DNA Synthesis Reagents Catalog

www.biosearchtech.com

BIOSEARCH TECHNOLOGIES

Advancing Nucleic Acid Technology℠

Biosearch Technologies:

Your single, cost-efficient source for reporter and quencher dyes across the spectrum!

- BHQ® dyes, a superior class of high-efficiency dark quenchers – NO native fluorescence
- CAL Fluor®, Quasar® and Pulsar® reporter dyes spectrally paired with BHQ dyes, intended for use in multiplexed assays
- Photostable dyes that stand up to oligonucleotide synthesis and aggressive work-up conditions
- Many other specialty modifiers: biotin, amino, spacers, and more
- Flexible reagents for a wide variety of probe geometries: 5'-, 3'-, and internal labeling
- Bulk amidites and CPGs for higher probe purity and yield than ester chemistry
- A variety of column formats to meet your automated synthesis needs
- Personal consultation to support the synthesis and application of modified oligos
- Custom production capabilities available and tailored to your needs!

DNA Synthesis Reagents

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BIOSEARCH
TECHNOLOGIES
Certified to
ISO 9001:2000
TÜV
TUV Rheinland
of North America

Ordering Information

This catalog contains all the necessary information for placing orders for a variety of quality products available from Biosearch Technologies—from custom-synthesized dual-labeled FRET probes and molecular beacons to off-the-shelf items such as specialty DNA synthesis reagents and DNA synthesis & purification columns.

All off-the-shelf product orders can be placed either on-line via our website, email, FAX, or over the phone with one of our Customer Service Representatives. Orders for all products custom synthesized to your specifications (single- or dual-labeled probes, dual-labeled molecular beacons, primers and standard modified and unmodified oligonucleotides) must be placed on-line either directly on our website or via email order submission using our Probe Submission email Form (http://www.biosearchtech.com/products/probe_ordering.asp).

Ordering Off-the-shelf Catalog Items
Orders for DNA synthesis reagents and columns, DNA purification columns and other off-the-shelf products are accepted by telephone, FAX, email or regular mail. All orders must include the following information to initiate a formal sale:

- Your institute's name
- Name of the person placing the order
- Your telephone number and email address
- Your institute's Purchase Order (P.O.) number if you have established credit with us
- Correct shipping and billing addresses

Or

- Your credit card number, expiration date and 3 digit security code
- The end user's name, if different from the person placing the order
- End user's correct shipping address
- End user's telephone number and email address
- The institute's correct billing address
- Biosearch catalog number(s)
- Product description
- Quantity desired

Ordering Dual-labeled Probes, Molecular Beacons & other Custom Oligonucleotides
This catalog contains all the information you will need to place an order for custom synthesized oligonucleotides including dual-labeled fluorogenic probes, molecular beacons, PCR primer pairs and standard modified and unmodified oligonucleotides.

We recommend the following:

1) Determine the specific type of custom DNA you wish to have synthesized.
2) Determine the synthesis scale required (25, 50, 100, 200, 1000 nmol) based on the amount of purified oligo you want "in hand" for your experiments. Use the "Minimum Delivered" amount shown and pick the synthesis scale yielding the closest amount of final product.
3) Determine any required internal, 3'- or 5'- modifications (Black Hole Quencher® dyes, other quencher moieties, fluorophores or other types of groups.)
4) If you are ordering other custom synthesized oligos you'll now need to select the level of purification required. We recommend the following: for unlabeled oligos / primers: Reverse Phase Cartridge (RPC) Purification typically provides 80-95% purity; for labeled oligos, such as fluorescent probes, we recommend either single HPLC or dual HPLC. Single HPLC oligos are processed with Reverse phase HPLC. Dual HPLC oligos are processed first with Anion Exchange and then with Reverse Phase HPLC. With the exception of the ValuProbe™ FAM/BHQ probe (which undergoes a single RP HPLC purification), all of our dual-labeled probes are dual-HPLC purified, which typically results in products with 97% purity. If you are ordering dual-labeled or molecular beacon probes, Black

Hole Scorpions® or Amplifluor® primers, the listed price includes appropriate purification. If you are ordering more than one modification, an additional purification charge may be added.

5) Finally, once you've selected all the required parameters for your oligo you can either go on-line to www.biosearchtech.com to place your order or use our email Probe Submission Form to submit your order. (NOTE: if you haven't previously requested this Excel spreadsheet-based form from Biosearch, please email info@biosearchtech.com for a copy or download from http://www.biosearchtech.com/products/probe_ordering.asp).

If at any point in creating your order you require assistance, please contact our customer service group during our regular office hours of 8:00 AM to 5:00 PM Pacific Time.

Customer Service:
1.800.436.6631 (US/Canada Only)
+1.415.883.8400
info@biosearchtech.com

Technical Support
We encourage our customers to take advantage of our expertise. You can contact our Technical Support group at the number above or by email to techsupport@biosearchtech.com.

Prices
All prices are quoted in U.S. Dollars and are subject to change without notice. The prices shown for dual-labeled and molecular beacon probes, or Black Hole Scorpions and Amplifluor primers include their synthesis, modification and dual HPLC purification, unless otherwise noted. Prices for standard custom oligonucleotides other than the above mentioned probes and primers can be calculated using the synthesis, modification and purification charts shown; if more than one modification is ordered, an additional purification charge may apply. Please inquire regarding discounts for standing orders of large numbers of probes, bulk orders, or large quantities of any product.

OEM, Bulk or Large Volume Orders
We will consider larger scale syntheses of any reagent in our catalog. Please contact Customer Service directly with your requirements. We would be pleased to provide a formal price quotation.

Freight
Freight charges, including insurance, must be prepaid and will be added to your final invoice.

Payment Terms
Standard payment terms are Net 30 days. A 1.5% monthly late charge may be assessed and added to any invoice over 30 days past due. Credit card payments (American Express, VISA or MasterCard) are acceptable for payment. Wire transfers directly to our bank can be arranged but may carry additional charges.

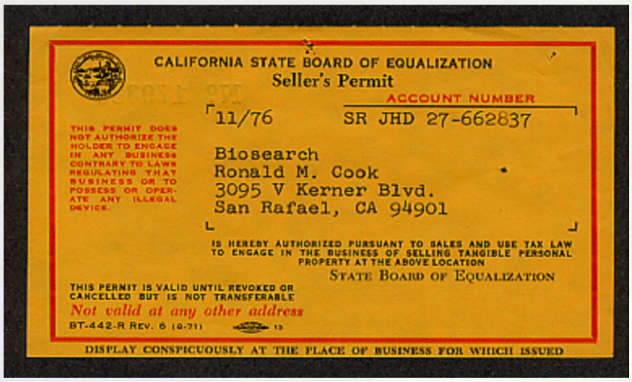
Returns
No returns will be accepted without prior written approval by Biosearch Technologies. Please inspect all shipments upon arrival. If damage is noted, please retain all packing materials for inspection by the carrier. Please contact Biosearch within seven (7) days of receipt of damaged merchandise for assistance in placing claims and obtaining replacements for goods arriving damaged.

Product Usage
All products are sold for research and development use only and are not intended for human use. Biosearch Technologies accepts no liability for any direct, indirect, consequential or incidental damages arising out of the use, results of use or the inability to use any product. No license or immunity under any patent is either granted or implied by the sale of our products.

Biosearch's Innovation in DNA Synthesis Chemistry and Reporter/ Quencher Development

History

Although Biosearch Technologies was founded in 1993, its roots can be traced back to 1976 when it was preceded by its first company, Biosearch, Inc., incorporated by Dr. Ronald Cook. Over the next 9 years, Biosearch helped launch the market for synthetic DNA by engineering and manufacturing one of the first automated solid-phase instruments, the SAM I. As time progressed, Biosearch commercialized other DNA synthesizers such as the Biosearch 8700, Biosearch 8800 Prep, and the Cyclone.


CALIFORNIA STATE BOARD OF EQUALIZATION
Seller's Permit
ACCOUNT NUMBER
11/76 SR JHD 27-662837
THIS PERMIT DOES NOT AUTHORIZE THE HOLDER TO ENGAGE IN ANY BUSINESS CONTRARY TO LAWS REGULATING THAT BUSINESS OR TO POSSESS OR OPERATE ANY ILLEGAL DEVICE.
Biosearch
Ronald M. Cook
3095 V Kerner Blvd.
San Rafael, CA 94901
IS HEREBY AUTHORIZED PURSUANT TO SALES AND USE TAX LAW TO ENGAGE IN THE BUSINESS OF SELLING TANGIBLE PERSONAL PROPERTY AT THE ABOVE LOCATION
STATE BOARD OF EQUALIZATION
THIS PERMIT IS VALID UNTIL REVOKED OR CANCELLED BUT IS NOT TRANSFERABLE
Not valid at any other address
BT-442-R REV. 6 (6-71)
DISPLAY CONSPICUOUSLY AT THE PLACE OF BUSINESS FOR WHICH ISSUED

Original Biosearch Seller's Permit from 1976

In the late 1980s the original Biosearch was acquired by Millipore Corporation and became Milligen-Biosearch, which was subsequently acquired by PerSeptive Biosystems in 1994, which in turn was acquired by Applied Biosystems in 1998.

With a renewed focus on refining nucleic acid technology after the Millipore acquisition, Dr. Cook returned to the oligonucleotide industry to found what is currently known as Biosearch Technologies, Inc. Having patented sophisticated reporter dyes, quenchers, and other custom modifications to confer new functionality upon the DNA strand, Biosearch makes these invaluable labels available to the research market, the industrial genomic market, and for *in vitro* diagnostic kit manufacturers.

BHQ and Reporter Dyes for PCR Probes

Since its invention, the Polymerase Chain Reaction (PCR) process has upended life science research by enriching DNA from trace amounts of material. The next evolutionary step is to monitor the amplification itself, known as real-time or quantitative PCR (qPCR). SYBR® Green chemistry may be used for this purpose, but the SYBR Green dye also binds to the double-stranded products of unwanted amplifications (primer-dimers and other non-specific PCR products), decreasing assay specificity and sensitivity. It is also not possible to distinguish multiplexed amplifications with this intercalating dye.

In its most advanced form, real-time PCR makes use of dual-labeled probes with a spectrally paired fluorophore and quencher, each covalently linked to the oligo to provide certainty in amplification identity. Dual-labeled probes are typically designed to take advantage of quenching by Förster resonance energy transfer (FRET) to detect and report binding to target molecules. These oligo probes incorporate a 5'-reporter dye and a 3'-quencher, although some probes may include an internal label or alternative labeling strategy.

Biosearch offers an economical and versatile selection of reporters and quenchers for the synthesis of dual-labeled probes. The proprietary BHQ dyes are superior high-efficiency dark quenchers that efficiently cloak fluorescence until a hybridization event or enzymatic cleavage occurs. Biosearch also offers the vibrant CAL Fluor, Quasar, and Pulsar reporter dyes for use in real-time PCR. With signals that span the spectrum, these dyes are essential for multiplexed assays combining two to five reporters into a single reaction tube.

Biosearch's fluorescent reporters and dark quenchers provide a single, cost-efficient licensing source for all the synthons in a qPCR assay - the perfect partnership for many *in vitro* diagnostic and other kit manufacturers

Biosearch Mission, Facilities and Capabilities

Biosearch Technologies is a vertically integrated, closely held California corporation, located in Novato California. We are a ISO 9001:2000 certified and GMP compliant biotechnology company with over 70 employees and 60,000 square feet of modern lab and office space.

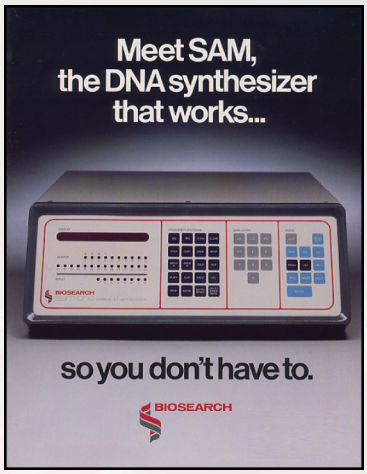
Our Mission

Biosearch Technologies commits itself to perfecting the design and manufacture of innovative nucleic acid based products crucial to the discovery and application of genomic information. We strive for the highest levels of product quality and customer satisfaction in the diverse markets to which we cater world-wide.

Our Markets

Biosearch has extensive experience manufacturing the synthetic DNA required of the biotechnology, agricultural, pharmaceutical, public health and biodefense sectors. To support the rising prominence of molecular diagnostics we offer GMP-grade components for IVD procedures. A sample of these research and diagnostic applications include:

- Real-Time Quantitative PCR
- Gene Expression Measurement
- Allelic Discrimination
- Multiplexed PCR
- Food and Water Testing
- Marker Assisted Selection
- Clinical Diagnostics
- SNP Discovery and Detection
- Pathogen Screening
- Other FRET-based Applications



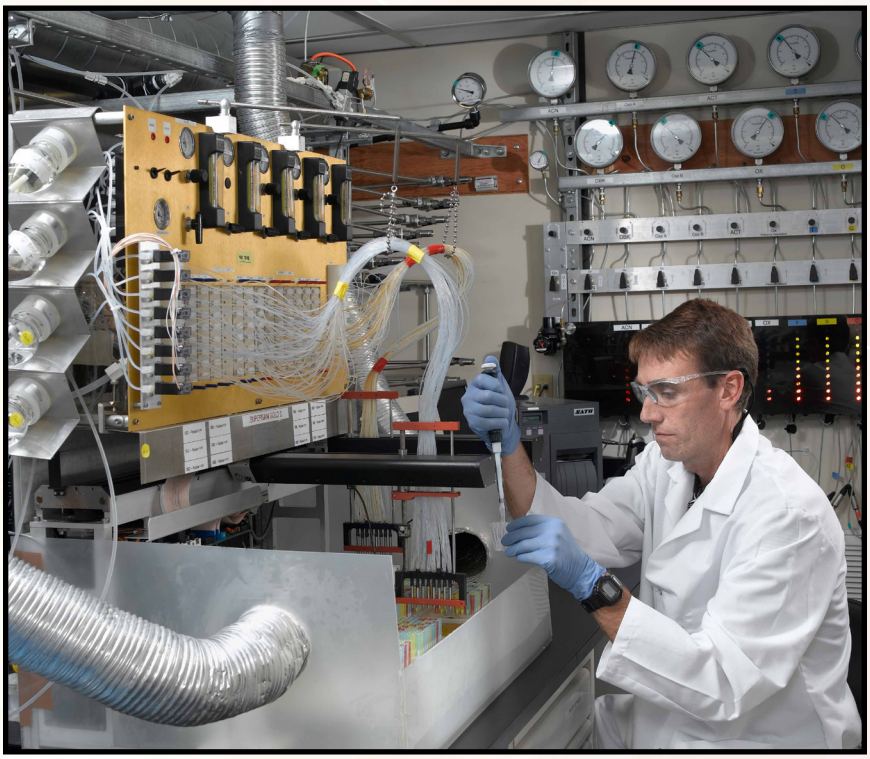
Biosearch
SAM I
circa 1982

Biosearch Cyclone
circa 1987

DNA Synthesis instruments then and now.

Above are DNA synthesizers from the original Biosearch.

To the left is one of our many SuperSAM robotic synthesizers that automatically manufacture several thousand oligonucleotides each day.



One of our High Throughput SuperSAMs in our Production Facility

PCR and Biosearch: A Timeline

1976
- Original Biosearch founded

1981
- Use of inorganic matrices as supports for oligonucleotide synthesis published by Matteucci and Caruthers[1]
- Phosphoramidite chemistry first published by Beaucage and Caruthers[2], improves oligo production

1983
- Kary Mullis invents PCR while at Cetus

1987
- U.S. Patent # 4,683,202 for PCR Process awarded to Cetus Corp.

1990
- Patent describing the 5′ to 3′exonuclease activity of *Taq* polymerase acting upon labeled probes[3]

1991
- Exonuclease activity used with radioactive probes to detect specific products[4]

1992
- Ethidium bromide applied for **real-time PCR**[5]

1993
- Biosearch Technologies, Inc. formed
- Kary Mullis awarded the Nobel Prize in Chemistry: Dr. Mullis's Nobel Lecture concerning his invention of the Polymerase Chain Reaction (PCR) process gratefully acknowledged the supporting role of Biosearch and Dr. Cook in furnishing one of the first SAM I DNA synthesizers to enable his research.
- Fluorogenic probes identify amplified products in homogeneous PCR[6]

1995
- Dual-labeled FAM-TAMRA probes adapted to real-time PCR[7]
- Dabcyl is used as a quencher in molecular beacons[8]

Late 1990s
- Real-time qPCR matures -- multiplexing limited by few available reporter dyes and the use of the fluorescent dye, TAMRA, as a quencher

2000
- A series of true dark quenchers, the Black Hole Quencher dyes, are introduced by Biosearch and quickly become the industry standard for fluorescence quenching across the spectrum

2000+
- All commercial real-time PCR instruments emphasize multiplexing capabilities

2004
- CAL Fluor, Pulsar, and Quasar dye technologies introduced by Biosearch Technologies

2005
- **Biosearch introduces** RealTimeDesign software to accelerate the selection of oligo sequences for qPCR

2006
- U.S. Patents # 7,019, 129 and # 7,109,312 awarded to Biosearch for BHQ dyes

2007
- BHQ*plus* duplex-stabilizing probes introduced for AT-rich regions and SNPs

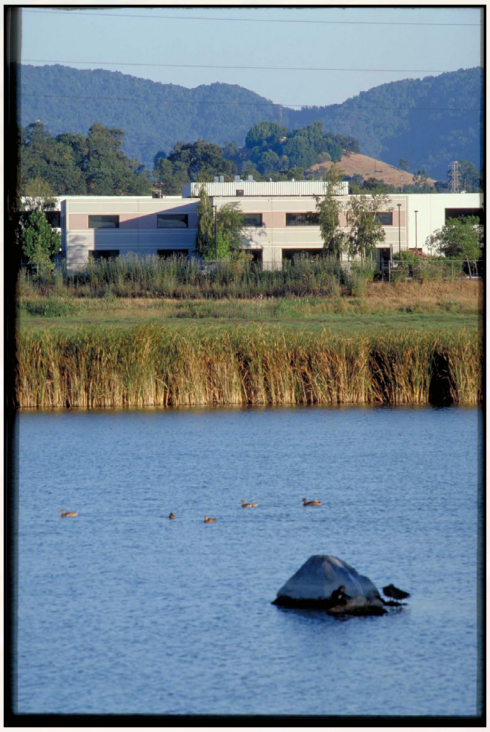
2008
- U.S. Patent # 7,344,701 Awarded to Biosearch for CAL Fluor Dyes
- Biosearch commemorates ***25 years of PCR*** in celebration with Kary Mullis

Ron Cook and Kary Mullis at 2007 qPCR Symposium

1 Beaucage, S.L. and Caruthers, M.H. 1981. *Tetrahedron Lett.* 22, 1859-62.
2 Matteucci, M.D. and Caruthers, M.H. 1981. *J. Am. Chem.Soc.* 103, 3185-91.
3 Gelfand, D.H. 1990. Homogeneous assay system using the nuclease activity of a nucleic acid polymerase. U.S. Patent 5,210,015.
4 Holland, P. M., Abramson, R. D., Watson, R., and Gelfand, D.H. 1991. Detection of specific polymerase chain reaction product by utilizing the 5′ to 3′ exonuclease activity of *Thermus aquaticus* DNA polymerase. *Proc. Natl. Acad. of Sci. U.S.A.* 88:7276–7280.
5 Higuchi, R., Dollinger, G., Walsh, P.S., Griffith, R. 1992. Simultaneous amplification and detection of specific DNA sequences. *Bio/Technology* 10:413–417.
6 Lee, L. G., Connell, C. R., and Bloch, W. 1993. Allelic discrimination by nick-translation PCR with fluorogenic probes. *Nucleic Acids Res.* 21:3761–3766.
7 Livak, K.J., Flood, S.J.A., Marmaro, J., Giusti, W., Deetz, K. 1995. Oligonucleotides with fluorescent dyes at opposite ends provide a quenched probe system useful for detecting PCR product and nucleic acid hybridization. *PCR Methods Applic.* 4:357-362.
8 Tyagi S., Kramer F.R., and Lizardi P.M. U.S. Patent 5,925,517 (July 20, 1999) and U.S. Patent 6,103,476 (August 15, 2000). Detectably labeled dual conformation oligonucleotide probes, assays and kits.

DNA Synthesis Reagents

One of the Biosearch buildings in Novato sits near a lovely, protected lagoon just north of San Francisco, and only minutes from Sonoma / Napa wine country.



Dyes have been at the nexus of Biosearch's business for many years. Biosearch reporter dyes and dye quenchers are found to be useful in both genomic and industrial applications.

Most of the major *in vitro* diagnostics companies prefer the quality, service and cost savings when they partner with Biosearch to provide all of their IVD dye needs. Biosearch has affordable licensing fees and a complete selection of reporter dyes and quenchers that can be matched across the spectrum, and are especially suitable for multiplex and SNP assays.

An Introduction to Black Hole Quencher Dyes

Black Hole Quencher dyes (BHQ dyes) have a polyaromatic-azo backbone, which makes the dyes nonfluorescent because electronic energy is dissipated as heat. Because BHQ dyes exhibit no native fluorescence they are true dark quenchers. BHQ dye absorption maxima are tuned through appropriate choice of electron-donating and -withdrawing substituents on the aromatic rings, resulting in a series of nonfluorescing dyes with absorption spectra that overlap with reporter dye emission spectra from blue into the near IR, and thereby maximize FRET (Förster resonance energy transfer) quenching for various fluorophores emitting from 400-650 nm.[1] Reporter–BHQ dual-labeled oligonucleotide probes, labeled with a fluorophore reporter dye and a BHQ dye, have extremely high signal to noise ratios in hybridization assays (Figure 1).

