLESTEROL LABELING

Potential therapeutic oligonucleotides must permeate the cell membrane for optimal activity. The addition of lipophilic groups to an oligonucleotide would be expected to enhance cellular uptake/membrane permeation. The use of cholesteryl oligos and the consequent improvement in activity has been described. We have designed our Cholesteryl products with triethyleneglycol (TEG) spacers for maximum solubility.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| Cholesteryl-TEG Phosphoramidite | 10-1975-95 | 50 µmole | 140.00 |
| | 10-1975-90 | 100 µmole | 265.00 |
| | 10-1975-02 | 0.25g | 545.00 |
| 5′-Cholesteryl-TEG Phosphoramidite | 10-1976-95 | 50 µmole | 95.00 |
| | 10-1976-90 | 100 µmole | 175.00 |
| | 10-1976-02 | 0.25g | 525.00 |
| 3′-Cholesteryl-TEG CPG | 20-2975-01 | 0.1g | 85.00 |
| | 20-2975-10 | 1.0g | 700.00 |
| 1 µmole columns | 20-2975-41 | Pack of 4 | 140.00 |
| 0.2 µmole columns | 20-2975-42 | Pack of 4 | 84.00 |
| 10 µmole column (ABI) | 20-2975-13 | Pack of 1 | 210.00 |
| 15 µmole column (Expedite) | 20-2975-14 | Pack of 1 | 315.00 |

### SEE ALSO

*Spermine on page 4*

## TOCOPHEROL LABELING

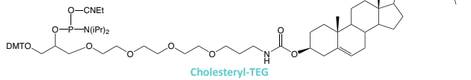
Vitamin E is both lipophilic and non-toxic even at high doses so would be an excellent candidate as a lipophilic carrier for oligonucleotides. Therefore, as an addition to our cholesteryl product line, we offer simple α-tocopheryl (vitamin E) labeling. Totally synthetic α-tocopherol is racemic at its three chiral centers and is used to prepare this product.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| α-Tocopherol-TEG Phosphoramidite | 10-1977-95 | 50 µmole | 160.00 |
| | 10-1977-90 | 100 µmole | 300.00 |
| | 10-1977-02 | 0.25g | 575.00 |

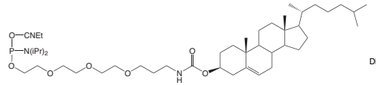
## STEARYL LABELING

We now offer a simple C18 lipid as an economical and effective carrier molecule. We envisage that the 5′-stearyl group will become a favored lipophilic carrier for experimentation with synthetic oligonucleotides.

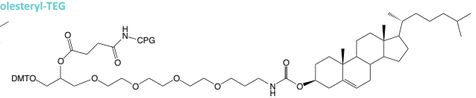
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 5′- Stearyl Phosphoramidite | 10-1979-90 | 100 µmole | 45.00 |
| | 10-1979-02 | 0.25g | 180.00 |



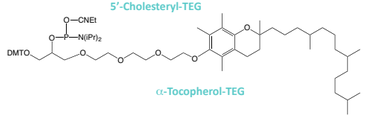
Cholesteryl-TEG



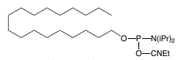
5′-Cholesteryl-TEG



3′-Cholesteryl-TEG CPG



α-Tocopherol-TEG



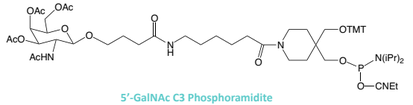
5′- Stearyl

## N-ACETYLGALACTOSAMINE (GalNAc) LABELING

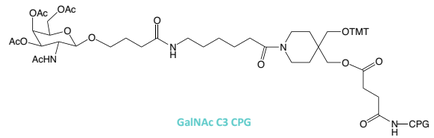
**A** directed approach to the delivery of therapeutic oligonucleotides specifically to the liver has been to target the asialoglycoprotein receptor (ASGPR) using a suitable glycoconjugate. Indeed, ASGPR is the ideal target for delivery of therapeutic oligonucleotides to the liver since it combines tissue specificity, high expression levels and rapid internalization and turnover. The use of oligonucleotide glycoconjugates has led to significant advances in therapeutic delivery as evidenced by the work of Alnylam Pharmaceuticals and Ionis Pharmaceuticals using multivalent N-acetylgalactosamine (GalNAc) oligonucleotide conjugates.