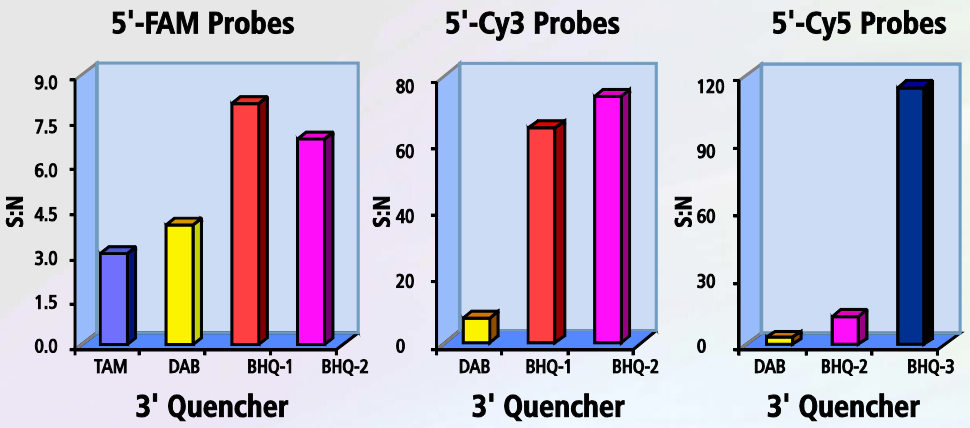


Figure 1 Signal-to-noise (S:N) ratios were calculated by dividing the fluorescence signal of a 25-mer in the presence of a five-fold excess of an exactly complementary target sequence by the fluorescence intensity of the probe alone. Each probe has a 5′ reporter group (FAM, Cy3, Cy5) and a 3′ quencher (TAMRA, dabcyl, BHQ-1, BHQ-2 or BHQ-3).

BHQ Dyes Eclipse TAMRA and Dabcyl as Quenchers

Although TAMRA is a reporter dye with fluorescence λ_{max} at approximately 576 nm, FAM/TAM probes, with FAM as a reporter and TAMRA as a quencher, were widely used prior to the introduction of BHQ dyes in 2000. FAM/TAM probes have only a modest FRET signal increase in hybridization and nuclease assays because of the interference of TAMRA's fluorescence.

Dabcyl was the first commonly used dark quencher in dual-labeled probes. However, dabcyl has less than ideal spectral characteristics with an absorption maximum at 474 nm (Figure 2), far removed from the fluorescence maxima of many reporters, and limiting its efficiency to quench via FRET.

After dabcyl, a few other dark quenchers have become available in the market. Unfortunately, poor spectral properties, background fluorescence, stability, versatility and/or high cost limit their utility. By design, BHQ dyes efficiently and reliably suppress fluorescence in dual-labeled fluorogenic probes. Due to their success as quenchers in oligonucleotide probes, BHQ dyes have become the new standard for applications making use of dark quenchers.

The BHQ-1 dye, with an absorption maximum of 534 nm (Figure 2) is a more efficient quencher than dabcyl for many reporter dyes because its absorption spectrum is directly superimposable with emission maxima of commonly used dyes such as FAM, TET and JOE, providing better spectral overlap for a significant increase in FRET quenching efficiency.

Also, as was shown in Figure 1, BHQ dye probes have much larger signal-to-noise ratios when compared to the corresponding dabcyl and TAMRA probes.

1 Johansson, M.K. and Cook, R.M. 2003. Intramolecular Dimers: A New Design Strategy for Fluorescence-Quenched Probes *Chem. Eur. J.* 9:15, 3466-3471.

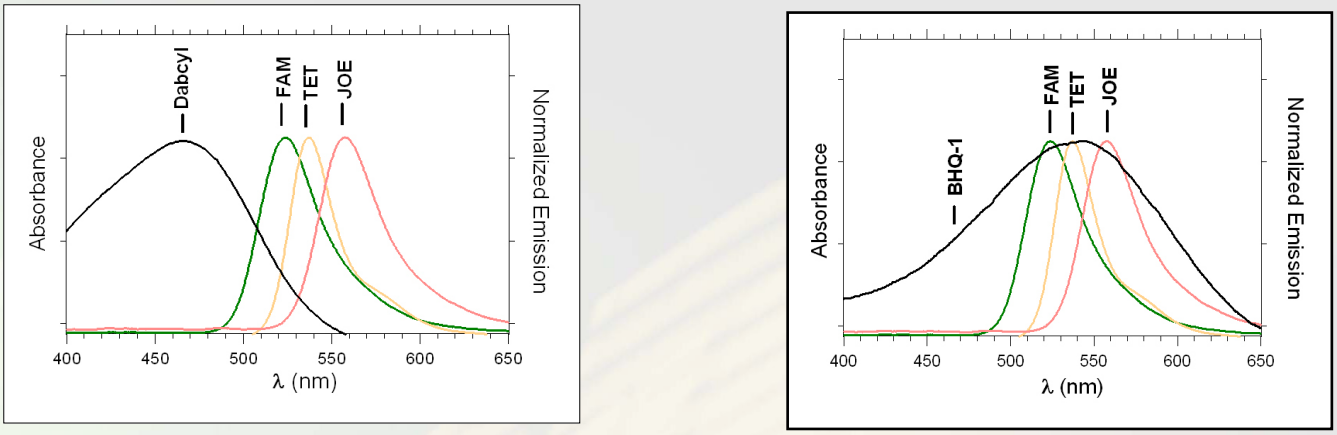


Figure 2 BHQ-1 has superior spectral overlap with commonly used reporter dyes such as FAM, TET and JOE, compared to dabcyl.

BHQ dyes quench across the visible spectrum and near-IR for reporting – 480 to 730 nm

Biosearch's proprietary BHQ dyes were designed to provide excellent spectral overlap over the entire range of commonly used reporter dyes. BHQ dyes permit efficient quenching across the visible spectrum from 480 nm into the near IR, making it possible to utilize reporter dyes that emit anywhere within this range (Figure 3). BHQ dyes work through a combination of FRET and static quenching (see pgs 15-17) to enable researchers to avoid the residual background signal common to TAMRA or low signal : noise ratio of dabcyl-quenched dual-labeled probes.

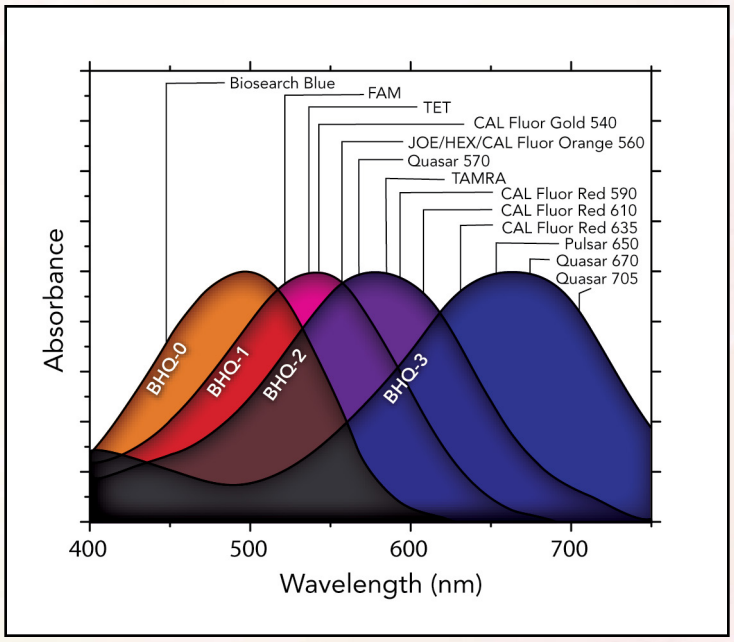
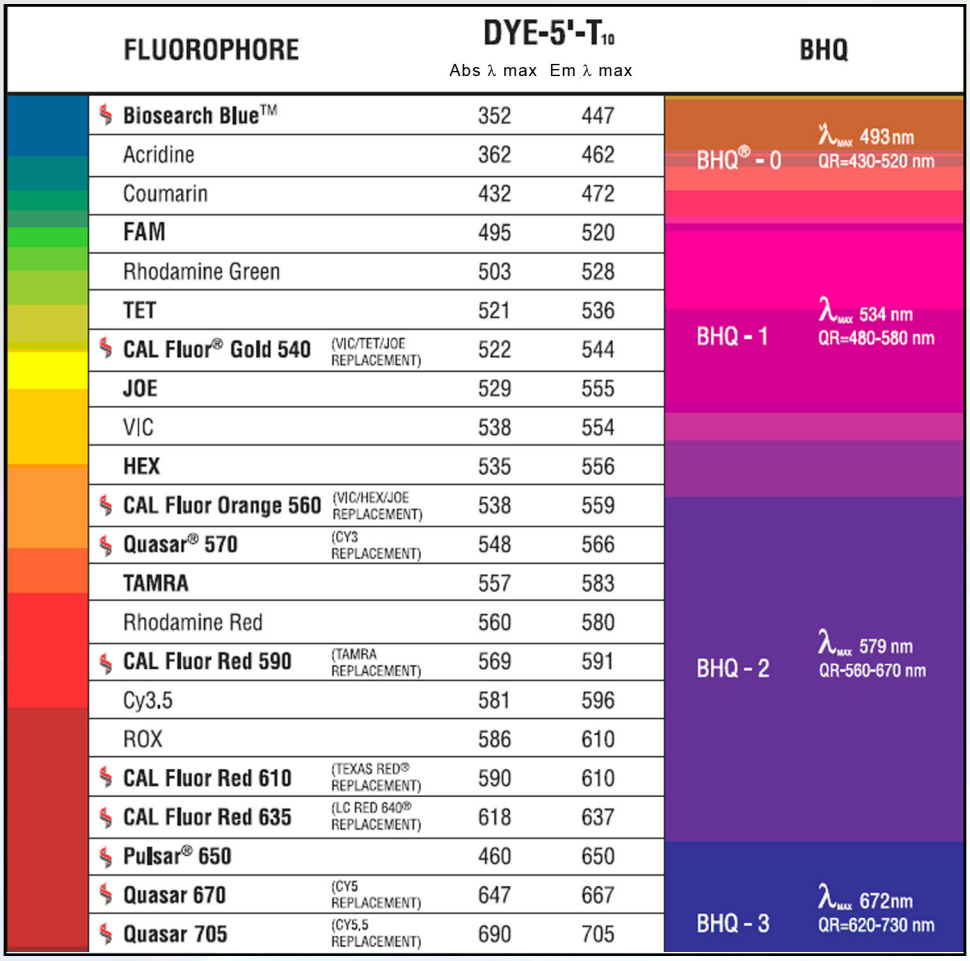


Figure 3 Absorption spectra of the three BHQ dyes (conjugated to T-9 and normalized to the poly-T absorbance of 260 nm) with the emission maxima of many commonly used reporter groups indicated.

Dye Selection Chart for Dual-Labeled Probes



FLUOROPHORE		DYE-5'-T10 Abs λ max	DYE-5'-T10 Em λ max	BHQ
Biosearch Blue™		352	447	BHQ® - 0: λmax 493nm, QR=430-520 nm
Acridine		362	462	
Coumarin		432	472	
FAM		495	520	
Rhodamine Green		503	528	
TET		521	536	
CAL Fluor® Gold 540	(VIC/TET/JOE REPLACEMENT)	522	544	BHQ - 1: λmax 534 nm, QR=480-580 nm
JOE		529	555	
VIC		538	554	
HEX		535	556	
CAL Fluor Orange 560	(VIC/HEX/JOE REPLACEMENT)	538	559	
Quasar® 570	(CY3 REPLACEMENT)	548	566	
TAMRA		557	583	
Rhodamine Red		560	580	
CAL Fluor Red 590	(TAMRA REPLACEMENT)	569	591	BHQ - 2: λmax 579 nm, QR-560-670 nm
Cy3.5		581	596	
ROX		586	610	
CAL Fluor Red 610	(TEXAS RED® REPLACEMENT)	590	610	
CAL Fluor Red 635	(LC RED 640® REPLACEMENT)	618	637	
Pulsar® 650		460	650	
Quasar 670	(CY5 REPLACEMENT)	647	667	BHQ - 3: λmax 672nm, QR=620-730 nm
Quasar 705	(CY5.5 REPLACEMENT)	690	705	

Indicates Biosearch Technologies' proprietary dyes. Dyes in **BOLDFACE** are standard products available from Biosearch. These and the BHQ dyes are available in one or more of the following forms: phosphoramidites, CPGs, pre-packaged DNA synthesis columns, carboxy acids, peptide synthesis resins, succinimidyl esters and amine labels.

QR (Quenching Range) stands for each BHQ dye's FRET quenching range according to spectral overlap. Slight variations in fluorophore Abs or Em maxima are due a number of factors, such as the moiety to which the fluorophore is conjugated. Fluorophore dyes are shown for informational purposes only. Non-Biosearch fluorophores listed may be trademarked by companies other than Biosearch Technologies and may not necessarily be available from Biosearch; please visit www.biosearchtech.com or the Licenses and Trademarks Appendix at the end of this catalog for full disclosure. Please contact our Customer Service Department at info@biosearchtech.com or call +1.800.436.6631 to determine current fluorophore availability.

Overview of FRET and Static Quenching Mechanisms

FRET (Förster Resonance Energy Transfer) Quenching

FRET is a quantum phenomenon occurring between two dye molecules.[1] A dye molecule, termed a "donor", becomes excited via a light source and this excitation is transferred from the donor to an "acceptor" molecule through dipole-dipole interaction without the emission of a photon. As a result, the donor molecule fluorescence is quenched, and the acceptor molecule becomes excited. The acceptor then loses energy via heat (for dark quenchers such as the BHQ dyes and dabcyl) or fluorescence emission (for fluorescent dye quenchers such as TAMRA).

In a typical probe, the quenched form has the reporter and quencher close to each other in space, while the fluorescent form has the reporter and quencher spatially separated. FRET is the mechanism that is commonly cited as controlling fluorescence quenching in such systems. In solution, unhybridized FRET probes are posited to exist as random coils, allowing the reporter and quencher dyes to remain in close proximity favoring FRET quenching. Upon hybridization to a complementary target, the probe is stretched out of its random coil configuration. Thus, the reporter and quencher are spatially separated and increased fluorescence results.

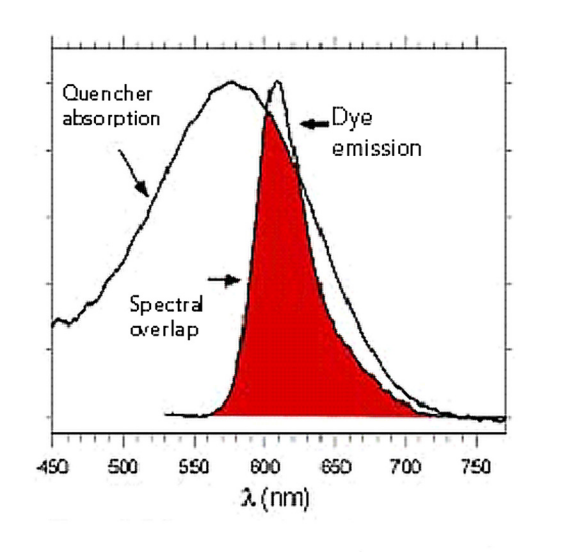


Figure 4 Reporter emission and quencher absorption with large spectral overlap.

Efficient FRET is dependent on:

a) **Proximity:** the donor and acceptor molecules must be close to each other (between approx. 10 – 100 Å). Quenching efficiency depends on $1/r^6$, where **r** is the dye-quencher distance,

b) **Spectral overlap:** According to Förster theory, the reporter and quencher should be chosen such that the spectral overlap between reporter fluorescence and quencher absorption is maximized (Figure 4),

c) **Relative donor-quencher orientation.** This is usually assumed to be random in dual-labeled oligonucleotide probes.

Refer to the Dye Selection Chart for Dual-Labeled Probes on the previous page to view how BHQ dyes have good spectral overlap with a variety of fluorophores. The selection of reporter-quencher combinations with discrete ranges of spectral overlap enables the design of efficient multiplex assays.

1 T. Förster, 1948. *Ann. Phys. 2*, 55.

Static Quenching

Over the past few years, there have been a few references to quenching in dual-labeled probes through non-FRET quenching mechanisms. This can occur especially in situations where the dyes are held close together through hybridization.[1,2] Static quenching occurs through formation of a ground state complex. The donor and quencher moieties bind together to form a ground state complex, an intramolecular dimer that has its own unique properties (Figure 5). In the ground state complex, the excited-state energy levels of the dyes couple. The electronic properties of the dimer depend on the dipolar interaction and the relative orientation of the reporter and quencher transition dipole moments. Dye aggregation is well-known and is often attributed to hydrophobic effects – the dyes stack together to minimize contact with water. Steric and electrostatic forces may also determine if, and how, dyes aggregate.[3] Quenching due to aggregation of dye labels is an unwanted effect when multiple dye labels are used in order to amplify the fluorescence signal.[4]

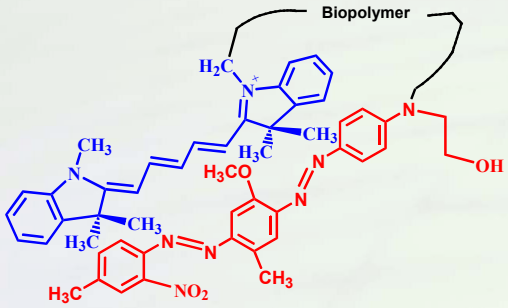


Figure 5 Hypothetical representation of an intramolecular Cy5-BHQ-1 heterodimer.

Marras *et. al.* compared static and FRET quenching efficiencies for a wide range of reporter-quencher pairs by placing the dyes on complementary oligonucleotides at 0, 5, or 10 bases apart.[5] They found that melting temperatures of blunt-end hybrids of the fluorophore-quencher pairs correlated well with percentage quenching, showing that the dyes that bind more strongly together in a dimer have higher quenching efficiencies.

Scientists at Biosearch showed that static quenching can be important in dual-labeled "linear" probes. Some dye-quencher pairs in dual-labeled probes can have a strong enough affinity for each other that they form an intramolecular, nonfluorescent complex. Efficient quenching can be obtained via static quenching without the use of molecular beacon stem-loop structures. The oligonucleotide presumably acts as a tether, effectively increasing the relative fluorophore-quencher concentration, promoting heterodimer formation.[6] Figure 6 shows the spectral changes before and after complementary sequence is added to a Cy5-BHQ-1 dual-labeled 25-mer oligonucleotide probe without defined secondary structure. The change in the shape of the absorption spectrum is indicative of Cy5-BHQ-1 intramolecular dimer formation.

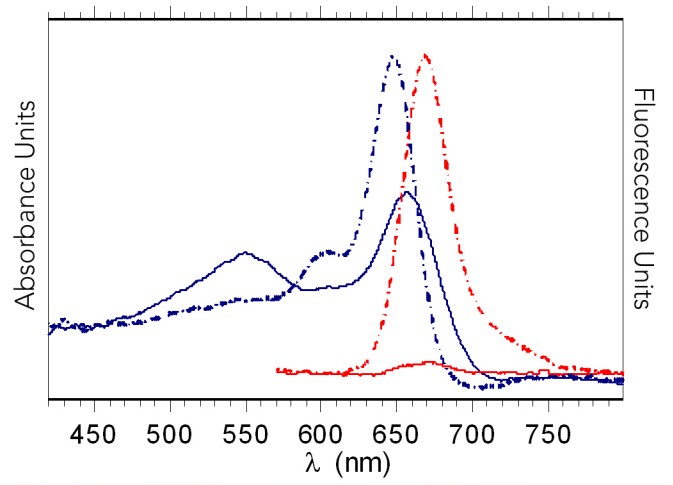


Figure 6 Room temperature hybridization assay with a 5'-Cy5-β-actin-3'-BHQ-1 oligonucleotide probe. The blue curves are absorption spectra, the red curves fluorescence spectra. Solid lines are the probe alone, dashed lines are for probe with excess complement. Cy5 and BHQ-1 have limited spectral overlap for FRET. Changes in fluorescence intensity and shape of the absorption curves indicate quenching *via* an intramolecular heterodimer.

Stability of fluorophore-quencher ground state complexes is very temperature dependent. It is reasonable to assume that intramolecular dimer formation is governed by an association constant and a temperature-dependent equilibrium. Static quenching within dual-labeled oligonucleotide probes is most likely to be significant only in room temperature assays, or perhaps at moderately elevated temperatures. Thus, for qPCR oligonucleotide probes for which the fluorescence intensity is typically read at 60 °C, quenching via intramolecular dimers may be less effective.

1 Parkhurst, K.M. and Parkhurst, L.J. 1995. *Biochemistry*, *34*, 293 and references therein.

2 Bernacchi, S. and Mély, Y. 2001. *Nucleic Acids Res. 29*, e62.

3 Khairutdinov, R.F. and Serpone, N. 1997. *J. Phys. Chem. B* 101: 2602.

4 Randolph, J.B. and Waggoner, A.S. 1997. *Nucleic Acids Res.* 25: 2923.

5 Marras, S.A.E., Kramer, F.R. and Tyagi, S. 2002. *Nucleic Acids Res.* 30: e122.

6 Johansson, M.K., Fidder, H., Dick, D. and Cook, R.M. 2002. *J. Am. Chem. Soc.* 124: 6950.

The Distinction Between Static Quenching and FRET

Static (contact, ground state) quenching involves formation of a reporter-quencher dimer. The intramolecular dimer effectively decreases the concentration of the fluorescent reporter by creating a new, nonfluorescent reporter-quencher dimer with a unique absorption spectrum. FRET is a dynamic quenching mechanism that does not affect the probe's absorption spectrum. Hybridization of the dual-labeled probe to its target or nuclease activity disrupts the reporter-quencher dimer, allowing the reporter to return to the state allowing fluorescence to occur.

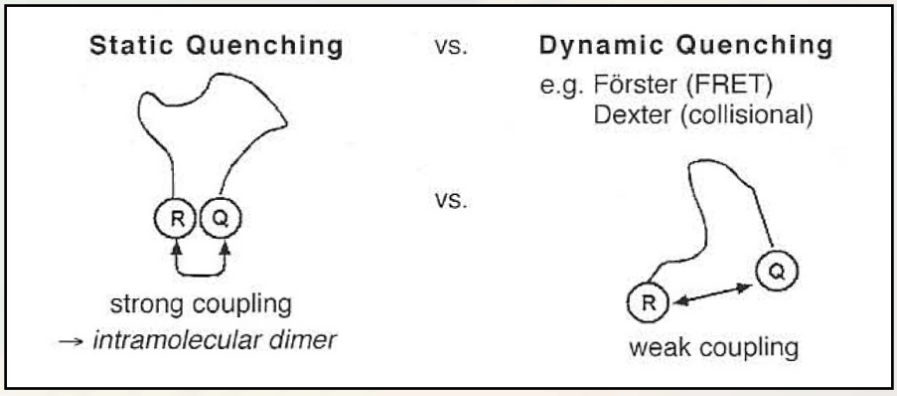


Figure 7 Illustration of static and FRET quenching mechanisms

Comparison of Static Quenching and FRET Mechanisms

Ground State Complex	FRET
Static quenching	Type of dynamic quenching
Dexter mechanism	Förster / Coulomb mechanism
Short distance <20Å	Long distance 40-100Å
Depends on e^{-R}	Depends on $1/r^6$
Very temperature dependent	Not very temperature dependent
Fluorophore absorption spectrum distorted	Fluorophore absorption spectrum unchanged

Reporter Dyes from Biosearch Technologies

CAL Fluor, Quasar and Pulsar Dyes: New Spectrally Distinct Reporters for Multiplex Assays

Biosearch developed its own vibrant reporter fluorophores as perfect partners to the BHQ quenchers, especially suitable for the challenges of multiplexed probe analysis. Today, Biosearch offers the most comprehensive reporter / quencher pairs to span the spectrum, routinely used in applications from R&D to IVD.

Dyes Designed to Enhance the Visibility of Modified DNA

The CAL Fluor dyes are novel xanthene dyes developed for the purpose of modifying synthetic DNA. The dye's equipped spacer arm attachment eliminates problems such as multiple isomers and low synthesis yields, commonly associated with other xanthene dyes. Quasar dyes are fluorescent indocarbocyanine dyes developed to replace other cyanine dyes such as Cy3 and Cy5. The Pulsar dye enables multiplex analysis upon LightCycler instruments (versions 1.0-3.0). Offered as phosphoramidites and CPGs, Biosearch's reporter dyes are compatible with all commercial DNA synthesizers and allow the rapid, efficient synthesis of 3', 5', and internally modified DNA.

Broad Instrument Compatibility & Ease of Use

Biosearch's reporter dyes are lower-cost, high performing fluorophores compatible with all probe/primer formats and all thermal cyclers. These advanced dyes do not require cumbersome labeling following DNA synthesis such as the manual methods of succinimidyl ester-coupling. With absorption and emission spectra ranging from 500 nm into the near IR, the Biosearch reporter dyes are great alternatives to JOE, HEX, TAMRA, and Texas Red® dyes.

Perfect Partners with the Black Hole Quencher Dyes

When tethered together through a DNA strand, the BHQ dye cloaks the fluorescence of the CAL Fluor, Quasar or Pulsar dye until a specific analyte is encountered. Target recognition releases the fluorescent signal which is easily recorded using devices such as real-time PCR thermal cyclers. Dual-labeled probes incorporating a CAL Fluor or Quasar dye coupled with a BHQ dye exhibit large signal to noise values and produce amplification traces with robust ΔRns and early CT values.

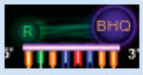
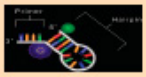
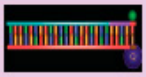
Ideal for Multiplex Real-time Quantitative PCR

When combining multiple Biosearch reporter dyes into the same reaction, different analytes can be assayed simultaneously but detected independently. This multiplexing capability was recently demonstrated at the 2007 International qPCR Symposium in Freising, Germany with an assay to identify and quantify environmental pathogens. Biosearch's proprietary dyes have been proven to perform 3-plex, 4-plex, and even 5-plex qPCR on most popular real-time PCR thermal cyclers. Visit www.multiplexqpcr.com for more information about our multiplex solutions.

An Overview of Probe / Primer Formats and a Multiplex Instrument Dye Selection Guide

Below is a table describing common probe/primer methodologies that are routinely performed with Biosearch reporters and quenchers. Following the chart is a section that walks through each of the reactions in a stepwise fashion. At the end of this section is a table that provides multiplexing recommendations for dual-labeled dark-quenched probes and primers on the most popular multiplex-capable instruments.

Probe/Primer Comparison Chart

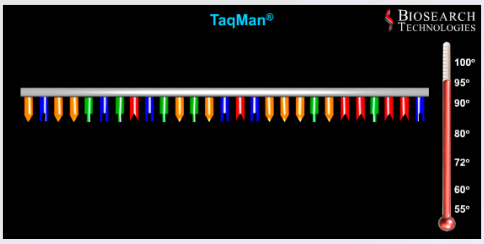
qPCR Chemistries	TaqMan®	Molecular Beacons	AmpliFluor® Primers	Black Hole Scorpions™	Plexor™ Primers	BHQ*plus*™ Probes
Structure	Linear 	Stem and Loop 	Stem and Loop with Primer 	Stem and Loop with Primer 	Labeled Primers with Modified Bases 	Linear 
Key Traits	»Dual-labeled, linear, sequence specific probe »Used with a pair of forward and reverse primers	»Dual-labeled hairpin probe with sequence specific loop »Used with a pair of forward and reverse primers	»Dual-labeled hairpin probe with sequence specific primer »One reverse primer	»Dual-labeled hairpin probe with sequence specific loop and primer »One reverse primer	»One forward primer, with modified iso-dC and 5' fluorophore »Modified iso-dG with quencher in reaction mix	»Same key traits as TaqMan Probes »Fortified, compact, contains duplex stabilizing technology
Specificity	★★★1/2	★★★★	★★★	★★★★	★★★	★★★★
Advantages	»Simplicity of design »Great value with powerful multiplexing capabilities	»Very low baseline fluorescence »High level of specificity with hairpin structure »Excellent Signal:Noise	»Very low baseline fluorescence »Easily adaptable for different applications	»Unimolecular structure incorporates both probe and primer »Fast amplicon detection »Excellent Signal:Noise	»Simplest to design (only primers) »Does not require a separate probe	»Shortened sequences permits enhanced target specificity »Discriminate difficult targets such as SNPs and AT-rich regions
Design Software	RealTimeDesign™ (Free!)	Beacon Designer PREMIER Biosoft	RealTimeDesign (Free!)	Visual OMP 5 DNA Software	Promega Plexor Primer Design Software	RealTimeDesign™ (Free!)
Common Applications	Gene Expression Clinical Diagnostics Allelic Discrimination	Gene Expression Clinical Diagnostics Allelic Discrimination	SNP Detection Gene Expression	Gene Expression SNP Detection Clinical Diagnostics Allelic Discrimination	Gene Expression SNP Genotyping	SNP Genotyping

Popular Quenching Mechanisms in Dual-Labeled Probes: Step by Step

Dual-labeled fluorescence-quenched oligonucleotide probes have become important reagents in several commercial genetic assays, most notably in real-time quantitative PCR (polymerase chain reaction) which measures the presence and copy number of specific genes or expressed mRNA.[1,2] Numerous assays with dual-labeled oligos that do not require PCR thermocycling have also been developed using oligonucleotide hybridization and/or cleavage to change the reporter-quencher distance[3]. Stem-loop structures known as molecular beacons, decrease background fluorescence by holding the dye and quencher close together in the unhybridized state.[4] As a result, molecular beacons typically have higher signal/noise ratios in FRET (Förster Resonance Energy Transfer) assays. Linear probes, typically work by hybridization to a target sequence and subsequent cleavage by an enzyme releasing the quencher from the probe. The following graphics are from an animation that can be found on the Biosearch web site.

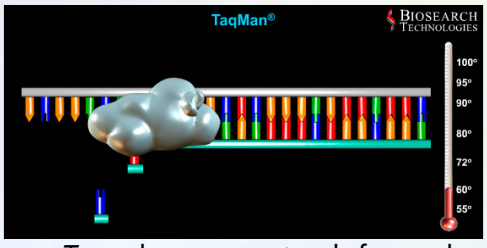
TaqMan® Probes

1



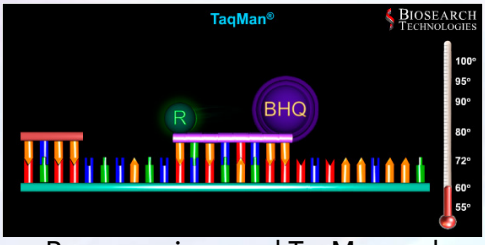
Denature double-stranded DNA

2



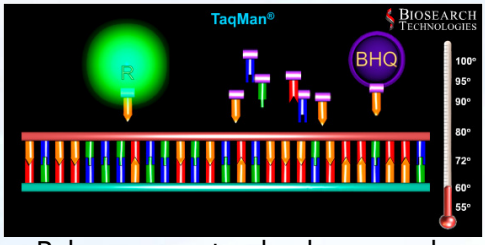
Taq polymerase extends forward primer

3



Reverse primer and TaqMan probe bind to new strand

4



Polymerase extends, cleaves probe from target, reporter dye no longer quenched

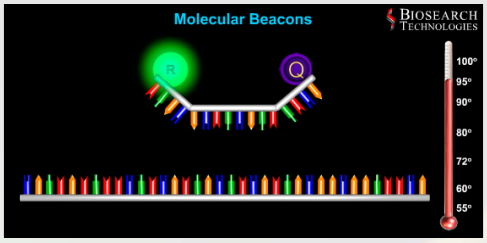
Figure 8 TaqMan probes are dual-labeled probes incorporating a fluorescent reporter molecule at either the 5′ end or the 3′ end of an oligo and a quencher (Black Hole Quencher) dye at the opposite end.

1) The first step involves heating to denature the double-stranded DNA into single-stranded DNA.
2) During the second step, a forward primer anneals to the target strand of DNA, and is extended by *Taq* polymerase.
3) A reverse primer and TaqMan probe then anneal to this newly replicated strand.
4) The polymerase extends and cleaves the probe from the target strand. Upon cleavage, the reporter is no longer quenched by its proximity to the BHQ dye and fluorescence is released. Each replication will result in the cleavage of a probe; as a result the fluorescent signal will increase proportionally to the amount of amplification product.

1 Lee, L.G., Connell, C.R., and Bloch, W. 1993. *Nucleic Acids Res.* 21: 3761.
2 Bustin, S.A. 2000. *J. Molec. Endocrinology* 25: 169.
3 Didenko, V.V. 2001. *BioTechniques* 31: 1106.
4 Tyagi, S., and Kramer, F.R. 1996. *Nature Biotech.* 14: 303.

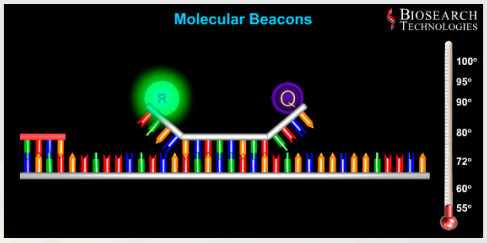
Molecular Beacons

1



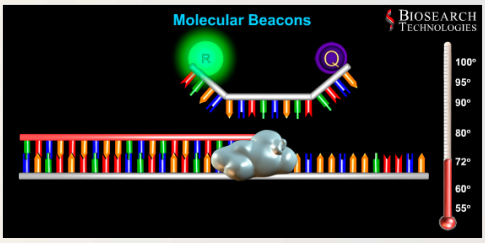
Heat denatures target strand and opens stem-loop structure

2



Lower temp to anneal, molecular beacon binds to target, releasing fluorescence

3



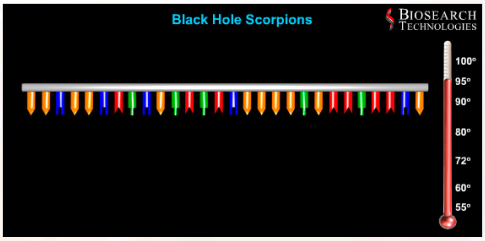
Increase temp for extension, molecular beacon-amplicon hybrids dissociate

Figure 9 Molecular beacons form "stem-loop" structures as a result of complementary stem sequences at their 5′ and 3′ ends and a target-specific region in the center, forming the loop. This structure brings the 5′ reporter and 3′ BHQ into close proximity to quench fluorescence. The presence of the "stem-loop" will increase the probe's stringency for the target.

1) The first step: heating denatures the double stranded target DNA and to open the "stem-loop" structure of the molecular beacon.
2) Second step: the temperature is lowered for annealing. As a result the molecular beacon binds to the target causing the reporter and quencher to spread apart and release fluorescence.
3) Finally, the temperature is increased for optimum extension, which causes the molecular beacon – amplicon hybrids to dissociate.

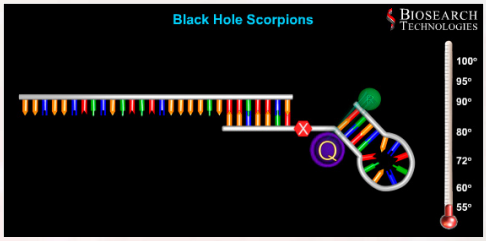
Black Hole Scorpions Assays

1



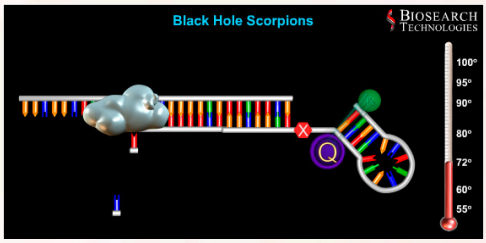
Heat to denature double-stranded DNA

2



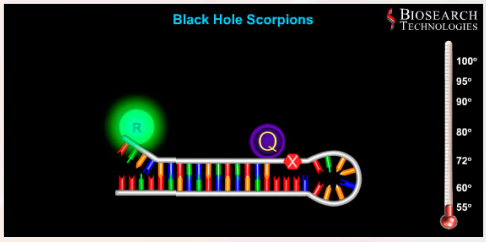
Lower temp, Scorpions primer anneals to target

3



Polymerase extends from Scorpions primer sequence

4

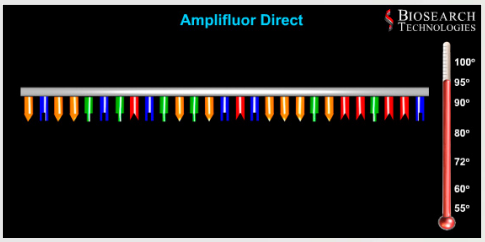


Heating unfolds Scorpions primer, cooling lets complementary sequence anneal to new strand, releasing fluorecense

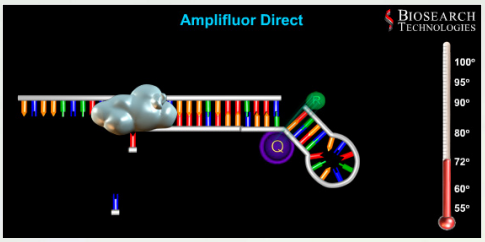
Figure 10 Black Hole Scorpions assays combine primer and probe in one molecule, with a 3′ primer sequence and a 5′ hairpin-loop structure. Similar to beacons, the hairpin brings the reporter and quencher into close proximity, and the loop contains a sequence complementary to the target. A PCR blocker (HEG) lies between the primer and hairpin sequences, blocking polymerase from extending into the hairpin region, preventing it from copying the probe sequence.

1) The first step involves heating to denature the double-stranded DNA into single-stranded DNA.
2) Second step: the temperature is lowered, allowing the target-specific primer of the Black Hole Scorpions sequence to anneal to the target.
3) During the third step, the polymerase extends from the Black Hole Scorpions primer sequence.
4) The final step involves heating which causes the Black Hole Scorpions structure to unfold, then cooling which allows the complementary sequence to anneal to the newly replicated strand. This prevents the "hairpin-loop" from reforming and separates the fluorophore and quencher, releasing fluorescence.

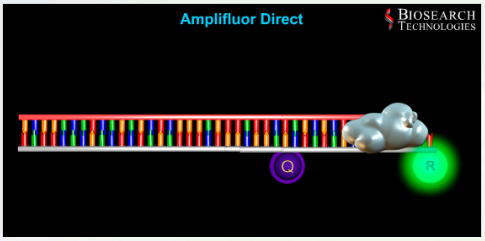
Amplifluor® assays



1 Heat to denature double-stranded DNA



2 Lower temp., Amplifluor primer anneals to DNA; primer extends leaving hairpin at end

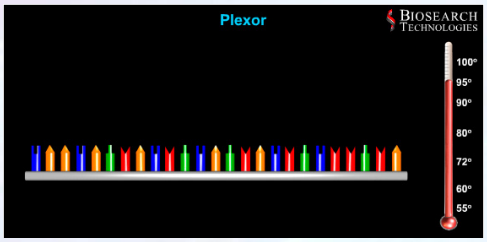


3 Final extension, *Taq* extends and disrupts hairpin, releasing fluorescence

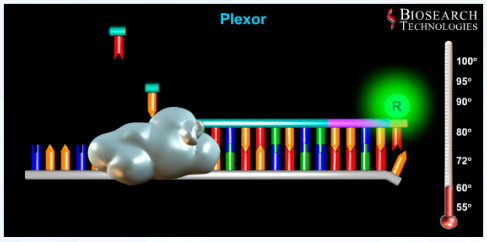
Figure 11 Amplifluor technology combines primer and probe in one molecule. Similar to Black Hole Scorpions primers, the oligo contains the primer sequence at the 3′ end and a hairpin structure at the 5′ end, which brings the reporter and quencher into close proximity. The loop sequence, however, is not specific to the target, and there is no blocker to prevent extension through the hairpin.

1) The first step involves heating to denature the double-stranded DNA into single-stranded DNA.
2) During the second step the temperature is lowered which allows the target-specific Amplifluor primer to anneal to the DNA. After the Amplifluor has annealed to the target strand, this primer is extended, incorporating the hairpin on the end of the newly replicated strand.
3) During the final extension of the reverse primer, the *Taq* polymerase will extend through the hairpin structure of the incorporated Amplifluor, causing the fluorophore and quencher to separate from one another and release fluorescence. The Amplifluor is incorporated into the double-stranded PCR product during each cycle, causing the fluorescent signal to increase with the accumulation of PCR product.

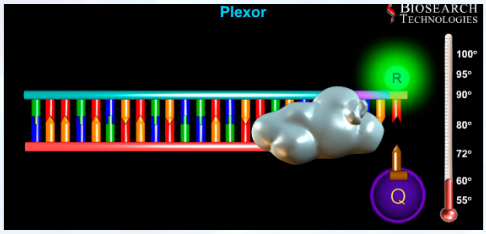
Plexor® Primer



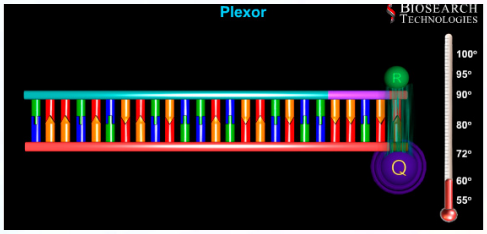
1 Heat to denature double-stranded DNA



2 Forward primer with iso-dC and reporter anneals to target and is extended by *Taq*



3 Double strand is melted, unlabeled reverse primer anneals and is extended by *Taq*, binds iso-dG-quencher



4 As product accumulates, iso-dC and iso-dG continue to bind and quenching increases

Figure 12 Plexor primer technology is based on a highly specific interaction between two nucleotides, iso-dC and iso-dG, which only pair with each other when forming double-stranded DNA. Plexor assays incorporate an iso-dC residue and a fluorescent label on the 5′ end of the forward primer while iso-dG residues labeled with dabcyl are included in the reaction mix along with unlabeled reverse primers.

1) The first step involves heating to denature the double-stranded target DNA into single-stranded DNA.
2) The forward primer with 5′ modified iso-dC and fluorophore anneals to target DNA and is extended by *Taq* polymerase.
3) The double-stranded DNA is melted and the unlabeled reverse primer anneals and is extended by *Taq* polymerase. When *Taq* encounters the 5′ iso-dC, a modified iso-dGTP is added instead of a standard guanine. The binding of iso-dC (linked to a fluorophore) and iso-dG (linked to a quencher) brings the fluorophore and quencher into close proximity, allowing quenching.
4) As PCR product continues to accumulate in subsequent cycles, the iso-dC and iso-dG will continue to bind with one another bringing the fluorophore and quencher together. In contrast to common FRET assays, the PCR products in a Plexor assay are quantified in direct proportion to the reduction of fluorescence.