Glen Research is delighted to introduce a GalNAc modification strategy using a monomeric GalNAc support and the equivalent GalNAc phosphoramidite. Our experimental work has shown that these products are fully compatible with regular oligonucleotide synthesis and deprotection. Oligonucleotides containing GalNAc can be deprotected using standard procedures during which the acetyl protecting groups on GalNAc are removed. We have demonstrated that 5′-GalNAc C3 phosphoramidite can be used to prepare oligonucleotides with multiple consecutive GalNAc additions at the 5′ terminus. Glen Research offers these GalNAc C3 products under an agreement with AM Chemicals LLC.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 5′-GalNAc C3 Phosphoramidite | 10-1974-95 | 50 µmole | 137.50 |
| | 10-1974-90 | 100 µmole | 255.00 |
| | 10-1974-02 | 0.25g | 500.00 |
| GalNAc C3 CPG | 20-2974-01 | 0.1g | 40.00 |
| | 20-2974-10 | 1.0g | 320.00 |
| 1 µmole columns | 20-2974-41 | Pack of 4 | 100.00 |
| 0.2 µmole columns | 20-2974-42 | Pack of 4 | 60.00 |
| 10 µmole column (ABI) | 20-2974-13 | Pack of 1 | 180.00 |
| 15 µmole column (Expedite) | 20-2974-14 | Pack of 1 | 280.00 |




5′-GalNAc C3 Phosphoramidite




GalNAc C3 CPG

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*





## CDPI$_3$ MGB™ LABELING

**T**he tripeptide of dihydropyrroloindole-carboxylate (CDPI$_3$) is a minor groove binding (MGB) moiety derived from the natural product CC-1065 with strong DNA binding properties. Synthetic oligonucleotides with covalently-attached CDPI$_3$ have enhanced DNA affinity and have improved the hybridization properties of sequence-specific DNA probes. Short CDPI$_3$-oligonucleotides hybridize with single-stranded DNA to give more stable DNA duplexes than unmodified ODNs of similar length. CDPI$_3$ MGB-oligonucleotide conjugates have been found to be useful in the following applications:

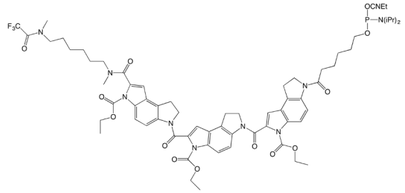
- Arrest of primer extension and PCR blockers
- Short and fluorogenic PCR primers
- Real-time PCR probes
- miRNA Inhibitors

The simplest approach to MGB probe design is to use an MGB support, add a quencher molecule as the first addition and complete the synthesis with a 5′-fluorophore. Alternatively, a fluorophore support could be used with the 5′ terminus containing a quencher molecule followed by a final MGB addition at the 5′ terminus. Glen Research offers 5′-CDPI$_3$ MGB™ Phosphoramidite and 3′-CDPI$_3$ MGB™ CPG.

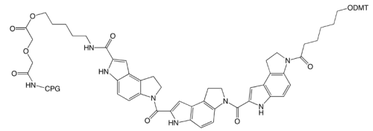
5′-CDPI$_3$ MGB phosphoramidite was found to be hydrophobic enough that it required 10% THF in ACN to go completely into solution at a 0.1 M concentration and required a 3 minute coupling time. Deprotection can be carried out in EtOH/NH4OH 1:3 (v/v) 17 hr at 55 °C and CDPI$_3$ MGB is compatible with GlenPak™ purification.

With the CDPI$_3$ MGB CPG, optimal results are obtained if UltraMild monomers and Cap A are used during synthesis along with 0.5 M CSO oxidizer. However, the use of standard monomers with iodine oxidation followed by deprotection with EtOH/NH4OH 1:3 (v/v) for 17 hr at 55 °C will give acceptable results.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 5′-CDPI$_3$ MGB™ Phosphoramidite | 10-5924-95 | 50 µmole | 705.00 |
| | 10-5924-90 | 100 µmole | 1390.00 |
| | 10-5924-02 | 0.25g | 2600.00 |
| CDPI$_3$ MGB™ CPG | 20-5924-01 | 0.1g | 215.00 |
| | 20-5924-10 | 1.0g | 1800.00 |
| 1 µmole columns | 20-5924-41 | Pack of 4 | 325.00 |
| 0.2 µmole columns | 20-5924-42 | Pack of 4 | 165.00 |
| 10 µmole column (ABI) | 20-5924-13 | Pack of 1 | 925.00 |
| 15 µmole column (Expedite) | 20-5924-14 | Pack of 1 | 1395.00 |




5′-CDPI$_3$ MGB™ Phosphoramidite




CDPI$_3$ MGB™ CPG

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21720 23rd Drive SE, Suite 150,
Bothell, WA 98021.
Phone (425) 482-5555.
Fax (425) 482-5550.
Email: mdx@elitechgroup.com.