Multiplexing Recommendations for Dual-Labeled Probes

MULTIPLEXING RECOMMENDATIONS[1] FOR DUAL-LABELED DARK-QUENCHED PROBES AND PRIMERS

INSTRUMENT	COMPANY	CALIBRATION REQUIRED?[2]	MULTIPLEXING DEGREE	DYE 1	DYE 2	DYE 3	DYE 4	DYE 5
Prism® 7700	ABI	Yes	Duplex	FAM	CAL Fluor® Gold 540	SuperROX[3®]		
Prism 7900	ABI	Yes	Duplex	FAM	CAL Fluor Gold 540	SuperROX		
Prism 7000	ABI	Yes	Duplex	FAM	CAL Fluor Gold 540	SuperROX		
Prism 7300	ABI	Yes	Duplex	FAM	CAL Fluor Orange 560	SuperROX		
Prism 7500	ABI	Yes	Quadraplex	FAM	CAL Fluor Orange 560	TAMRA	SuperROX[3]	Quasar 670
iCycler iQ®	Bio-Rad Laboratories	Yes	Quadraplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar® 670	
iQ™5	Bio-Rad Laboratories	Yes	5-Plex	FAM	CAL Fluor Gold 540	CAL Fluor Red 590	CAL Fluor Red 610	Quasar 670
SmartCycler®	Cepheid	Yes	Triplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 635		
SmartCycler II	Cepheid	Yes	Quadraplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar 670	
Rotor-Gene 3000	Corbett Research	No	Quadraplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar 670	
Rotor-Gene 6000 (5 channels)	Corbett Research	No	5-Plex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar 670	Quasar 705
Mastercycler ep Realplex	Eppendorf	Yes	Duplex	FAM	CAL Fluor Gold 540			
Opticon 2	Bio-Rad Laboratories	Yes	Duplex	FAM	CAL Fluor Orange 560			
Chromo 4	Bio-Rad Laboratories	Yes	Quadraplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar 670	
MX3000P	Stratagene	No	Quadraplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar 670	
MX4000®	Stratagene	No	Quadraplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar 670	
LightCycler 1.2	Roche	Yes[4]	Duplex	FAM	Pulsar® 650			
LightCycler 2.0	Roche	Yes[4]	Triplex	FAM	CAL Fluor Red 610	Pulsar 650		
LightCycler 480	Roche	Yes[4]	Quadraplex	FAM	CAL Fluor Orange 560	CAL Fluor Red 610	Quasar 670	

Determined through research at Biosearch | Determined through research of a collaborator | Predicted based on instrument specifications

[1]These recommendations apply to dual-labeled, dark-quenched probes (TaqMan probes, Molecular Beacons, Black Hole Scorpions primers, Amplifluor primers, etc.). They should not be used as guidelines for TAMRA-quenched probes or for hybridization probes that rely on FRET as a means of excitation.

[2]Some instruments require fluorescence calibration. Fluorescence calibration allows these instruments to record the spectral profile for the dye(s) to be used in subsequent assays by resolving the total detected light into signals contributed by the individual fluorophores. Please visit our calibration dye webpage for additional information .

[3]SuperRox is a proprietary passive reference dye available from Biosearch.

[4]LightCycler® instrument users can calibrate using TaqMan probes directly and therefore aren't required to purchase dye calibration kits to perform color calibration.

Recommendations highlighted in yellow have not bee proven and should be used cautiously on an experimental basis. Stratagene customers select their filters from among a series upon instrument ppurchase. Because multiplexing dye compatibility is affected by filter specifications, the above Stratagene recommendations only apply to the standard FAM/HEX/ROX/Cy5 filter set.

General Information About Biosearch Synthesis Columns and CPGs

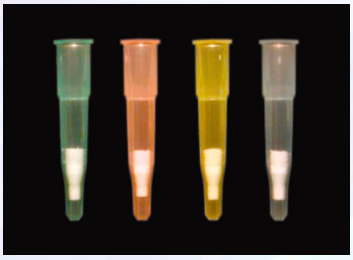
Synthesis Columns


K&A H6


ABI 394

Standard synthesis columns can be used on the ABI 394, Expedite and any other luer–luer connected synthesizers. Most dye-conjugated CPG-packed columns are offered with 500 Å CPG. Standard dA, dC, dG and T synthesis columns are available packed with 500, 1000, 1400 and 2000 Å CPGs, and are available for 50, 200, 1000, 1500 and 3000 nmol synthesis scales. Nucleosides are linked to the CPG by standard 3'-glycolate linkage.

SuperColumns




MerMade


ABI 3900

SuperColumns are designed for use on a variety of commercially available DNA synthesizers (ABI 3900, MerMade, etc.). They have an upper pipette fitting and a lower luer fitting. Most of our dye-conjugated CPG columns are packed with 500 or 1000 Å CPG and are available in 50, 200 and 1000 nmol synthesis scales. We offer standard dA, dC, dG and T SuperColumns packed with 1000 Å CPG and in 50, 200 and 1000 nmol synthesis scales.

CPGs

The 500 Å CPG is useful for the synthesis of oligos up to 50 nucleotides in length, especially when larger amounts of product are desired, as it allows for greater nucleoside loading amounts (30-50 μmol/g) than do supports with larger pore sizes. The 1000 Å CPG support has a loading range of 30-40 μmol/g and is suitable for oligomers over 100 bases.

For experienced users who prefer to make their own columns, Biosearch offers CPG in bulk quantities. The same CPG that is used in our own commercial DNA synthesis operation is available for others who want quality starting materials for their commercial DNA synthesis operations. Each lot is evaluated and tested under rigorous DNA synthesis conditions guaranteeing that the CPG you receive will meet or exceed your most stringent requirements.

Ordering Information for Quenchers and Reporter Dyes

Black Hole Quencher Amidites

BHQ amidites are used for the 5' labeling of fluorogenic probes or to place a quencher internally. These amidites are available with or without a DMT protecting group on the 5' terminus. The amidites with the DMT group, removed under traditional conditions, can be used for 5' labeling and DMT-On cartridge purification, or oligo extension. Our quenchers have absorption values and pair with reporter dyes that emit in the following ranges:

BHQ-0: 430-520 nm
BHQ-1: 480-580 nm
BHQ-2: 560-670 nm
BHQ-3: 620-730 nm

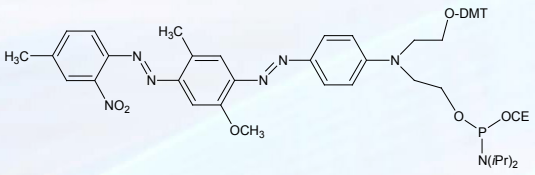
References:

1. Johansson, M.K., Fidder, H., Dick, D. and Cook, R.M. 2002. Intramolecular Dimers: A New Strategy to Fluorescence Quenching in Dual-Labeled Oligonucleotide Probes. *J. Am. Chem. Soc.* 124: 6950-6956.
2. Johansson, M.K. and Cook, R.M. 2003. Intramolecular Dimers: A New Design Strategy for Fluorescence-Quenched Probes. *Chem. Eur. J.* 9: 3466-3471.
3. Johansson, M.K. 2006. Choosing Reporter-Quencher Pairs for Efficient Quenching Through Formation of Intramolecular Dimers. In *Methods In Molecular Biology*, V.V. Didenko, Ed; Humana Press: Totowa, NJ, v. 335: pp 17-29.

BHQ-1 DMT Amidite

Used for the 5' labeling of fluorogenic probes or to place the BHQ internally; contains a DMT protecting group removed under traditional conditions.

Catalog No.	Item Description	Size/Scale	Price
BNS-5051-50	BHQ-1 DMT Amidite	50 mg	$175
BNS-5051-100		100 mg	$325
BNS-5051-250		250 mg	$800
BNS-5051-B		Bulk	Inquire



Abs λmax = 534 nm

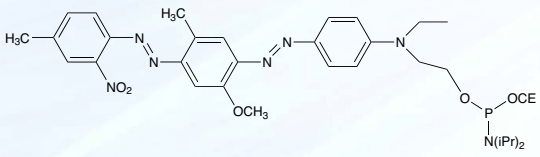
ε_{534} = ca 34,000 $M^{-1}cm^{-1}$
ε_{260} = ca 8,000 $M^{-1}cm^{-1}$

MW $_{true}$ 995.11
MW_{add} 553.5

BHQ-1 Amidite

Used for the 5' labeling of fluorogenic probes; no DMT protecting group.

Catalog No.	Item Description	Size/Scale	Price
BNS-5051N-50	BHQ-1 Amidite	50 mg	$160
BNS-5051N-100		100 mg	$300
BNS-5051N-250		250 mg	$800
BNS-5051N-B		Bulk	Inquire



Abs λmax = 534 nm

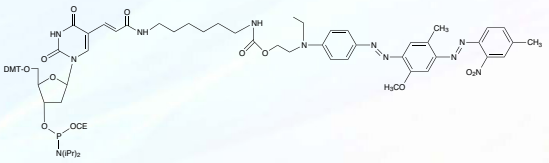
ε_{534} = ca 34,000 $M^{-1}cm^{-1}$
ε_{260} = ca 8,000 $M^{-1}cm^{-1}$

MW $_{true}$ 676.75
MW_{add} 537.5

BHQ-1 T Linker Amidite

Used for the 5' labeling of fluorogenic probes or to place the BHQ internally; contains a DMT protecting group removed under traditional conditions.

CatalogID	Item Description	Size/ Scale	Price
BNS-5051T-50	BHQ-1 T Linker Amidite	50 µmol	$200
BNS-5051T-100		100 µmol	$375
BNS-5051T-250		250 mg	$920
BNS-5051T-B		Bulk	Inquire



Abs λmax = 548 nm

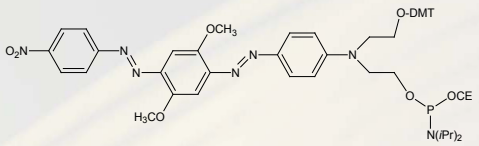
ε_{548} = ca 41,600 $M^{-1}cm^{-1}$
ε_{260} = ca 30,100 $M^{-1}cm^{-1}$

MW $_{true}$ 1401.54
MW_{add} 959.93

BHQ-2 DMT Amidite

Used for the for the 5' labeling of fluorogenic probes or to place a quencher internally. The DMT protecting group is removed under traditional conditions.

Catalog No.	Item Description	Size/Scale	Price
BNS-5052-50	BHQ-2 DMT Amidite	50 mg	$175
BNS-5052-100		100 mg	$325
BNS-5052-250		250 mg	$800
BNS-5052-B		Bulk	Inquire



Abs λmax = 579 nm

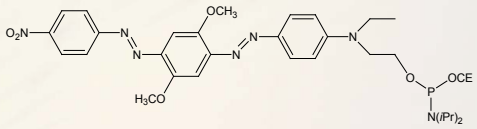
ε_{579} = ca 38,000 $M^{-1}cm^{-1}$
ε_{260} = ca 8,000 $M^{-1}cm^{-1}$

MW $_{true}$ 997.08
MW_{add} 555.47

BHQ-2 Amidite

Used for the for the 5' labeling of fluorogenic probes or to place a quencher internally. This amidite has no DMT protecting group.

Catalog No.	Item Description	Size/Scale	Price
BNS-5052N-50	BHQ-2 Amidite	50 mg	$160
BNS-5052N-100		100 mg	$300
BNS-5052N-250		250 mg	$800
BNS-5052N-B		Bulk	Inquire



Abs λmax = 579 nm

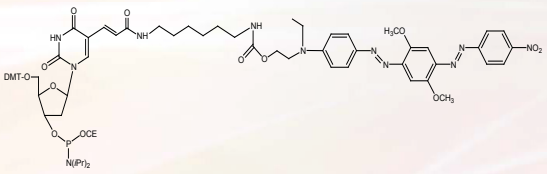
ε_{579} = ca 38,000 $M^{-1}cm^{-1}$
ε_{260} = ca 8,000 $M^{-1}cm^{-1}$

MW $_{true}$ 678.72
MW_{add} 539.47

BHQ-2 T Linker Amidite

Used for the for the 5' labeling of fluorogenic probes or to place a quencher internally. The DMT protecting group is removed under traditional conditions.

Catalog No.	Item Description	Size/Scale	Price
BNS-5052T-50	BHQ-2 T Linker Amidite	50 µmol	$200
BNS-5052T-100		100 µmol	$375
BNS-5052T-250		250 mg	$920
BNS-5052T-B		Bulk	Inquire



Abs λmax = 592 nm

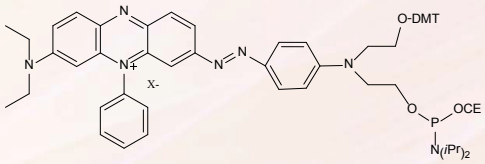
ε_{592} = ca 44,000 $M^{-1}cm^{-1}$
ε_{260} = ca 26,100 $M^{-1}cm^{-1}$

MW $_{true}$ 1403.52
MW_{add} 961.91

BHQ-3 DMT Amidite

Used for the for the 5' labeling of fluorogenic probes or to place a quencher internally. The DMT protecting group is removed under traditional conditions.

Catalog No.	Item Description	Size/Scale	Price
BNS-5053-50	BHQ-3 DMT Amidite	50 mg	$215
BNS-5053-100		100 mg	$405
BNS-5053-B		Bulk	Inquire



Abs λmax = 672 nm

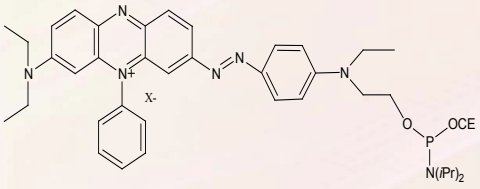
ε_{672} = ca 42,700 $M^{-1}cm^{-1}$
ε_{260} = ca 13,000 $M^{-1}cm^{-1}$

MW $_{true}$ 1038.24
MW_{add} 596.63

BHQ-3 Amidite

Used for the for the 5' labeling of fluorogenic probes, this amidite does not contain a DMT protecting group.

Catalog No.	Item Description	Size/Scale	Price
BNS-5053N-50	BHQ-3 Amidite	50 mg	$200
BNS-5053N-100		100 mg	$375
BNS-5053N-B		Bulk	Inquire



Abs λmax = 672 nm

ε_{672} = ca 42,700 $M^{-1}cm^{-1}$
ε_{260} = ca 13,000 $M^{-1}cm^{-1}$

MW $_{true}$ 719.88
MW_{add} 580.63

Black Hole Quencher Synthesis Columns and Bulk CPG Supports

For labeling the 3' end of an oligonucleotide with a Black Hole Quencher, Biosearch offers controlled pore glass (CPG) and DNA synthesis columns containing BHQ CPG. All BHQ CPG supports have a glycolate linkage to the CPG which allows for rapid cleavage of the oligonucleotides, and is labile enough for base-sensitive oligonucleotides. The 500 Å CPG is useful for the synthesis of oligos up to 50 nucleotides in length, especially when larger amounts of product are desired, as it allows for greater nucleoside loading amounts (30-50 µmol/g) than do supports with larger pore sizes. The 1000 Å CPG support has a loading range of 30-40 µmol/g and is suitable for oligomers over 100 bases.

BHQ SuperColumns are designed for use on a variety of commercially available DNA synthesizers (ABI 3900, MerMade, etc.). The columns have an upper pipette fitting and a lower luer fitting. Standard synthesis columns can be used on the ABI 394, Expedite, Biosearch 8700 and any other luer–luer connected synthesizers.

Our quenchers have absorption and pair with reporter dyes that emit in the following ranges:

BHQ-0: 430-520 nm
BHQ-1: 480-580 nm
BHQ-2: 560-670 nm
BHQ-3: 620-730 nm

All spectral properties are measured in PCR buffer as 3' labeled poly(T) oligo. MW_{add} designates the mass this product adds after conjugation to an oligo and work-up (the additional mass seen by mass spectrometry).

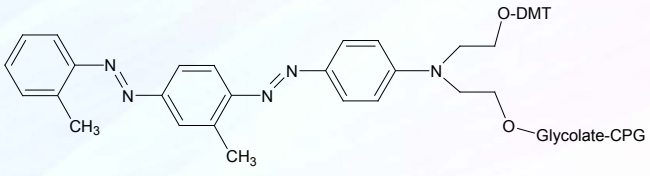
References:

1. Johansson, M.K., Fidder, H., Dick, D. and Cook, R.M. 2002. Intramolecular Dimers: A New Strategy to Fluorescence Quenching in Dual-Labeled Oligonucleotide Probes. *J. Am. Chem. Soc.* 124: 6950-6956.
2. Johansson, M.K. and Cook, R.M. 2003. Intramolecular Dimers: A New Design Strategy for Fluorescence-Quenched Probes. *Chem. Eur. J.* 9: 3466-3471.
3. Johansson, M.K. 2006. Choosing Reporter-Quencher Pairs for Efficient Quenching Through Formation of Intramolecular Dimers. In *Methods In Molecular Biology*, V.V. Didenko, Ed; Humana Press: Totowa, NJ, v. 335: pp 17-29.

BHQ-0 Synthesis Columns and Bulk CPG - Pair with reporters with Em λmax 430-520 nm

Catalog No.	Item Description	Scale	Price
SCG5-5040G-5	BHQ-0 SuperColumn; 500 Å	50 nmol	$14
SCG5-5040G-2		200 nmol	$20
SCG5-5040G-1		1 µmol	$75
CG5-5040G-5	BHQ-0 Synth. Column; 500 Å	50 nmol	$14
CG5-5040G-2		200 nmol	$20
CG5-5040G-1		1 µmol	$75
BG5-5040G-100	BHQ-0 CPG; 500 Å	100 mg	$190
BG5-5040G-1		1 g	$1500
BG1-5040G-100	BHQ-0 CPG; 1000 Å	100 mg	$190
BG1-5040G-1		1 g	$1500
	Inquire for bulk pricing		

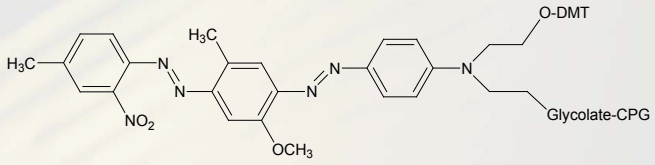
Abs λmax = 493 nm
ε_{493} = ca 34,000 $cm^{-1}M^{-1}$
ε_{260} = ca 7,700 $cm^{-1}M^{-1}$
MW_{add} 399.5



BHQ-1 Synthesis Columns and Bulk CPG - Pair with reporters with Em λmax 480-580 nm

Catalog No.	Item Description	Scale	Price
SCG5-5041G-2	BHQ-1 SuperColumn; 500 Å	200 nmol	$20
SCG5-5041G-1		1 µmol	$75
CG5-5041G-5	BHQ-1 Synth. Column; 500 Å	50 nmol	$14
CG5-5041G-2		200 nmol	$20
CG5-5041G-1		1 µmol	$75
CG1-5041G-5	BHQ-1 Synth. Column; 1000 Å	50 nmol	$14
CG1-5041G-2		200 nmol	$20
CG1--5041G-1		1 µmol	$75
BG5-5041G-100	BHQ-1 CPG; 500 Å	100 mg	$190
BG5-5041G-1		1 g	$1500
BG1-5041G-100	BHQ-1 CPG; 1000 Å	100 mg	$190
BG1-5041G-1		1 g	$1500
	Inquire for bulk pricing		

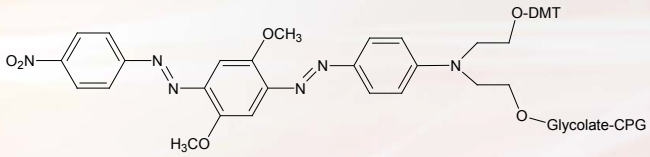
Abs λmax = 534 nm
ε_{534} = ca 34,000 $cm^{-1}M^{-1}$
ε_{260} = ca 8,000 $cm^{-1}M^{-1}$
MW_{add} 474.53



BHQ-2 Synthesis Columns and Bulk CPG - Pair with reporters with Em λmax 560-670 nm

Catalog No.	Item Description	Scale	Price
SCG5-5042G-2	BHQ-2 SuperColumn; 500 Å	200 nmol	$20
SCG5-5042G-1		1 µmol	$75
CG5-5042G-5	BHQ-2 Synth. Column; 500 Å	50 nmol	$14
CG5-5042G-2		200 nmol	$20
CG5-5042G-1		1 µmol	$75
CG1-5042G-5	BHQ-2 Synth. Column; 1000 Å	50 nmol	$14
CG1-5042G-2		200 nmol	$20
CG1-5042G-1		1 µmol	$75
BG5-5042G-100	BHQ-2 CPG; 500 Å	100 mg	$190
BG5-5042G-1		1 g	$1500
BG1-5042G-100	BHQ-2 CPG; 1000 Å	100 mg	$190
BG1-5042G-1		1 g	$1500
	Inquire for bulk pricing	1 µmol	

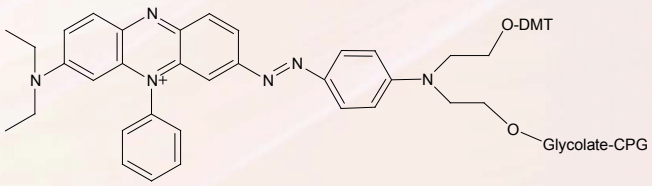
Abs λmax = 579 nm
ε_{579} = ca 38,000 $cm^{-1}M^{-1}$
ε_{260} = ca 8,000 $cm^{-1}M^{-1}$
MW_{add} 476.5



BHQ-3 Synthesis Columns and Bulk CPG - Pair with reporters with Em λmax 620-730 nm

Catalog No.	Item Description	Scale	Price
SCG5-5043G-2	BHQ-3 SuperColumn; 500 Å	200 nmol	$22
SCG5-5043G-1		1 µmol	$83
CG5-5043G-5	BHQ-3 Synth. Column; 500 Å	50 nmol	$16
CG5-5043G-2		200 nmol	$22
CG5-5043G-1		1 µmol	$83
BG5-5043G-100	BHQ-3 CPG; 500 Å	100 mg	$209
BG5-5043G-1		1 g	$1650
	Inquire for bulk pricing		

Abs λmax = 672 nm
ε_{672} = ca 42,700 $cm^{-1}M^{-1}$
ε_{260} = ca 13,000 $cm^{-1}M^{-1}$
MW_{add} 517.66



Other Quencher Amidites, Synthesis Columns and Bulk CPG Supports

For labeling the 5′ end of an oligonucleotide, Biosearch offers Dabsyl Amidite (T Linker Arm). For labeling the 3′ end of an oligonucleotide with a Dabcyl quencher, Biosearch offers 500 Å controlled pore glass (CPG) and DNA synthesis columns containing Dabcyl CPG. Columns are available for a range of DNA synthesizers and CPG is available in a variety of modifications and pore sizes.

SuperColumns are designed for use on a variety of commercially available DNA synthesizers (ABI 3900, MerMade, etc.). They have an upper pipette fitting and a lower luer fitting. Standard synthesis columns can be used on the ABI 394, Expedite, Biosearch 8700 and any other luer–luer connected synthesizers.

The 500 Å CPG is useful for the synthesis of oligos up to 50 nucleotides in length, especially when larger amounts of product are desired, as it allows for greater nucleoside loading amounts (30-50 µmol/g) than do supports with larger pore sizes. The 1000 Å CPG support has a loading range of 30-40 µmol/g and is suitable for oligomers over 100 bases.

Dabsyl has an Abs λmax at 464 nm. Dabcyl absorbs between 400 - 525 nm, with maximum quenching at 472 nm. Both Dabsyl and dabcyl may be used as a quencher for fluorophore groups such as :

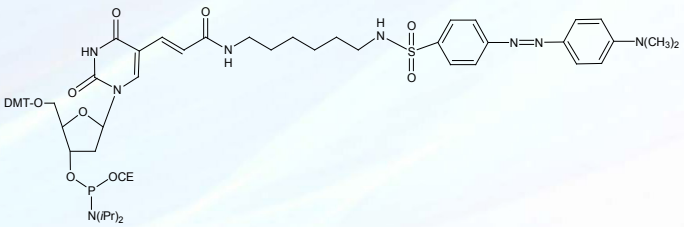
Fluorescein
TAMRA
JOE

For the amidite, two values for molecular weight are listed. MW_{add} designates the mass this product adds after conjugation to an oligo and work-up (the additional mass seen by mass spectrometry). MW_{true} is the original molecular weight of the chemical structure. For CPGs, MW_{add} is given.

Dabsyl Amidite (T Linker Arm)

Dabsyl is a nonfluorescent amidite that quenches in the green region of the visible spectrum. It is used especially for the 5′ labeling of Amplifluor Primers. This amidite contains a DMT protecting group and can be added internally to the oligonucleotide.

Catalog No.	Item Description	Scale	Price
BNS-5061-100	Dabsyl Amidite (T Linker Arm)	100 µmol	$325
BNS-5061-250		250 mg	$675
BNS-5061-1		1 g	$2200
BNS-5061-B		Bulk	inquire



Abs λmax = 464 nm

ε_{464} = ca 25,500 $M^{-1}cm^{-1}$
ε_{260} = ca 15,683 $M^{-1}cm^{-1}$

MW_{true} 1186.36
MW_{add} 744.75

Spectral properties measured in water coupled onto T-10.

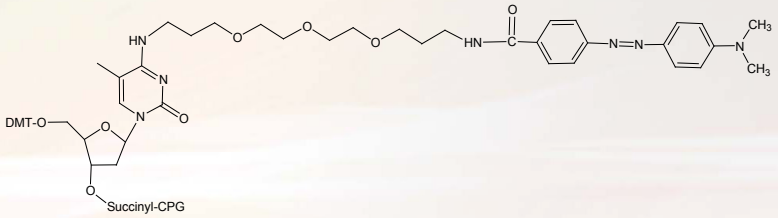
Dabcyl-Suc-CPG Columns and Bulk CPG

Biosearch Technologies' Dabcyl-Suc-CPG is based on a modified cytosine residue linked to the Dabcyl chromophore via a triethyleneglycol spacer. The 3' end is conjugated to the CPG support via succinyl linkage. 5'-DMT-mdC(TEG-Dabcyl)-Suc-CPG is specifically suited for the preparation of molecular beacons or fluorescent energy transfer probes.

λmax = 472 nm
ε_{472} = ca 32,000 $M^{-1}cm^{-1}$
ε_{260} = ca 14,333 $M^{-1}cm^{-1}$
MW_{add} 675.79

Catalog No.	Item Description	Scale	Price
SCG5-5025S-5	Dabcyl-Suc-CPG SuperColumn; 500 Å	50 nmol	$12
SCG5-5025S-2		200 nmol	$16
SCG5-5025S-1		1 µmol	$40
CG5-5025S-5	Dabcyl-Suc-CPG Synthesis Column; 500 Å	50 nmol	$12
CG5-5025S-2		200 nmol	$16
CG5-5025S-1		1 µmol	$40
BG5-5025S-100	Dabcyl-Suc-CPG; 500 Å	100 mg	$100
BG5-5025S-1		1 g	$800
BG1-5025S-100	Dabcyl-Suc-CPG; 1000 Å	100 mg	$100
BG1-5025S-1		1 g	$800

Inquire for bulk pricing



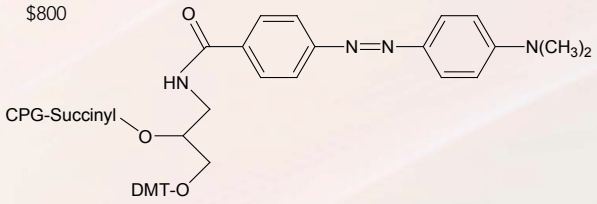
Dabcyl-C3-Suc-CPG Columns and Bulk CPG

Dabcyl-C3-Suc-CPG is synthesized with a three carbon linker arm and is attached to the solid support via a succinate linkage. This support allows for 3' labeling of molecular beacons and acts as a quencher moiety. Dabcyl is used as a quencher for fluorophore groups such as fluorescein, TAMRA and JOE. Dabcyl absorbs between 400 to 525 nm with maximum quenching at 474 nm.

λmax = 474 nm
MW_{true} 340.14
MW_{add} 324.39

Catalog No.	Item Description	Scale	Price
CG5-5026-5	Dabcyl-C3-Suc-CPG Synthesis Column; 500 Å	50 nmol	$15
CG5-5026-2		200 nmol	$20
CG5-5026-1		1 µmol	$40
BG5-5026-100	Dabcyl-C3-Suc-CPG; 500 Å	100 mg	$100
BG5-5026-1		1 g	$800

Inquire for bulk pricing



CAL Fluor® and Quasar® Dye Amidites

Superior alternatives to Vic, JOE, Texas Red®, Cy3® and Cy5®

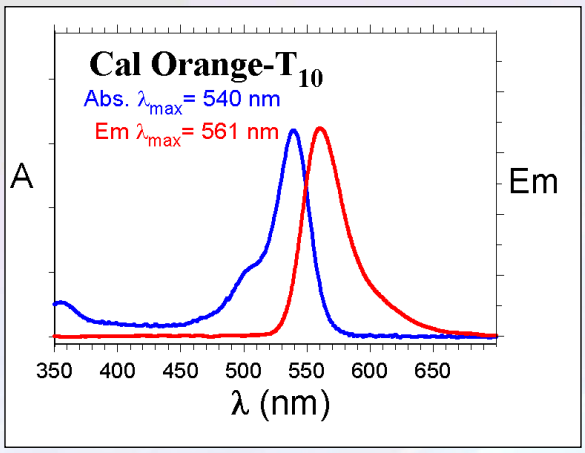
Dual-labeled probes incorporating CAL Fluor or Quasar dyes coupled with a BHQ dye exhibit large signal to noise values and produce amplification traces with robust ΔRns and earlier CT values. This capability was powerfully demonstrated in a poster presented by Biosearch at the Quantitative PCR meeting in 2004, where real-time data showing the simultaneous amplification of four different genomic DNA targets in a quadraplex assay was presented.

Dual-labeled probes synthesized with JOE, VIC and Texas Red (only available as esters whose use is labor intensive), HEX (which suffers from instability during post DNA synthesis work-up), and Cy3 and Cy5 (which are expensive dyes) require careful and experienced handling during synthesis and purification to guarantee probes of outstanding quality.

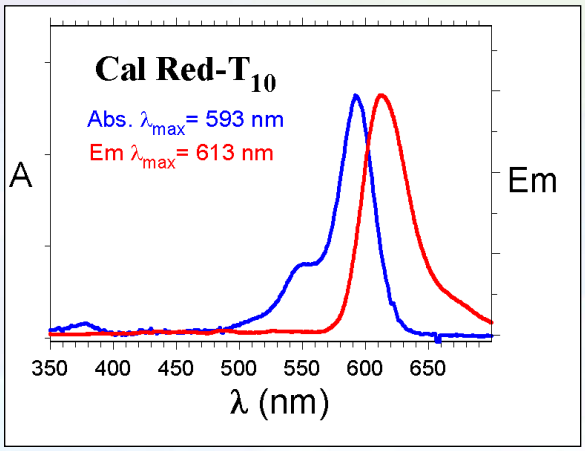
The CAL Fluor and Quasar dyes overcome each of these disadvantages: probe synthesis with the CAL Fluor and Quasar dyes can be automated, they are stable to DNA probe work-up conditions and this translates into cost savings to you, the scientist.

All spectral properties are measured in PCR buffer as 5' labeled poly(T) oligo. Two values for molecular weight are listed. MW_{add} designates the mass this product adds after conjugation to an oligo and work-up (the additional mass seen by mass spectrometry). MW_{true} is the molecular weight of the chemical structure before cleavage and deprotection.

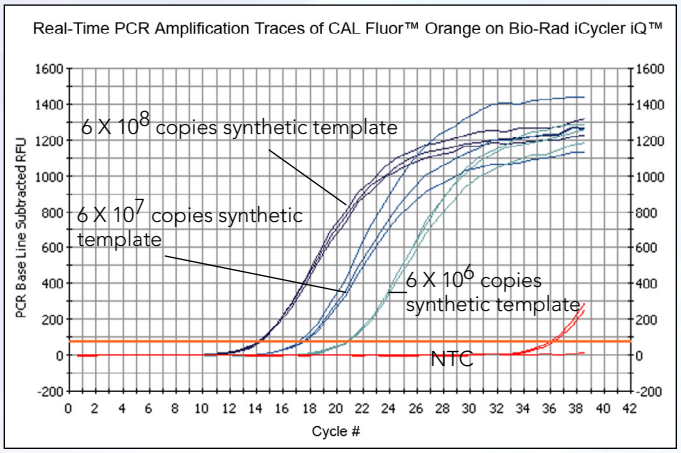
The quadraplexed assay shown below was designed and optimized by Bio-Rad laboratories, and adapted to the CAL Fluor/Quasar dye series by Biosearch Technologies.

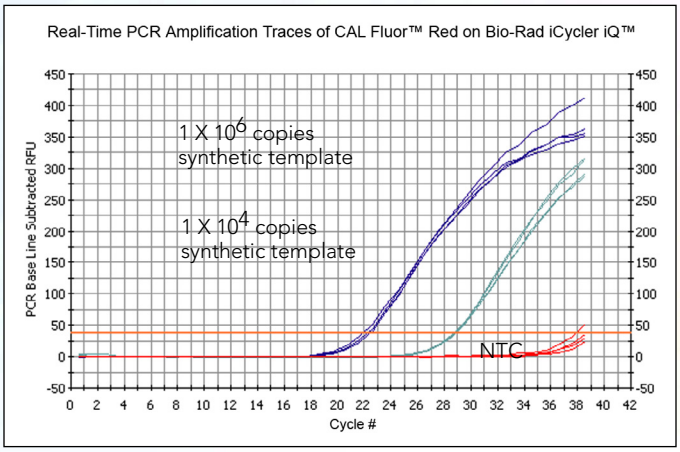


Emission and absorption spectra of CAL Fluor Orange 560 dye linked to a T_{10} oligonucleotide.



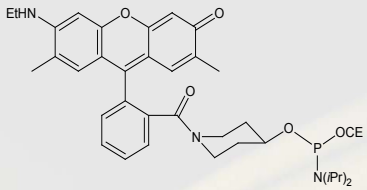
Emission and absorption spectra of CAL Fluor Red 610 dye linked to a T_{10} oligonucleotide.





CAL Fluor Gold 540 Amidite - *Alternative for TET - Quenched by BHQ-1*

CAL Fluor Gold 540 is an amidite which fluoresces in the yellow green region of the visible spectrum and is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays, molecular beacons, and other detection assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo. BHQ-1 dye will quench the CAL Fluor Gold 540 moiety. CAL Fluor Gold 540 is an alternative for TET.



Abs λmax = 522 nm

ε_{522} = ca 81,100 $M^{-1}cm^{-1}$
ε_{260} = ca 15,100 $M^{-1}cm^{-1}$

Em λmax = 543 nm

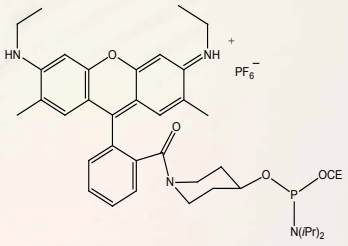
MW_{true} 670.33

MW_{add} 531.53

Catalog No.	Item Description	Size/Scale	Price
BNS-5080-50	CAL Fluor Gold 540 Amidite	50 µmol	$125
BNS-5080-100		100 µmol	$225
BNS-5080-250		250 mg	$625
BNS-5080-B		Bulk	Inquire

CAL Fluor Orange 560 Amidite - *Alternative for VIC, HEX and JOE, Quenched by BHQ-1*

CAL Fluor Orange 560 fluoresces in the yellow-orange region of the visible spectrum, and is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays, molecular beacons, and other genomic assays. This amidite does not contain a DMT protecting group and therefore can only be added to the 5′ terminus of the oligo. BHQ-1 dye will quench the CAL Fluor Orange 560 moiety. CAL Fluor Orange 560 is an alternative for VIC, HEX and JOE.



Abs λmax = 537 nm

ε_{537} = ca 81,000 $M^{-1}cm^{-1}$
ε_{260} = ca 15,000 $M^{-1}cm^{-1}$

Em λmax = 558 nm

MW_{true} 843.82

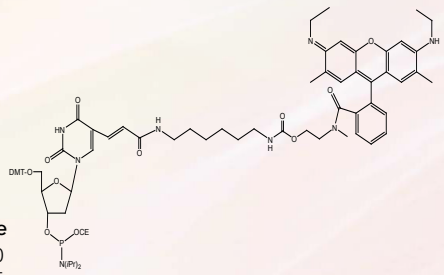
MW_{add} 559.61

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

Catalog No.	Item Description	Size/Scale	Price
BNS-5081-50	CAL Fluor Orange 560 Amidite	50 µmol	$125
BNS-5081-100		100 µmol	$225
BNS-5081-250		250 mg	$625
BNS-5081-B		Bulk	Inquire

CAL Fluor Orange 560 C6 T Amidite - *Alternative for VIC, HEX and JOE - Quenched by BHQ-1*

CAL Fluor Orange 560 C6 T amidite is used for the 5′ or internal labeling of synthetic oligonucleotides for a wide array of applications including dual labeled fluorogenic probes for real time PCR. The CAL Fluor Orange 560 moiety is coupled to a thymine for addition to synthetic oligonucleotides. CAL Fluor Orange 560 fluoresces in the yellow-orange region of the visible spectrum and can be effectively quenched by BHQ-1 dye. CAL Fluor Orange 560 is an alternative for VIC, HEX and JOE.



Abs λmax = 542 nm

ε_{542} = ca 85,900 $M^{-1}cm^{-1}$
ε_{260} = ca 36,500 $M^{-1}cm^{-1}$

Em λmax = 561 nm

MW_{true} 1396.61

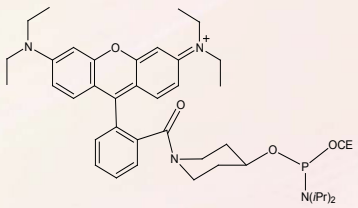
MW_{add} 956

Spectral properties measured in PCR buffer as internal-labeled poly(T) oligo.

Catalog No.	Item Description	Size/Scale	Price
BNS-5081T-50	CAL Fluor Orange 560 C6 T Amidite	50 µmol	$250
BNS-5081T-100		100 µmol	$425
BNS-5081T-250		250 mg	$725
BNS-5081T-B		Bulk	Inquire

CAL Fluor Red 590 Amidite - *Alternative for TAMRA - Quenched by BHQ-2*

CAL Fluor Red 590 is an amidite which fluoresces in the yellow-orange region of the visible spectrum, and is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays, Molecular Beacons™, and other genomic assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo. CAL Fluor Red 590 is an alternative dye for TAMRA and is quenched by BHQ-2 dye.



Abs λmax = 569 nm

ε_{569} = ca 79,000 $M^{-1}cm^{-1}$
ε_{260} = ca 20,900 $M^{-1}cm^{-1}$

Em λmax = 591 nm

MW_{true} 726.91

MW_{add} 587.66

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

Catalog No.	Item Description	Size/Scale	Price
BNS-5083-50	CAL Fluor Red 590 Amidite	50 µmol	$185
BNS-5083-100		100 µmol	$360
BNS-5083-250		250 mg	$810
BNS-5083-B		Bulk	Inquire

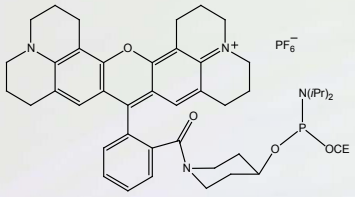
CAL Fluor® and Quasar® Dye Amidites

Superior alternatives to Vic, JOE, Texas Red, Cy3 and Cy5

CAL Fluor Red 610 Amidite - *Alternative for Texas Red and ROX - Quenched by BHQ-2*

CAL Fluor Red 610 is an amidite which fluoresces in the orange-red region of the visible spectrum and is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays, molecular beacons, and other detection assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus. BHQ-2 will quench the CAL Fluor Red 610 moiety. CAL Fluor Red 610 is an alternative for Texas Red and ROX.

Catalog No.	Item Description	Size/Scale	Price
BNS-5082-50	CAL Fluor Red 610 Amidite	50 µmol	$125
BNS-5082-100		100 µmol	$225
BNS-5082-250		250 mg	$625
BNS-5082-B		Bulk	Inquire



Abs λmax = 590 nm

ε_{590} = ca 108,000 $M^{-1}cm^{-1}$
ε_{260} = ca 18,800 $M^{-1}cm^{-1}$

Em λmax = 610 nm

MW_{true} 919.91

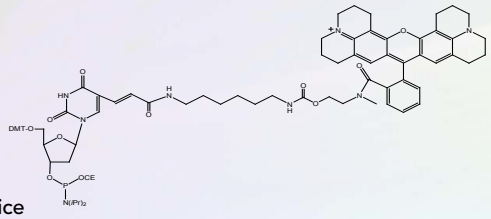
MW_{add} 635.7

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

CAL Fluor Red 610 C6 T Amidite - *Alternative for Texas Red and ROX - Quenched by BHQ-2*

CAL Fluor Red 610 C6 T amidite is used for the 5′ or internal labeling of synthetic oligonucleotides for a wide array of applications including dual labeled fluorogenic probes for real time PCR. The CAL Fluor Red 610 moiety is coupled to a thymine for addition to synthetic oligonucleotides. CAL Fluor Red 610 fluoresces in the orange-red region of the visible spectrum and can be quenched effectively by BHQ-2. CAL Fluor Red 610 is an alternative for Texas Red and ROX

Catalog No.	Item Description	Size/Scale	Price
BNS-5082T-50	CAL Fluor Red 610 C6 T Amidite	50 µmol	$250
BNS-5082T-100		100 µmol	$425
BNS-5082T-250		250 mg	$725
BNS-5082T-B		Bulk	Inquire



Abs λmax = 592 nm

ε_{592} = ca 107,000 $M^{-1}cm^{-1}$
ε_{260} = ca 70,700 $M^{-1}cm^{-1}$

Em λmax = 610 nm

MW_{true} 1473.71

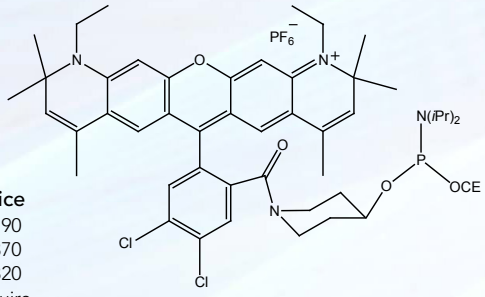
MW_{add} 1032.1

Spectral properties measured in PCR buffer as internal-labeled poly(T) oligo.