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## PSORALEN LABELING

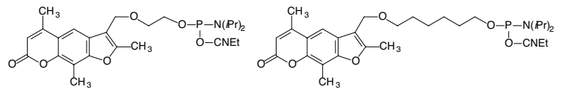
**P**soralen C2 at the 5'-terminus of an oligonucleotide serves effectively as a cross-linking reagent in double-stranded oligonucleotides. The 6 atom spacer arm of Psoralen C6 allows cross-linking with a triplex oligonucleotide strand. Click Chemistry with psoralen azide and one of our many nucleosidic and non-nucleosidic alkyne derivatives has the potential to generate a variety of practical cross-linkers. The well known reversible cross-linking behavior of psoralen with an adjacent thymidine residue could be very useful.

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Psoralen C2 Phosphoramidite | 10-1982-90 | 100 µmole | 195.00 |
| | 10-1982-02 | 0.25g | 495.00 |
| Psoralen C6 Phosphoramidite | 10-1983-90 | 100 µmole | 195.00 |
| | 10-1983-02 | 0.25g | 495.00 |
| Psoralen Azide | 50-2009-92 | 25 µmole | 115.00 |
| | 50-2009-90 | 100 µmole | 350.00 |

## EDTA LABELING

**E**DTA-C2-dT phosphoramidite contains the triethyl ester of EDTA which allows sequence-specific cleavage of single- and double-stranded DNA and RNA. The cleavage reaction is only initiated once Fe(II) and dithiothreitol are added and so is readily controlled. Coupling of EDTA-dT is normal but cleavage and deprotection should be carried out with sodium hydroxide in aqueous methanol (0.4M NaOH in methanol/water 4:1) overnight at room temperature.

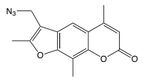
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| EDTA-C2-dT-CE Phosphoramidite | 10-1059-95 | 50 µmole | 250.00 |
| | 10-1059-90 | 100 µmole | 495.00 |
| | 10-1059-02 | 0.25g | 975.00 |



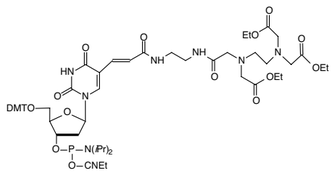
Psoralen C2



Psoralen C6



Psoralen Azide



EDTA-C2-dT

### OTHER INSTRUMENT TYPES

All minor bases, RNA products and modifiers are packaged in septum-capped vials suitable for ABI and other instruments. If you would like another type of vial/column add the following to the end of the catalog number.

Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

*(Please inquire for availability of vials and columns for other instrument types.)*





## FERROCENE LABELING

**W**ith an excellent stability profile, ferrocene has always attracted considerable interest for DNA labeling to generate probes for electrochemical detection. Based on our Amino-Modifier C6-dT structure, Ferrocene-dT is easily added to oligonucleotides with no disruption of regular hybridization behavior. Multiple incorporations into an oligonucleotide probe are also simply achieved. Oligonucleotides are deprotected using standard techniques. Ferrocene oligonucleotides should be stored under Argon and aqueous solutions should be degassed immediately.

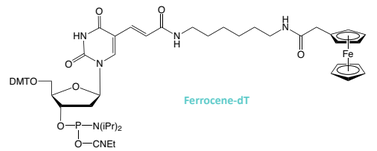
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Ferrocene-dT-CE Phosphoramidite | 10-1576-95 | 50 µmole | 170.00 |
| | 10-1576-90 | 100 µmole | 330.00 |
| | 10-1576-02 | 0.25g | 670.00 |

## METHYLENE BLUE LABELING

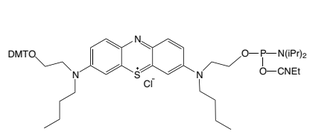
**M**ethylene Blue, which belongs to the phenothiazine family of dyes, is a unique dye with a variety of useful properties. Despite its high extinction coefficient in the visible region (81,000 L/mol.cm), it is weakly fluorescent due to its high rate of intersystem crossing from the $S_1$ excited state to the $T_1$ triplet state. This property makes it an excellent photosensitizer, and it has been used extensively to produce highly reactive singlet oxygen. Methylene blue has the ability to both intercalate in duplex DNA, preferring G:C over T:A base pairs, and can act as an electrochemical redox probe. Methylene blue has also been shown to be unmatched in performance as a redox-active reporter for electrochemical biosensors.