CAL Fluor Red 635 Amidite - *Alternative for LightCycler Red 640 - Quenched by BHQ-2*

CAL Fluor Red 635 is an amidite which fluoresces in the orange-red region of the visible spectrum. CAL Fluor Red 635 amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays, molecular beacons, and other genomic assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo. BHQ-2 will quench the CAL Fluor Red 635 moiety. CAL Fluor Red 635 is an alternative for LightCycler Red 640.

Catalog No.	Item Description	Size/Scale	Price
BNS-5084-50	CAL Fluor Red 635 Amidite	50 µmol	$190
BNS-5084-100		100 µmol	$370
BNS-5084-250		250 mg	$820
BNS-5084-B		Bulk	Inquire



Abs λmax = 616 nm

ε_{616} = ca 112,000 $M^{-1}cm^{-1}$
ε_{260} = ca 36,500 $M^{-1}cm^{-1}$

Em λmax = 637 nm

MW_{true} 899.95

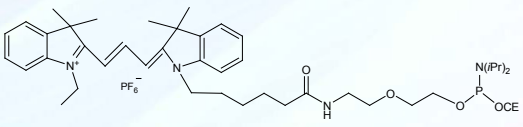
MW_{add} 760.7

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

Quasar 570 Amidite - *Alternative for Cy3 - Quenched by BHQ-2*

Quasar 570 is an indocarbocyanine which fluoresces in the yellow-orange region of the visible spectrum. This compound is a direct replacement for Cy3 dye. Quasar 570 amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays, molecular beacons, and other detection assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo or internally on a free hydroxyl. BHQ-2 will quench the Quasar 570 moiety.

Catalog No.	Item Description	Size/Scale	Price
BNS-5063-50	Quasar 570 Amidite	50 µmol	$140
BNS-5063-100		100 µmol	$275
BNS-5063-250		250 mg	$725
BNS-5063-B		Bulk	Inquire



Abs λmax = 547 nm

ε_{547} = ca 115,000 $M^{-1}cm^{-1}$
ε_{260} = ca 9,000 $M^{-1}cm^{-1}$

Em λmax = 570 nm

MW_{true} 903.95

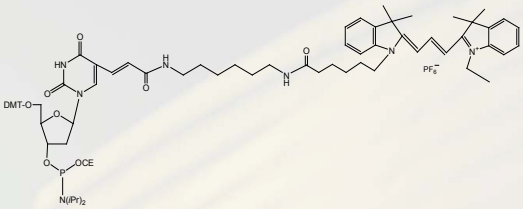
MW_{add} 619.75

Spectral properties measured in PCR buffer as 5′-labeled - poly(T) oligo.

Quasar 570 C6 T Amidite - *Alternative for Cy3 - Quenched by BHQ-2*

Quasar 570 C6 T amidite is used for the 5′ or internal labeling of synthetic oligonucleotides for a wide array of applications including dual labeled fluorogenic probes for real time PCR. The Quasar 570 moiety is coupled to a thymine for addition to synthetic oligonucleotides. Quasar 570 is an indocarbocyanine that fluoresces in the yellow-orange region of the visible spectrum and can be effectively quenched by BHQ-2. It is also a direct replacement for Cy3 dye.

Catalog No.	Item Description	Size/Scale	Price
BNS-5063T-50	Quasar 570 C6 T Amidite	50 µmol	$250
BNS-5063T-100		100 µmol	$425
BNS-5063T-250		250 mg	$625
BNS-5063T-B		Bulk	Inquire



Abs λmax = 547 nm

ε_{547} = ca 118,000 $M^{-1}cm^{-1}$
ε_{260} = ca 20,000 $M^{-1}cm^{-1}$

Em λmax = 570 nm

MW_{true} 1352.66

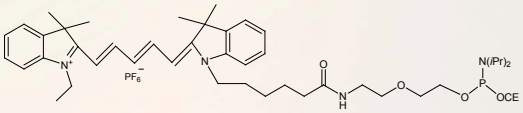
MW_{add} 911.05

Spectral properties measured in PCR buffer as internal-labeled poly(T) oligo.

Quasar 670 Amidite - *Alternative for Cy5 - Quenched by BHQ-2 or BHQ-3*

Quasar 670 is an indocarbocyanine which fluoresces in the red region of the visible spectrum. This compound is a direct replacement for Cy5™. Quasar 670 amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays, Molecular Beacons™, and other detection assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo or internally on a free hydroxyl. BHQ-2 or BHQ-3 dyes will quench the Quasar 670 moiety.

Catalog No.	Item Description	Size/Scale	Price
BNS-5065-50	Quasar 670 Amidite	50 µmol	$140
BNS-5065-100		100 µmol	$275
BNS-5065-250		250 mg	$725
BNS-5065-B		Bulk	Inquire



Abs λmax = 644 nm

ε_{644} = ca 187,000 $M^{-1}cm^{-1}$
ε_{260} = ca 2,800 $M^{-1}cm^{-1}$

Em λmax = 670 nm

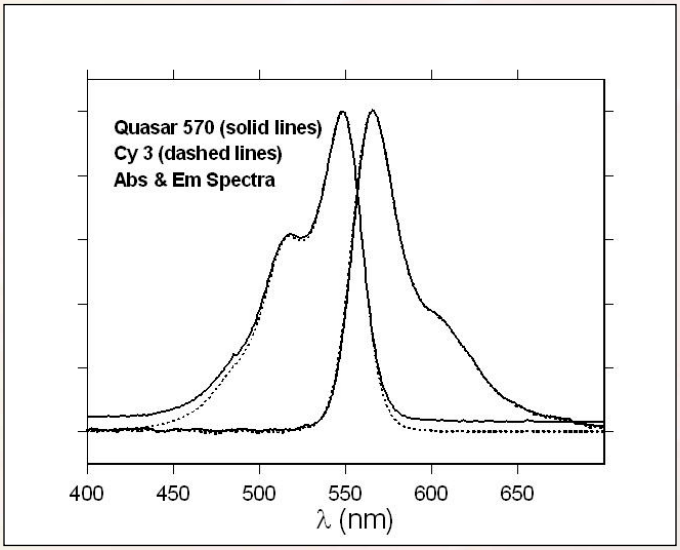
MW_{true} 785.03

MW_{add} 645.78

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

Comparison of Quasar 570 and Cy3

Cy3 and Quasar 570 have the same cyanine chromophore - only the structure of the linkage has been changed. The absorption and fluorescence spectra below are of 5′-labeled oligos that were prepared by coupling amidites of the two dyes to T10 oligos. The absorption spectra are very similar. The relative intensity at the dye's lmax compared to the intensity at 260 nm indicates that the extinction coefficients are also nearly the same. The fluorescence curves are virtually superimposable. The similar emission intensities indicate that the fluorescence quantum yields of Cy3 and Quasar 570 are very similar.

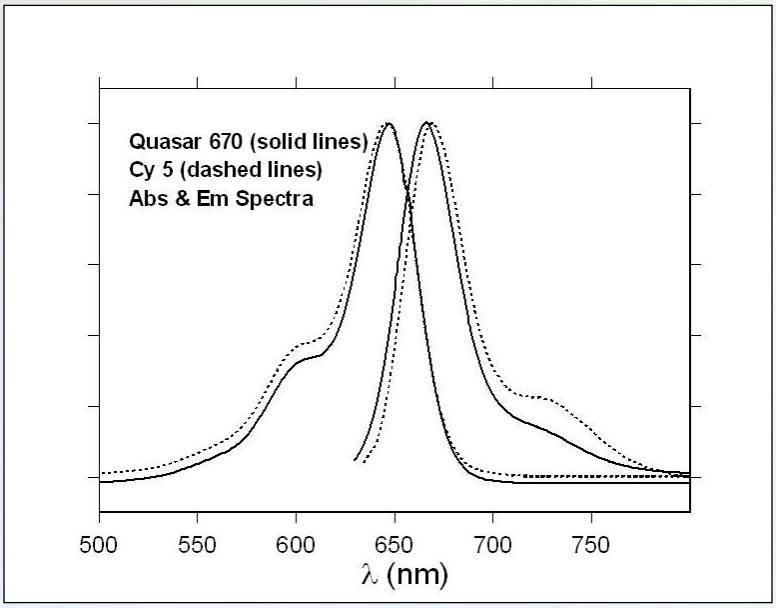


CAL Fluor® and Quasar® Dye Amidites

Superior alternatives to Vic, JOE, Texas Red, Cy3 and Cy5

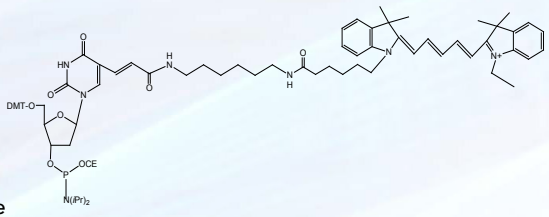
Comparison of Quasar 670 and Cy5

5′-labeled oligos were prepared by coupling amidites of the two dyes to a T10 oligo. Absorption spectra were taken during reversed-phase analytical HPLC analysis. The absorption spectra are very similar with slightly shifted maxima. The relative intensity at the dye's λmax compared to the intensity at 260 nm indicate that the extinction coefficients are also nearly the same. Emission spectra were collected using broad-band excitation of samples.



Quasar 670 C6 T Amidite - *Alternative for Cy5 - Quenched by BHQ-2 or BHQ-3*

Quasar 670 C6 T amidite is used for the 5′ or internal labeling of synthetic oligonucleotides for a wide array of applications including dual labeled fluorogenic probes for real time PCR. The Quasar 670 moiety is coupled to a thymine for internal labeling. Quasar 670 is an indocarbocyanine that fluoresces in the red region of the visible spectrum and can be effectively quenched by BHQ-2 or BHQ-3 dyes. It is also a direct replacement for the Cy5 dye.



Catalog No.	Item Description	Size/ Scale	Price
BNS-5065T-50	Quasar 670 C6 T Amidite	50 µmol	$275
BNS-5065T-100		100 µmol	$450
BNS-5065T-250		250 mg	$650
BNS-5065T-B		Bulk	Inquire

Abs λmax = 644 nm

ε_{644} = ca 176,000 $M^{-1}cm^{-1}$
ε_{260} = ca 2,640 $M^{-1}cm^{-1}$

Em λmax = 670 nm

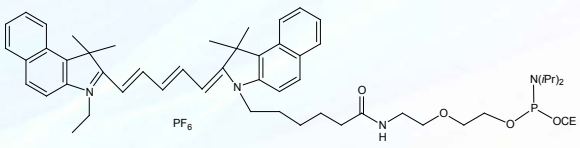
MW_{true} 1378.7

MW_{add} 937.09

Spectral properties measured in PCR buffer as an internal-labeled poly(T) oligo.

Quasar 705 Amidite - *Alternative for Cy5.5 - Quenched by BHQ-2 or BHQ-3*

Quasar 705 is an indocarbocyanine which fluoresces in the red region of the visible spectrum and is a direct replacement for Cy5.5 dye. Quasar 705 amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays and other detection assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo. BHQ-2 or BHQ-3 dyes will quench the Quasar 705 moiety.



Catalog No.	Item Description	Size/Scale	Price
BNS-5067-50	Quasar 705 Amidite	50 µmol	$155
BNS-5067-100		100 µmol	$305
BNS-5067-250		250 mg	$800
BNS-5067-B		Bulk	Inquire

Abs λmax = 690 nm

ε_{690} = ca 206,000 $M^{-1}cm^{-1}$
ε_{260} = ca 15,600 $M^{-1}cm^{-1}$

Em λmax = 705 nm

MW_{true} 1030.11

MW_{add} 745.9

Spectral properties measured in PCR buffer as an 5′-labeled poly(T) oligo.

The final mass determination of each oligo is measured by electrospray ionization mass spec

CAL Fluor and Quasar Dye Synthesis Columns and Bulk CPGs

Superior alternatives to VIC, JOE, Texas Red, ROX, Cy3 and Cy5

For labeling the 3' end of an oligonucleotide with CAL Fluor and Quasar Dyes, Biosearch offers controlled pore glass (CPG) and DNA synthesis columns containing dyes with glycolate linkages to CPG. Columns are available for the range of DNA synthesizers and are available in a variety of pore sizes.

Biosearch SuperColumns are designed for use on a variety of commercially available DNA synthesizers (ABI 3900, MerMade, etc.). They have an upper pipette fitting and a lower luer fitting. Standard synthesis columns can be used on the ABI 394, Expedite, Biosearch 8700 and any other luer–luer connected synthesizers.

Dye-linked CPG supports have a glycolate linkage to the CPG which allows for rapid cleavage of the oligonucleotides, and is labile enough for base-sensitive oligonucleotides. The 500 Å CPG is useful for the synthesis of oligos up to 50 nucleotides in length, especially when larger amounts of product are desired, as it allows for greater nucleoside loading amounts (30-50 μmol/g) than do supports with larger pore sizes. The 1000 Å CPG support has a loading range of 30-40 μmol/g and is suitable for oligomers over 100 bases.

As companions for these dyes, we have designed our proprietary Black Hole Quencher dyes to have maximal absorption in the following ranges:

BHQ-0: 430-520 nm
BHQ-1: 480-580 nm
BHQ-2: 560-670 nm
BHQ-3: 620-730 nm

All spectral properties are measured in PCR buffer as 3' labeled poly(T) oligo. MW_{add} designates the mass this product adds after conjugation to an oligo and work-up (the additional mass seen by mass spectrometry).

CAL Fluor Orange 560 Synthesis Columns and Bulk CPG - *Alternative for VIC, HEX and JOE, Quenched by BHQ-1*

Synthesis columns, packed with CAL Fluor Orange 560 CPG, allows for the introduction of the CAL Fluor Orange 560 moiety onto the 3'-terminus of an oligonucleotide and is particularly useful for the preparation of dual labeled Fluorescent Energy Transfer (FRET) probes. CAL Fluor Orange 560 fluoresces in the yellow-orange region of the visible spectrum and is an alternative for VIC, HEX, and JOE. The CAL Fluor Orange 560 moiety can be quenched by BHQ-1. Bulk CPG is available for those who wish to pack their own columns.

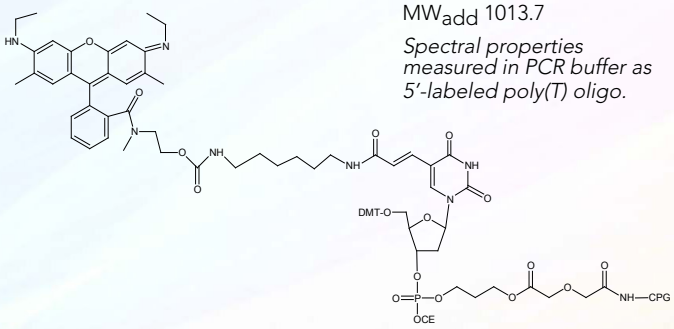
Catalog No.	Item Description	Scale	Price
CG5-5081-2	CAL Fluor Orange 560 Synthesis Column; 500 Å	200 nmol	$20
CG5-5081-1		1 μmol	$75
BG5-5081-2	CAL Fluor Orange 560 CPG; 500 Å	100 mg	$190
BG5-5081-1		1 g	$1500
	Inquire for bulk pricing		

Abs λmax = 540 nm
ε_{540} = ca 87,600 $cm^{-1}M^{-1}$
ε_{260} = ca 28,500 $cm^{-1}M^{-1}$

Em λmax = 561 nm

MW_{add} 1013.7

Spectral properties measured in PCR buffer as 5'-labeled poly(T) oligo.



Quasar 570 Synthesis Columns and Bulk CPG- *Alternative for Cy3 - Quenched by BHQ-2*

Quasar 570 CPG is a fluorescent indocarbocyanine which fluoresces in the yellow-orange region of the visible spectrum. Quasar 570 CPG can be substituted for Cy3 CPG. Biosearch Technologies has developed a DMT-protected Quasar 570 CPG 3'-Glycolate support which is specifically suited for the preparation of single or dual labeled Fluorescent Energy Transfer probes. Quasar 570 CPG support allows for the introduction of a Quasar 570 moiety onto the 3'-terminus of the oligonucleotide. The Quasar 570 moiety is linked to 500 Å CPG via a glycolate spacer, and can be quenched by BHQ-2 dye.

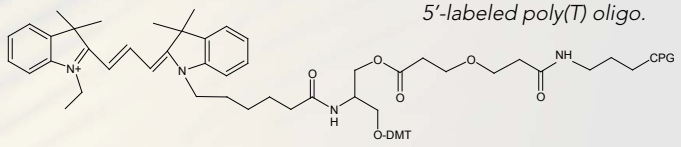
Abs λmax = 550 nm
ε_{550} = ca 115,000 $cm^{-1}M^{-1}$
ε_{260} = ca 9,000 $cm^{-1}M^{-1}$

Em λmax = 570 nm

MW_{add} 526.75

Spectral properties measured in PCR buffer as 5'-labeled poly(T) oligo.

Catalog No.	Item Description	Scale	Price
SCG5-5063-2	Quasar 570 SuperColumn; 500 Å	200 nmol	$28
SCG5-5063-1		1 µmol	$90
CG5-5063-5	Quasar 570 Synthesis Column; 500 Å	50 nmol	$20
CG5-5063-2		200 nmol	$28
CG5-5063-1		1 µmol	$90
BG5-5063-100	Quasar 570 CPG; 500 Å	100 mg	$180
BG5-5063-1		1 g	$1600
	Inquire for bulk pricing		



Quasar 670 Synthesis Columns and Bulk CPG- *Alternative for Cy5 - Quenched by BHQ-2 or BHQ-3*

Quasar 670 is a fluorescent indocarbocyanine, which fluoresces in the red region of the visible spectrum. Quasar 670 CPG can be substituted for Cy5 CPG. Biosearch Technologies has developed a DMT-protected Quasar 670 3'-Glycolate support which is specifically suited for the preparation of single or dual labeled Fluorescent Energy Transfer probes. Quasar 670 CPG support, allows for the introduction of a Quasar 670 moiety onto the 3'-terminus of the oligonucleotide. The Quasar 670 moiety is linked to 500 Å CPG via a glycolate spacer, and can be quenched by BHQ-2 or BHQ-3 dye.

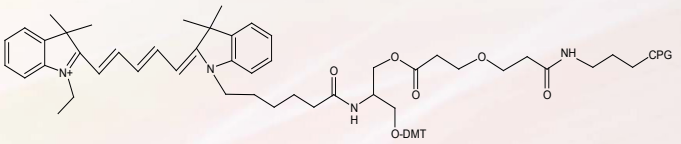
Abs λmax = 644 nm
ε_{644} = ca 187,000 $cm^{-1}M^{-1}$
ε_{260} = ca 2,800 $cm^{-1}M^{-1}$

Em λmax = 670 nm

MW_{add} 552.78

Spectral properties measured in PCR buffer.

Catalog No.	Item Description	Scale	Price
SCG5-5065-2	Quasar 670 SuperColumn; 500 Å	200 nmol	$28
SCG5-5065-1		1 µmol	$90
CG5-5065-5	Quasar 670 Synthesis Column; 500 Å	50 nmol	$20
CG5-5065-2		200 nmol	$28
CG5-5065-1		1 µmol	$90
BG5-5065-100	Quasar 670 CPG; 500 Å	100 mg	$180
BG5-5065-1		1 g	$1600
	Inquire for bulk pricing		



Quasar 705 Synthesis Columns and Bulk CPG- *Alternative for Cy5.5 - Quenched by BHQ-2 or BHQ-3*

Quasar 705 is an indocarbocyanine which fluoresces in the red region of the visible spectrum. This compound is a direct replacement for Cy5.5. Quasar 705 CPG is used for the 3' labeling of fluorogenic probes used in 5' nuclease assays and other detection assays. BHQ-2 or BHQ-3 dyes will quench the Quasar 705 moiety.

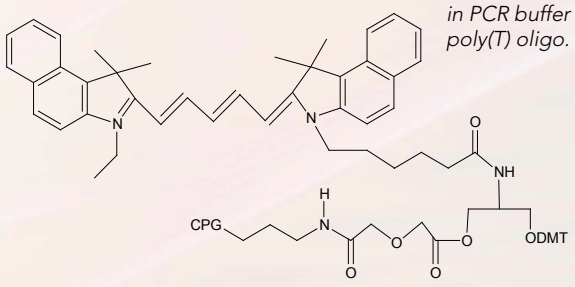
Abs λmax = 691 nm
ε_{691} = ca 211,000 $cm^{-1}M^{-1}$
ε_{260} = ca 17,000 $cm^{-1}M^{-1}$

Em λmax = 709 nm

MW_{add} 652.9

Spectral properties measured in PCR buffer as 3'-labeled poly(T) oligo.

Catalog No.	Item Description	Scale	Price
SCG5-5067-2	Quasar 705 SuperColumn; 500 Å	200 nmol	$28
SCG5-5067-1		1 µmol	$90
CG5-5067-2	Quasar 705 Synthesis Column; 500 Å	200 nmol	$28
CG5-5067-1		1 µmol	$90
BG5-5067-100	Quasar 705 CPG; 500 Å	100 mg	$180
BG5-5067-1		1 g	$1600
	Inquire for bulk pricing		



Pulsar® 650 Dye Synthesis Columns and Bulk CPGs

For adapting your real-time PCR assays to the LightCycler System

Pulsar 650 is a fluorescent reporter dye that significantly enhances multiplex applications for LightCycler instruments. Fluorescence-quenched dual-labeled probes (TaqMan probes and Molecular Beacons) can be designed and multiplexed on the LightCycler 1.5 or 2.0 systems. Consequently, the numerous assays designed for other real-time thermocyclers can be adapted to the LightCycler system. Because the Pulsar dye is directly excited by the instrument's blue LED excitation source, LightCycler 1.5 users can set up a duplex TaqMan type assay using both FAM and Pulsar 650 as reporter fluorophores. Your sequence of interest can be analyzed simultaneously with an internal reference gene by detecting FAM on the 530 nm channel and P-650 on the 705 nm channel.

You can use two BHQ-quenched dual-labeled probes as follows:

Probe 1: 5' FAM / 3' BHQ-1 for detection in the 530 nm channel
Probe 2: 5' BHQ-2 / 3' Pulsar-650 for detection in the 705 nm channel

LightCycler 2.0 users can achieve triplexing by including Biosearch's own CAL Fluor Red 610 dye as a third reporter, detected on the 610 nm channel of the instrument. What could be more powerful!

The Advantages of Pulsar 650 dye are:

- Simplified Probe Design
- Assays designed for other real-time instruments can now be adapted to the LightCycler
- Blue LED excitation with detection on the 705 channel
- Efficiently quenched by Black Hole Quencher dyes
- Allows for duplexing on the LightCycler 1.5 and triplexing on the LightCycler 2.0

Pulsar 650 Synthesis Columns and Bulk CPG- *Quenched by BHQ-2*

Pulsar 650 (P-650) is a fluorophore designed especially for use on the LightCycler 1.5 and 2.0 real-time, qPCR instruments. In addition to its value in real-time PCR, Pulsar 650 is also useful for electrochemiluminescence, electrochemical detection, redox reactions, chemiluminescence and time-resolved luminescence. CPG-derivatized with P-650 is used for the synthesis of 3'-labeled oligonucleotides on any DNA synthesizer according to standard oligonucleotide synthesis procedures.

Users of the LightCycler 1.5 and 2.0 can now set up and run duplexed assays on your instrument by using two BHQ-quenched dual-labeled probes. Calibration is required for first time users. Additionally, LightCycler 2.0 users will need to spike FAM calibration dye into their Pulsar 650 capillaries. Please refer to the product usage area or visit www.biosearchtech.com for details on duplexing or triplexing on the LightCycler systems.

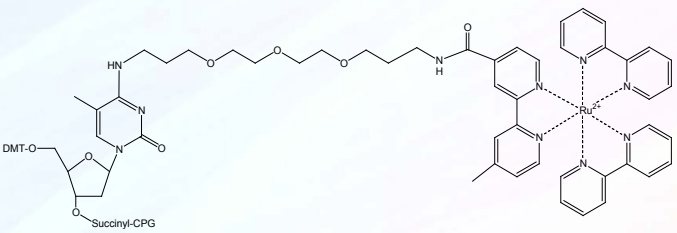
Abs λmax = 460 nm
ε_{460} = ca 14,800 $cm^{-1}M^{-1}$
ε_{260} = ca 31,500 $cm^{-1}M^{-1}$

Em λmax = 650 nm

MW_{add} 1036.17

Spectral properties measured in PCR buffer as 3'-labeled poly(T) oligo.

Catalog No.	Item Description	Scale	Price
SCG5-5070-5	Pulsar 650 SuperColumn; 500 Å	50 nmol	$35
SCG5-5070-2		200 nmol	$50
SCG5-5070-1		1 µmol	$95
SCG1-5070-5	Pulsar 650 SuperColumn; 1000 Å	50 nmol	$35
SCG1-5070-2		200 nmol	$50
SCG1-5070-1		1 µmol	$95
CG5-5070-5	Pulsar 650 Synthesis Column; 500 Å	50 nmol	$35
CG5-5070-2		200 nmol	$50
CG5-5070-1		1 µmol	$95
CG1-5070-5	Pulsar 650 Synthesis Column 1000 Å	50 nmol	$35
CG1-5070-2		200 nmol	$50
CG1-5070-1		1 µmol	$95
BG5-5070-100	Pulsar 650 CPG; 500 Å	100 mg	$300
BG5-5070-1		1 g	$2600
BG1-5070-100	Pulsar 650 CPG; 1000 Å	100 mg	$300
BG1-5070-1		1 g	$2600
RD-5025-5	6-FAM T10 Calibration Standard	5 nmol	$95
	Inquire for bulk pricing		

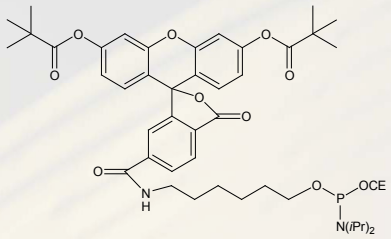


Fluorescein Amidites, Synthesis Columns and Bulk CPGs

6-FAM, Single Isomer Amidite

Fluorescein labeled oligonucleotides have become indispensable tools for genomic research and molecular biology. 6-Carboxyfluorescein amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo or internally to free hydroxyls. This product is prepared using the 6-carboxy fluorescein isomer.

Catalog No.	Item Description	Size/Scale	Price
BNS-5025-50	6-FAM, Single Isomer Amidite	50 µmol	$110
BNS-5025-100		100 µmol	$150
BNS-5025-250		250 mg	$400
BNS-5025-1		1 g	$1200
BNS-5025-B		Bulk	Inquire



Abs λmax = 496 nm

ε_{496} = ca 71,300 $M^{-1}cm^{-1}$
ε_{260} = ca 26,900 $M^{-1}cm^{-1}$

Em λmax = 520 nm

MW_{true} 843.94

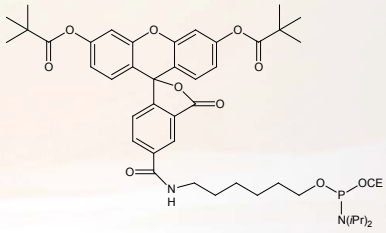
MW_{add} 536.46

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

5-FAM, Single Isomer Amidite

Fluorescein labeled oligonucleotides have become indispensable tools for genomic research and molecular biology. 5-Carboxyfluorescein amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo. This product is prepared using only the 5-carboxy fluorescein isomer.

Catalog No.	Item Description	Size/Scale	Price
BNS-5024-50	5-FAM, Single Isomer Amidite	50 µmol	$110
BNS-5024-100		100 µmol	$150
BNS-5024-250		250 mg	$400
BNS-5024-B		Bulk	Inquire



Abs λmax = 494 nm

ε_{494} = ca 71,300 $M^{-1}cm^{-1}$
ε_{260} = ca 26,900 $M^{-1}cm^{-1}$

Em λmax = 520 nm

MW_{true} 843.94

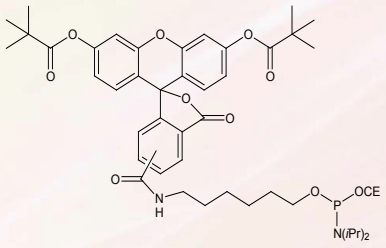
MW_{add} 536.46

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

(5 and 6)-FAM, Mixed Isomers Amidite

Fluorescein labeled oligonucleotides have become indispensable tools for genomic research and molecular biology. 5,6-Carboxyfluorescein amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays. This amidite does not contain a DMT protecting group and can only be added to the 5′ terminus of the oligo. This product is prepared using a mixture of 5- and 6-carboxy fluorescein isomers.

Catalog No.	Item Description	Size/Scale	Price
BNS-5026-50	(5 and 6)-FAM,	50 µmol	$65
BNS-5026-100	Mixed Isomers Amidite	100 µmol	$120
BNS-5026-250		250 mg	$350
BNS-5026-B		Bulk	Inquire



Abs λmax = 495 nm

ε_{495} = ca 71,300 $M^{-1}cm^{-1}$
ε_{260} = ca 26,900 $M^{-1}cm^{-1}$

Em λmax = 520 nm

MW_{true} 843.95

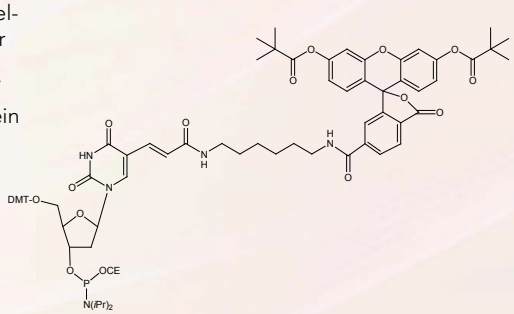
MW_{add} 536.46

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

6-FAM, Single Isomer T Amidite (Fluorescein T Amidite)

Fluorescein T amidite is used for the 5′ labeling or internal labeling of fluorogenic probes used in 5′ nuclease assays, Molecular Beacons, and other detection assays. This amidite contains a DMT protecting group and can be added to the 5′ terminus of the oligo or placed internally. BHQ-1 will quench the fluorescein moiety.

Catalog No.	Item Description	Size/Scale	Price
BNS-5047-50	6-FAM, Single Isomer	50 µmol	$180
BNS-5047-100	T Amidite	100 µmol	$325
BNS-5047-250		250 mg	$550
BNS-5047-B		Bulk	Inquire



Abs λmax = 498 nm

ε_{498} = ca 54,700 $M^{-1}cm^{-1}$
ε_{260} = ca 25,500 $M^{-1}cm^{-1}$

Em λmax = 520 nm

MW_{true} 1425.26

MW_{add} 816.72

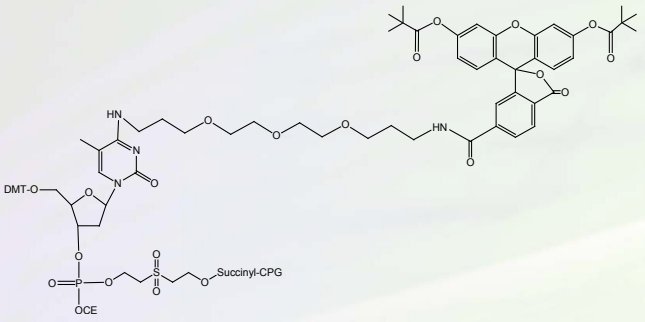
Spectral properties measured in PCR buffer as internal labeled poly(T) oligo.

Fluorescein Amidites, Synthesis Columns and Bulk CPGs

6-FAM-Phos-CPG, Single Isomer, Columns and CPG

This 5′-DMT mdC(TEG-Fluorescein) 3′-Phosphate support is specifically suited for the preparation of single or dual labeled Fluorescent Energy Transfer probes. It is based on a modified cytosine residue linked to the flourescein moiety via a triethyleneglycol spacer while the 3′ end is conjugated to the CPG support via a phosphate linkage. The 500 Å pore size is best suited for the synthesis of DNA sequences up to 50-mers in length. The 6-carboxyfluorescein isomer is used to prepare this product.

Abs λmax = 495 nm
MW_{add} 864.8

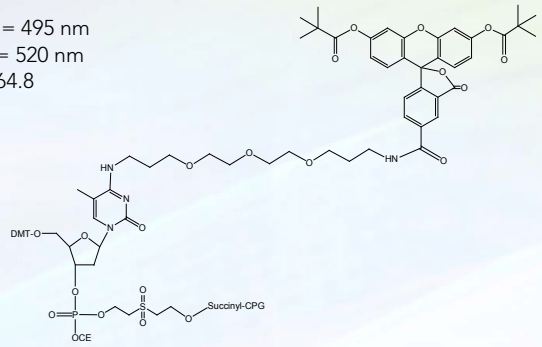


Catalog No.	Item Description	Size/Scale	Price
SCG5-5017-2	6-FAM-Phos-CPG SuperColumn; 500 Å	200 nmol	$16
SCG5-5017-1		1 µmol	$40
CG5-5017-5	6-FAM-Phos-CPG Synthesis	50 nmol	$12
CG5-5017-2	Column; 500 Å	200 nmol	$16
CG5-5017-1		1 µmol	$40
BG5-5017B-100	6-FAM-Phos-CPG; 500 Å	100 mg	$100
BG5-5017B-1		1 g	$800
	Inquire for bulk pricing		

5-FAM-Phos-CPG, Single Isomer, Columns and CPG

This 5′-DMT mdC(TEG-Fluorescein) 3′-Phosphate support is specifically suited for the preparation of fluorescently labeled oligonucleotides. It is based on a modified cytosine residue linked to the flourescein moiety via a triethyleneglycol spacer while the 3′ end is conjugated to the CPG support via a phosphate linkage. The 1000 Å pore size is best suited for the synthesis of DNA sequences over 100 bases. The 5-carboxyfluorescein isomer is used to prepare this product.

Abs λmax = 495 nm
Em λmax = 520 nm
MW_{add} 864.8



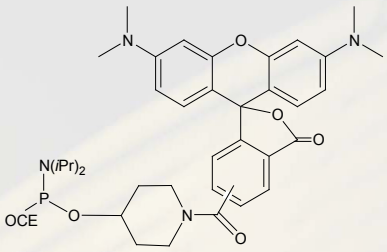
Catalog No.	Item Description	Size/Scale	Price
BG1-5017A-100	6-FAM-Phos-CPG; 1000 Å	100 mg	$100
BG1-5017A-1		1 g	$800
	Inquire for bulk pricing		

TAMRA Amidites, Synthesis Columns and Bulk CPGs

(5 and 6)-TAMRA, Mixed Isomers Amidite

TAMRA Amidite is used for the labeling of oligonucleotides and fluorogenic probes. This product is prepared using the 5- and 6- carboxytetramethylrhodamine isomers and can only be added to the 5′ terminus of the oligo.

Catalog No.	Item Description	Size/Scale	Price
BNS-5027-50	(5 and 6)-TAMRA,	50 µmol	$85
BNS-5027-100	Mixed Isomers Amidite	100 µmol	$150
BNS-5027-250		250 mg	$600
BNS-5027-B		Bulk	Inquire



Abs λmax = 555 nm

ε_{555} = ca 90,000 $M^{-1}cm^{-1}$
ε_{260} = ca 31,980 $M^{-1}cm^{-1}$

Em λmax = 576 nm

MW_{true} 713.33

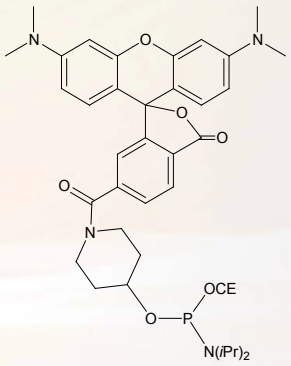
MW_{add} 574.56

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

6-TAMRA, Single Isomer 5′ Amidite

TAMRA Amidite is used for the labeling of oligonucleotides and fluorogenic probes. This product is prepared using the pure 6-carboxytetramethylrhodamine isomer and can only be added to the 5′ terminus of the oligo, thereby terminating the synthesis.

Catalog No.	Item Description	Size/Scale	Price
BNS-5027B-50	6-TAMRA, Single Isomer	50 µmol	$125
BNS-5027B-100	5′ Amidite	100 µmol	$225
BNS-5027B-250		250 mg	$800
BNS-5027B-B		Bulk	Inquire



Abs λmax = 555 nm

ε_{555} = ca 90,000 $M^{-1}cm^{-1}$
ε_{260} = ca 31,980 $M^{-1}cm^{-1}$

Em λmax = 576 nm

MW_{true} 713.33

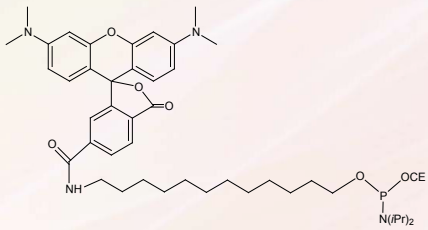
MW_{add} 574.56

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

6-TAMRA-C12, Single Isomer 5′ Amidite

TAMRA C12 Amidite is used for the labeling of oligonucleotides and fluorogenic probes. This product is prepared using the pure 6- carboxytetramethylrhodamine isomer and can only be added to the 5′ terminus of the oligo, thereby terminating the synthesis.

Catalog No.	Item Description	Size/Scale	Price
BNS-5060B-50	6-TAMRA-C12, Single Isomer	50 µmol	$190
BNS-5060B-100	5′ Amidite	100 µmol	$350
BNS-5060B-250		250 mg	$800
BNS-5060B-B		Bulk	Inquire



Abs λmax = 555 nm

ε_{555} = ca 90,000 $M^{-1}cm^{-1}$
ε_{260} = ca 32,000 $M^{-1}cm^{-1}$

Em λmax = 576 nm

MW_{true} 814.19

MW_{add} 674.76

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

TAMRA Amidites, Synthesis Columns and Bulk CPGs

6-TAMRA-Phos-CPG, Single Isomer, Columns and CPG

Biosearch Technologies' 5'-DMT-mdC(TEG-TAMRA)-Phosphate CPG is based on a modified cytosine residue linked to the TAMRA moiety via a triethyleneglycol spacer. The 3' end is conjugated to the CPG support via a phosphate linkage. Our TAMRA CPG supports allow for the introduction of a reporter or quencher molecule onto the 3'-terminus end of the oligonucleotide, and is offered on a 500 Å or 1000 Å support . The 6-carboxytetramethylrhodamine isomer was used to prepare this product.

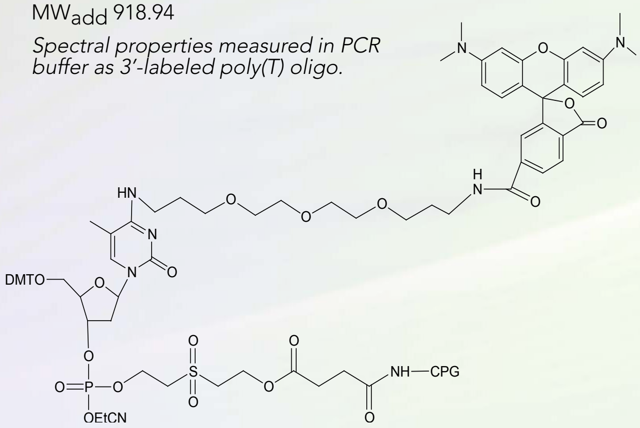
Abs λmax = 555 nm

ε_{555} = ca 90,000 $M^{-1}cm^{-1}$
ε_{260} = ca 31,980 $M^{-1}cm^{-1}$

Em λmax = 576 nm

MW_{add} 918.94

Spectral properties measured in PCR buffer as 3'-labeled poly(T) oligo.



Catalog No.	Item Description	Size/Scale	Price
SCG5-5008-2	6-TAMRA-Phos-CPG, Single Isomer	200 nmol	$20
SCG5-5008-1	SuperColumn; 500 Å	1 µmol	$75
CG5-5008-5	6-TAMRA-Phos-CPG, Single Isomer	50 nmol	$12
CG5-5008-2	Synthesis Column; 500 Å	200 nmol	$20
CG5-5008-1		1 µmol	$75
CG1-5008-5	6-TAMRA-Phos-CPG, Single Isomer	50 nmol	$15
CG1-5008-2	Synthesis Column; 1000 Å	200 nmol	$25
CG1-5008-1		1 µmol	$90
BG5-5008B-100	6-TAMRA-Phos-CPG, Single Isomer;	100 mg	$135
BG5-5008B-1	500 Å	1 g	$900
BG1-5008B-100	6-TAMRA-Phos-CPG, Single Isomer;	100 mg	$135
BG1-5008B-1	1000 Å	1 g	$900
	Inquire for bulk pricing		

5-TAMRA-C9-Suc-CPG, Single Isomer, Columns and CPG

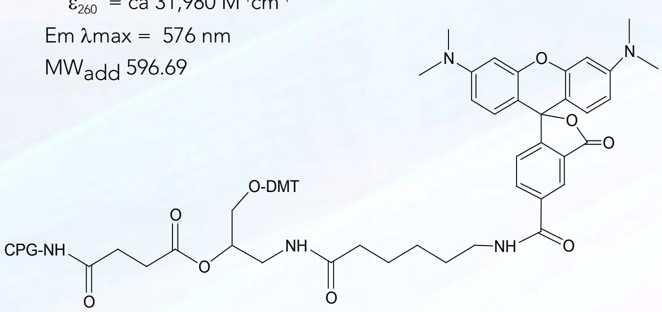
TAMRA-C9-Suc-CPG is suited for the preparation of fluorescently labeled oligonucleotides. The TAMRA-C9-Suc CPG labels the 3' terminus, protecting the 3' OH from enzymatic processing, and may be used in lieu of 3' phosphate. The 5-carboxytetramethylrhodamine isomer was used to prepare this product.

Abs λmax = 555 nm

ε_{555} = ca 90,000 $M^{-1}cm^{-1}$
ε_{260} = ca 31,980 $M^{-1}cm^{-1}$

Em λmax = 576 nm

MW_{add} 596.69



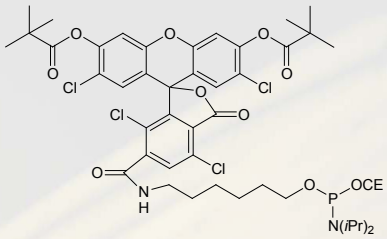
Catalog No.	Item Description	Size/Scale	Price
SCG5-5012-5	5-TAMRA-C9-Suc-CPG, Single Isomer	50 nmol	$9
SCG5-5012-2	SuperColumn; 500 Å	200 nmol	$20
SCG5-5012-1		1 µmol	$75
CG5-5012-5	5-TAMRA-C9-Suc-CPG, Single Isomer	50 nmol	$9
CG5-5012-2	Synthesis Column; 500 Å	200 nmol	$20
CG5-5012-1		1 µmol	$75
BG5-5012-100	5-TAMRA-C9-Suc-CPG, Single Isomer;	100 mg	$135
BG5-5012-1	500 Å	1 g	$900
	Inquire for bulk pricing		

TET and HEX Amidites

6-TET, Single Isomer 5′ Amidite - *Quenched by BHQ-1*

Tetrachlorofluorescein amidite is used for the 5′ labeling of fluorogenic probes used in 5′ nuclease assays. TET has maximum absorbance at 523 nm, maximum emission at 540 nm and is quenched by BHQ-1.