Earlier, we introduced Methylene Blue C3 Phosphoramidite but this product proved to have quite limited stability and has been discontinued. As an alternative option, we introduced Methylene Blue NHS Ester to allow researchers to label amino-modified oligonucleotides with this interesting dye. With the encouragement and technical expertise of Carole Chaix and her colleagues at the University of Lyon, we decided to prepare an alternative structure that seemed to have a much superior stability profile - Methylene Blue II Phosphoramidite. Fortunately, this structure did indeed prove more stable and we are now able to offer again a Methylene Blue Phosphoramidite.

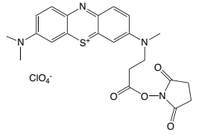
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Methylene Blue NHS Ester (Dissolve 5.4mg in 60µL of DMSO) | 50-1960-23 | 5.4mg | 540.00 |
| Methylene Blue II Phosphoramidite | 10-5961-95 | 50 µmole | 310.00 |
| | 10-5961-90 | 100 µmole | 595.00 |
| | 10-5961-02 | 0.25g | 1500.00 |



Ferrocene-dT



Methylene Blue II



Methylene Blue NHS Ester

### INTELLECTUAL PROPERTY

Methylene Blue II is covered under patent applications FR12 51739 and PCT/FR2013/050356 and is sold under license from the University of Lyon.

## LABELING WITH METAL CHELATES

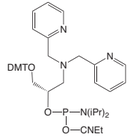
**2**,2′-Dipicolylamine Phosphoramidite has been discontinued  This product was manufactured and developed by Syntrix Biosystems Inc.  For further information, please contact:

Dean Y. Maeda, Ph.D., M.B.A.
Director, Chemistry and Preclinical Development
Syntrix Biosystems
215 Clay St NW Ste B5
Auburn, WA 98001
tel: 253-833-8009 ext. 23
fax: 253-833-8127
Dmaeda@syntrixbio.com

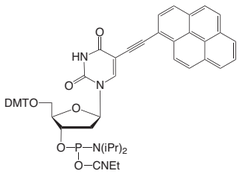
## LABELING WITH POLYAROMATIC HYDROCARBONS

**P**yrene and perylene are fluorescent polycyclic aromatic hydrocarbons that have the ability to form 'excited state dimers' known as excimers.  This unstructured, long-wavelength emission arises from the formation of a charge-transfer complex between the excited state and the ground state of two fluorescent molecules.  In Pyrene-dU and perylene-dU, the hydrocarbon is attached at the 5 position of deoxyuridine through a triple bond and is electronically coupled to the deoxyuridine base.  This electronic coupling of the base and the hydrocarbon makes the fluorescence sensitive to the base pairing of the dU portion of the molecule, allowing the discrimination between perfect and one base mismatched targets.

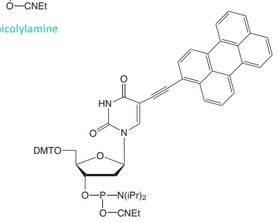
| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| Pyrene-dU-CE Phosphoramidite | 10-1590-95 | 50 µmole | 105.00 |
| | 10-1590-90 | 100 µmole | 210.00 |
| | 10-1590-02 | 0.25g | 550.00 |
| Perylene-dU-CE Phosphoramidite | 10-1591-95 | 50 µmole | 150.00 |
| | 10-1591-90 | 100 µmole | 300.00 |
| | 10-1591-02 | 0.25g | 720.00 |



2,2′-Dipicolylamine



Pyrene-dU



Perylene-dU

### OTHER INSTRUMENT TYPES

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Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

***(Please inquire for availability of vials and columns for other instrument types.)***

### FLUORESCENT DYES

| | *Absorbance Maximum* | *Emission Maximum* | *Excimer* |
|---|---|---|---|
| Pyrene-dU | 402nm | 472nm | 486nm |
| Perylene-dU | 473nm | 490nm | Not Determined |





## PUROMYCIN CPG

**O**ne of the most challenging requirements associated with combinatorial chemistry is the recovery of sequence information of the oligonucleotide or peptide selected by the screening assay.  A method1 has been developed to generate a fusion product between mRNA and the polypeptide it encodes using ***in vitro*** translation of synthetic RNAs 3′-labeled with puromycin, an antibiotic that mimics transfer RNA.  Puromycin binds in the ribosome's A site, forms a peptide bond with the growing peptide chain, and blocks further peptide elongation.  By linking puromycin to mRNA, a peptide-RNA fusion product results from the translation of the message linking the encoding mRNA with its peptide product.

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| Puromycin CPG | 20-4040-01 | 0.1g | 120.00 |
| | 20-4040-10 | 1.0g | 995.00 |
| 1 µmole columns | 20-4140-41 | Pack of 4 | 200.00 |
| 0.2 µmole columns | 20-4140-42 | Pack of 4 | 120.00 |
| 10 µmole column (ABI) | 20-4140-13 | Pack of 1 | 360.00 |
| 15 µmole columns (Expedite) | 20-4140-14 | Pack of 1 | 540.00 |

### REFERENCE

(1) R.W. Roberts and J.W. Szostak, ***Proc. Natl. Acad. Sci. USA***, 1997, **94**, 12297-302.

## QUENCHED AUTOLIGATION (QUAL) PROBES

**Q**UAL probes[1] consist of two oligonucleotides, the first containing a nucleophilic group at the 3′-terminus, while the second has an electrophilic group at the 5′-terminus.  When the probe pair finds the target, the oligos line up with the 3′-terminus of the first directly adjacent to the 5′-terminus of the second.  An autoligation reaction then takes place to combine the two oligos into a single probe.  As usual, the 3′ nucleophilic group is the 3-thiophosphate, easily prepared using 3′-phosphate CPG with a sulfurizing step in the first cycle.  In this case, the electrophilic group is a 5′-dabsyl group, which is an excellent leaving group as well as a fine quencher of fluorescence.  The second oligo, therefore, contains a fluorophore which is quenched by the dabsyl group.  A popular choice for fluorophore is fluorescein-dT but it is easy to imagine that a variety of fluorophores could be attached to any of the commercially available amino-modified nucleoside phosphoramidites.

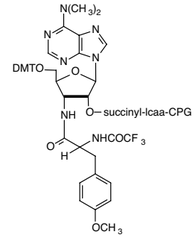
| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| 5′-Dabsyl-dT-CE Phosphoramidite | 10-1532-90 | 100 µmole | 250.00 |
| | 10-1532-02 | 0.25g | 775.00 |

### REFERENCE

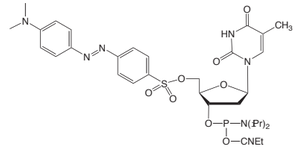
(1) S. Sando and E.T. Kool, *J Amer Chem Soc*, 2002, **124**, 2096-2097.

### SEE ALSO

*3′-Phosphate CPG on page 12*
*Sulfurizing Reagent on page 4*
*Fluorescein-dT on page 33*



Puromycin CPG



5′-Dabsyl-dT

## LABELING FOR PHOTO-REGULATION OF OLIGONUCLEOTIDES

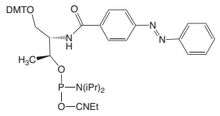
**P**hoto-control, the use of ultraviolet or visible light to control a reaction, has a number of advantages over other external stimuli:

- Light does not introduce contaminants into the reaction system,
- Excitation wavelength can be controlled through the design of the photo-responsive molecule, and
- It is now straightforward to control irradiation time and/or local excitation.

When a photo-responsive molecule is directly attached to DNA as a receptor, photo-regulation of the bioprocess regulated by that DNA molecule could, in principle, be achieved. Such photo-responsive DNA could also be used as a switch in a DNA-based nano-machine. Professor Hiroyuki Asanuma and his group at the department of Molecular Design and Engineering of the Graduate School of Engineering of the Nagoya University (Japan) have developed an efficient method to achieve this goal. They have attached azobenzene to DNA and made it photo-responsive[1,2]. Azobenzene is a typical photo-responsive molecule that isomerizes from its planar ***trans***-form to the non-planar ***cis***-form after UV-light irradiation with a wavelength between 300 nm and 400 nm ($\lambda_{max}$ is around 330 nm). Interestingly, the system reverts from the ***cis***-form to the ***trans***-form after further irradiation with visible light (wavelength over 400 nm). This process is completely reversible, and the azobenzene group does not decompose or induce undesirable side reactions even on repeated ***trans***-***cis*** isomerization. By introducing azobenzenes into DNA through D-threoninol as a linker, Asanuma and co-workers succeeded in achieving photo-regulation of:

- Formation and dissociation of a DNA duplex[3,4] and
- Transcription by T7-RNA polymerase reaction[5,6,7].

| Item | Catalog No. | Pack | Price($) |
|---|---|---|---|
| Azobenzene Phosphoramidite | 10-5800-95 | 50 µmole | 105.00 |
| | 10-5800-90 | 100 µmole | 200.00 |
| | 10-5800-02 | 0.25g | 550.00 |




Azobenzene Phosphoramidite

### REFERENCES

(1) H. Asanuma, et al., ***Angew Chem Int Ed***, 2001, **40**, 2671-2673.
(2) T. Takarada, et al., ***Chem Lett.***, 2001, **30**, 732.
(3) H. Asanuma, X.G. Liang, T. Yoshida, and M. Komiyama, ***Chembiochem***, 2001, **2**, 39-44.
(4) H. Asanuma, D. Matsunaga, and M. Komiyama, ***NUCLEIC ACIDS SYMP SER (OXF)***, 2005, **49**, 35.
(5) H. Asanuma, et al., ***Chembiochem***, 2002, **3**, 786.
(6) M. Liu, H. Asanuma, and M. Komiyama, ***J. Amer. Chem. Soc.***, 2006 , **128**, 1009.
(7) H. Asanuma, et al., ***Nature Protocols***, 2007, **2**, 203-212.

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Monomers

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| MerMade | M |

Columns

| *For Instrument type* | *Add* |
|---|---|
| Expedite | E |
| Applied Biosystems 3900 | A |
| MerMade | M |

***(Please inquire for availability of vials and columns for other instrument types.)***



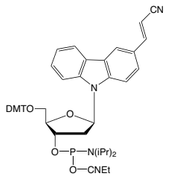


## LABELLING WITH ULTRAFAST PHOTO CROSS-LINKER

**W**hen 3-cyanovinylcarbazole nucleoside ($^{CNV}$K) is incorporated into an oligonucleotide, very rapid photo cross-linking to the complementary strand can be induced at one wavelength and rapid reversal of the cross-link is possible at a second wavelength. Neither wavelength has the potential to cause significant DNA damage. Irradiation of a duplex containing a single incorporation of $^{CNV}$K at 366nm led to 100% cross-linking to thymine base in 1 second, although complete cross-linking to cytosine takes 25 seconds.[1] A 30 second irradiation time should cover all situations. In addition, it was demonstrated that the purine bases were unreactive to cross-linking, allowing differentiation between pyrimidines and purines at the target site. The authors also determined the effect of sequence contexts around the $^{CNV}$K site and demonstrated that the identity of bases on either side of the cross-linking site has little effect on the reaction. Once cross-linked, the UV melting temperature of the duplex was raised by around 30 °C relative to the duplex before irradiation. Complete reversal of the cross-link takes place at 312nm in 3 minutes. This facile reversal reaction is, therefore, accomplished with no damage to normal DNA.

In a later publication, a further application of this cross-linking technique was investigated.[2] When $^{CNV}$K was cross-linked with a dC residue in duplex DNA, heating at 90°C for 3.5 hours led to deamination of the cytosine base to form uracil in the complementary strand. Reversal of the cross-link at 312nm led to a DNA strand in which dC had been converted to dU. The authors showed that this transformation is specific for the dC residue opposite the $^{CNV}$K and any further adjacent dC residues are unaffected. Similarly, the authors have shown that $^{CNV}$K can be cross-linked to an adjacent RNA strand.[3]

| Item | Cat. No. | Pack | Price ($) |
|---|---|---|---|
| 3-Cyanovinylcarbazole Phosphoramidite ($^{CNV}$K) | 10-4960-95 | 50 µmole | 200.00 |
| | 10-4960-90 | 100 µmole | 390.00 |
| | 10-4960-02 | 0.25g | 1125.00 |




3-Cyanovinylcarbazole

### REFERENCES

(1) Y. Yoshimura, and K. Fujimoto, ***Org Lett,*** 2008, **10**, 3227-30.
(2) K. Fujimoto, K. Konishi-Hiratsuka, T. Sakamoto, and Y. Yoshimura, ***ChemBioChem,*** 2010, **11**, 1661-4.
(3) Y. Yoshimura, T. Ohtake, H. Okada, and K. Fujimoto, ***ChemBioChem,*** 2009, **10**, 1473-6.

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