Catalog No.	Item Description	Size/Scale	Price
BNS-5033-50	6-TET, Single Isomer 5′ Amidite	50 µmol	$160
BNS-5033-100		100 µmol	$310
BNS-5033-250		250 mg	$750
BNS-5033-B		Bulk	Inquire



Abs λmax = 523 nm

ε_{260} = ca 16,255 $M^{-1}cm^{-1}$

Em λmax = 540 nm

MW_{true} 981.73

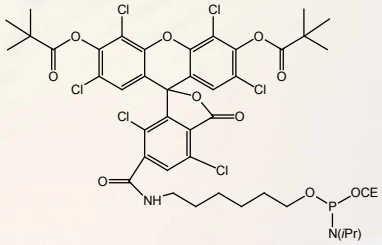
MW_{add} 674.24

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

6-HEX, Single Isomer 5′ Amidite - *Quenched by BHQ-1*

Hexachloro-Fluorescein CE (HEX) phosphoramidite is used for the 5′ labeling of synthetic oligonucleotide probes used in 5′ nuclease assays. HEX has maximum absorbance at 535 nm, maximum emission at 556 nm and is quenched by BHQ-1.

Catalog No.	Item Description	Size/Scale	Price
BNS-5032-50	6-HEX, Single Isomer	50 µmol	$160
BNS-5032-100	5′ Amidite	100 µmol	$310
BNS-5032-250		250 mg	$750
BNS-5032-B		Bulk	Inquire



Abs λmax = 535 nm

ε_{535} = ca 73,000 $M^{-1}cm^{-1}$
ε_{260} = ca 31,580 $M^{-1}cm^{-1}$

Em λmax = 556 nm

MW_{true} 1050.61

MW_{add} 743.13

Spectral properties measured in PCR buffer as 5′-labeled poly(T) oligo.

ROX Synthesis Columns and Bulk CPG

ROX-Phos-CPG Synthesis Columns and Bulk CPG - *Quenched by BHQ-2*

Biosearch Technologies' 5′-DMT-mdC(TEG-ROX)-Phosphate CPG is based on a modified cytosine residue linked to the ROX moiety via a triethyleneglycol spacer. The 3′ end is conjugated to the 500 Å CPG support via phosphate linkage. Our ROX CPG support allows for the introduction of a reporter molecule onto the 3′-terminus end of the oligonucleotide.

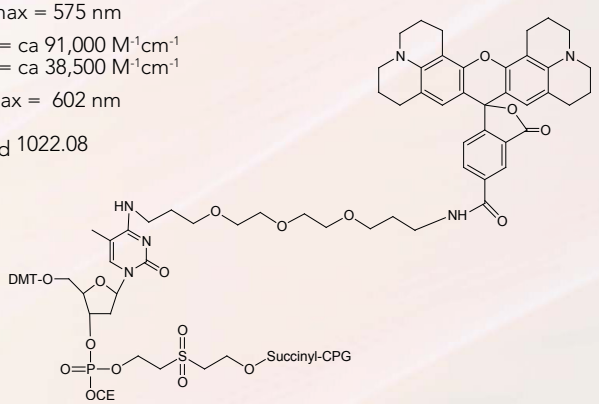
Catalog No.	Item Description	Size/Scale	Price
CG5-5021-5	ROX-Phos-CPG	50 nmol	$20
CG5-5021-2	Synthesis Column; 500 Å	200 nmol	$25
CG5-5021-1		1 µmol	$90
BG5-5021-100	ROX-Phos CPG; 500 Å	100 mg	$175
BG5-5021-1		1 g	$1600
BG5-5021-B		Bulk	Inquire

Abs λmax = 575 nm

ε_{575} = ca 91,000 $M^{-1}cm^{-1}$
ε_{260} = ca 38,500 $M^{-1}cm^{-1}$

Em λmax = 602 nm

MW_{add} 1022.08

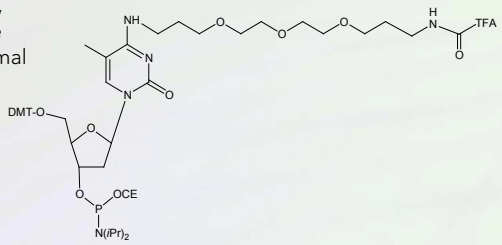


Amino Modifying Amidites

Amino Modifier TEG mdC DMT Amidite

Amino Modifier TEG mdC amidite (5′-DMT-mdC(TEG-Amino-TFA)) incorporates an amino functionality within an oligonucleotide sequence or on the 5′ terminus. The amine group is attached to a modified cytidine residue via triethyleneglycol linker, making it less likely for the label to interact with the double stranded duplex. The trifluoroacetyl (TFA) protecting group on the primary amine comes off during normal deprotection.

MW_{true} 1043.12
MW_{add} 505.49

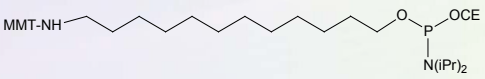


Catalog No.	Item Description	Size/Scale	Price
BNS-5044-50	Amino Modifier TEG mdC	50 µmol	$85
BNS-5044-100	DMT Amidite	100 µmol	$150
BNS-5044-250		250 mg	$350
BNS-5044-B		Bulk	Inquire

Amino Modifier C12 MMT Amidite

Amino Modifier C12 (MMT-12-Aminododecyl) amidite is typically used to add amino functionality to oligonucleotides.

MW_{true} 673.44
MW_{add} 262.32

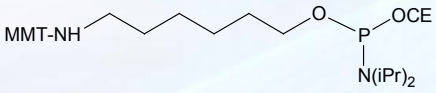


Catalog No.	Item Description	Size/Scale	Price
BNS-5039-100	Amino Modifier C12	100 µmol	$90
BNS-5039-250	MMT Amidite	250 mg	$250
BNS-5039-B		Bulk	Inquire

Amino Modifier C6 MMT Amidite

Amino Modifier C6 (MMT-6-Aminohexyl) amidite is typically used to add amino functionality to oligonucleotides.
Ref: Connolly, B.A. and Rider, P. *Nucl Acids Res.* 1985, 13, 4485.

MW_{true} 589.75
MW_{add} 178.16

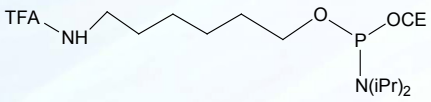


Catalog No.	Item Description	Size/Scale	Price
BNS-5015-50	Amino Modifier C6	50 µmol	$32
BNS-5015-100	MMT Amidite	100 µmol	$60
BNS-5015-250		250 mg	$230
BNS-5015-B		Bulk	Inquire

Amino Modifier C6 TFA 5′ Amidite

Amino Modifier C6 (TFA-6-Aminohexyl) Amidite can be used to produce a functional amine group on the 5′ end of an oligonucleotide. The trifluoroacetyl (TFA) protecting group on the primary amine comes off during normal deprotection.

MW_{true} 413.42
MW_{add} 178.16

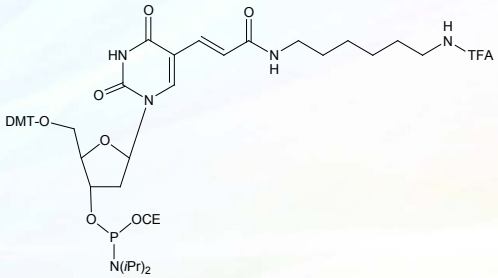


Catalog No.	Item Description	Size/Scale	Price
BNS-5017-100	Amino Modifier C6 TFA	100 µmol	$35
BNS-5017-250	5′ Amidite	250 mg	$150
BNS-5017-B		Bulk	Inquire

Amino Modifier C6 T Amidite

Amino Modifier C6 T Amidite incorporates an amino functionality within an oligonucleotide sequence or on the 5′ terminus. This amino modifier is based on a thymidine residue which when incorporated allows for standard hybridization characteristics such as normal melting temperatures. The amine group is attached via 10 atom linker, making it less likely for the label to interact with the double stranded duplex.

MW_{true} 995.03
MW_{add} 457.41



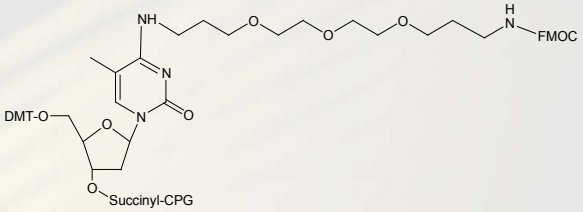
Catalog No.	Item Description	Size/Scale	Price
BNS-5040-50	Amino Modifier C6 T Amidite	50 µmol	$85
BNS-5040-100		100 µmol	$150
BNS-5040-250		250 mg	$350
BNS-5040-B		Bulk	Inquire

Amino Modifying Synthesis Columns and Bulk CPGs

Amino Modifier Suc-CPG Synthesis Columns and Bulk CPG

AminoModifier - Suc-CPG (5'-DMT-mdC(TEG-NH-Fmoc)-Suc-CPG) support allows for the preparation of 3' amino oligonucleotides. The Fmoc protecting group can be cleaved during normal cleavage and deprotecting conditions, leaving the amine labeled oligo intact for further processing or conjugation.

MW_{add} 426.52



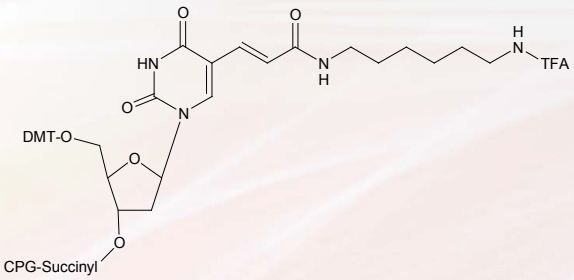
Catalog No.	Item Description	Size/Scale	Price
SCG1-5002-5	Amino Modifier Suc-CPG SuperColumn; 1000 Å	50 nmol	$3.25
SCG1-5002-2		200 nmol	$4
CG5-5002-2	Amino Modifier Suc-CPG Synth. Column; 500 Å	200 nmol	$4
CG1-5002-5	Amino Modifier Suc-CPG Synth. Column; 1000 Å	50 nmol	$3.25
CG1-5002-2		200 nmol	$4
CG1-5002-1		1 µmol	$10
BG5-5002-100	Amino Modifier Suc-CPG; 500 Å	100 mg	$37.5
BG5-5002-1		1 g	$300
BG5-5002-B		Bulk	Inquire
BG1-5002-100	Amino Modifier Suc-CPG; 1000 Å	100 mg	$37.50
BG1-5002-1		1 g	$300
BG1-5002-B		Bulk	Inquire

Amino Modifier C6 DMT-T-Suc-CPG Synthesis Columns and Bulk CPG

Amino Modifier C6 DMT-T-Suc CPG incorporates a functionalized primary amine on the 3' terminus of the target oligonucleotide. This amino modifier is based on a thymidine residue; when incorporated, it allows for standard hybridization characteristics such as normal melting temperatures. The amine group is attached via a ten atom linker to the modified T residue and is protected with a trifluoroacetyl (TFA) protecting group, which comes off during normal deprotection.

ε_{260} = ca 8,400 $M^{-1}cm^{-1}$

MW_{add} 378.44



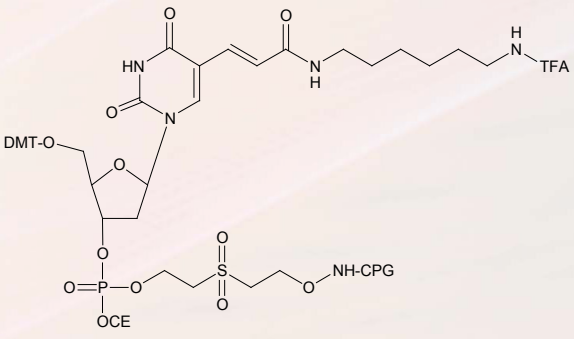
Catalog No.	Item Description	Size/Scale	Price
CG5-5009-5	Amino Modifier C6 DMT-T-Suc-CPG	50 nmol	$12
CG5-5009-2	Synthesis Column; 500 Å	200 nmol	$25
CG5-5009-1		1 µmol	$50
BG5-5009-100	Amino Modifier C6 DMT-T-Suc-CPG; 500 Å	100 mg	$90
BG5-5009-1		1 g	$650
BG5-5009-B		Bulk	Inquire

Amino Modifier C6 DMT-T-Phos-CPG Synthesis Columns and Bulk CPG

Amino Modifier C6 DMT-T-Phos-CPG incorporates a functionalized primary amine on the 3' terminus of the target oligonucleotide. The amine group is attached via a ten atom linker to the thymidine ring and is protected with a trifluoroacetyl (TFA) protecting group which comes off during normal ammonia deprotection. The presence of the 3' phosphate blocks 3' extension by polymerases.

ε_{260} = ca 8,400 $M^{-1}cm^{-1}$

MW_{add} 378.44



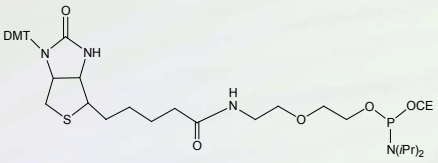
Catalog No.	Item Description	Size/Scale	Price
SCG5-5010-5	Amino Modifier C6 DMT-T-Phos-CPG	50 nmol	$8
SCG5-5010-2	SuperColumn; 500 Å	200 nmol	$15
SCG5-5010-1		1 µmol	$40
CG5-5010-5	Amino Modifier C6 DMT-T-Phos-CPG	50 nmol	$8
CG5-5010-2	Synthesis Column; 500 Å	200 nmol	$15
CG5-5010-1		1 µmol	$40
BG5-5010-100	Amino Modifier C6 DMT-T-Phos-CPG; 500 Å	100 mg	$90
BG5-5010-1		1 g	$650
BG5-5002-B		Bulk	Inquire

Biotinylating Amidites, Synthesis Columns and Bulk CPGs

Biotin 5′ Amidite

Biotin is used in the 5′ labeling of synthetic oligonucleotide probes. Biotin labeling can be detected through the use of enzyme labeled avidin or streptavidin conjugates. Biotin 5′ Amidite can only be added to the 5′ terminus of the oligonucleotide, thus terminating the synthesis.

MW_{true} 832.04
MW_{add} 392.41

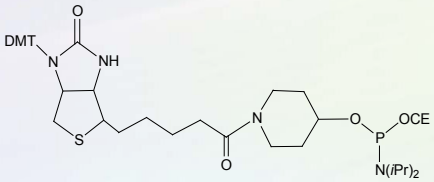


Catalog No.	Item Description	Size/Scale	Price
BNS-5021-50	Biotin 5′ Amidite	50 µmol	$90
BNS-5021-100		100 µmol	$160
BNS-5021-250		250 mg	$425
BNS-5021-B		Bulk	Inquire

Biotin-Pip-5′ Amidite

Biotin is used in the 5′ labeling of synthetic oligonucleotide probes. Biotin labeling can be detected through the use of enzyme labeled avidin or streptavidin conjugates. Biotin-Pip-5′ Amidite can only be added to the 5′ terminus of the oligonucleotide, thus terminating the synthesis.

MW_{true} 830.03
MW_{add} 388.42



Catalog No.	Item Description	Size/Scale	Price
BNS-5021A-50	Biotin-Pip-5′ Amidite	50 µmol	$90
BNS-5021A-100		100 µmol	$160
BNS-5021A-250		250 mg	$425
BNS-5021A-B		Bulk	Inquire

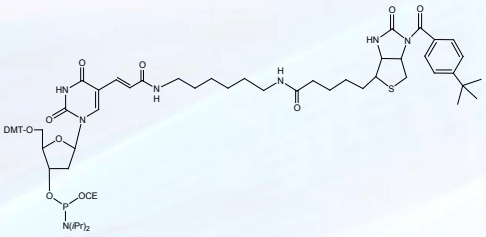
Biotin-C6-T-5′ Amidite

The Biotin-C6-T-5′ amidite allows for the incorporation of biotin functionality within an oligonucleotide or on the 5′ terminus. Biotin labeling can be detected through the use of enzyme labeled avidin or strepavidin conjugates. This biotin amidite is based on a thymidine residue which when incorporated allows for standard hybridization characteristics such as normal melting temperature.

ε_{260} = ca 8,400 $M^{-1}cm^{-1}$

MW_{true} 1285.53
MW_{add} 683.71

Spectral properties measured in water, for the cleaved and deprotected nucleoside.

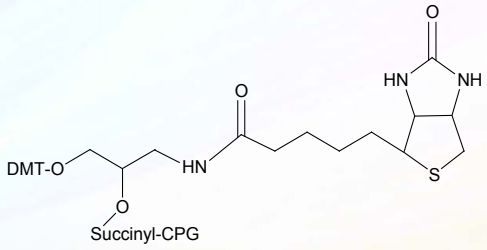


Catalog No.	Item Description	Size/Scale	Price
BNS-5022-50	Biotin-C6-T-5′ Amidite	50 µmol	$160
BNS-5022-100		100 µmol	$275
BNS-5022-250		250 mg	$530
BNS-5022-B		Bulk	Inquire

Biotin-C3-Suc-CPG Synthesis Columns and Bulk CPG

Biosearch Technologies 5′-DMT-Biotin-C3-Suc-CPG is specifically suited for preparation of 3′ Biotin labeled oligonucleotides. The biotin moiety is linked to CPG via a three carbon spacer. This support has a succinate linkage to the CPG, which can be cleaved using standard cleavage protocols. Synthesis can proceed in a manner analogous to the use of a normal nucleotide support. The biotin labeling can be detected through the use of enzyme labeled avidin or strepavidin conjugates. This product is made on a1000 Å CPG support.

MW_{add} 299.41



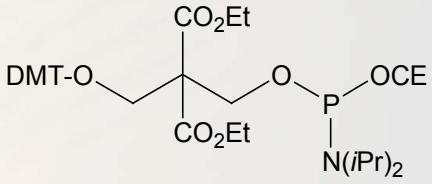
Catalog No.	Item Description	Size/Scale	Price
SCG1-5004-2	Biotin-C3-Suc-CPG SuperColumn; 1000 Å	200 nmol	$6
SCG1-5004-1		1 µmol	$8
CG1-5004-2	Biotin-C3-Suc-CPG Synthesis Column; 1000 Å	200 nmol	$6
CG1-5004-1		1 µmol	$8
BG1-5004-100	Biotin-C3-Suc-CPG; 1000 Å	100 mg	$70
BG1-5004-1		1 g	$500
BG1-5004-B		Bulk	Inquire

Phosphorylating Amidites, Synthesis Columns and Bulk CPGs

5′ Phosphorylating Amidite II

MW_{true} 722.8
MW_{add} 78.99

Oligonucleotides having a 5′-phosphate group are valuable tools for many molecular biology applications including gene construction, cloning, mutagensis, and ligation chain reaction. Several methods have been developed to allow for the 5′ phosphorylation of synthetic oligonucleotides. The most common is through the use of a 5′ Phosphate Amidite (2-O-4,4′-dimethoxytrityl-2′-oxydiethane sulfonyl)-(2-cyanoethyl)-(N,N-diisopropyl)-phosphoramidite (BNS-5010). Unfortunately, the DMT group cannot be left on for DMT-ON purification due to the elimination reaction of the DMT and sulfonyl ethyl group during normal ammonium hydroxide deprotection and cleavage.



Phosphorylating Amidite II (O-DMT-2,2-di(ethoxycarbonyl)propan-1,3-diol) contains a DMT group that may be left on to allow for reverse phase cartridge purification. Deprotection and cleavage to yields a 5′ Phosphate.

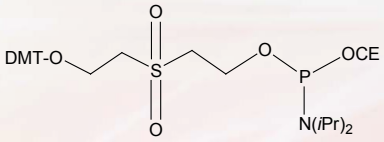
Catalog No.	Item Description	Size/Scale	Price
BNS-5009-100	5′ Phosphorylating Amidite II	100 µmol	$50
BNS-5009-250		250 mg	$160
BNS-5009-B		Bulk	Inquire

5′ Phosphate Amidite

MW_{true} 656.77
MW_{add} 78.99

5′ Phosphate Amidite (O-DMT-2,2′-sulfonyldiethanol) enables the introduction of a phosphate group to the 5′ terminus of an oligonucleotide. Oligonucleotides having a 5′-phosphate group are valuable tools for many molecular biology applications including gene construction, cloning, mutagensis, and ligation chain reaction.

Reference: T. Horn and M. Urdea, *Tetrahedron Letters*, 1986, **27**, 4705.

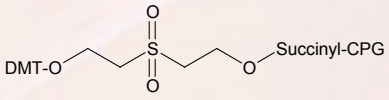


Catalog No.	Item Description	Size/Scale	Price
BNS-5010-50	5′ Phosphate Amidite	50 µmol	$30
BNS-5010-100		100 µmol	$50
BNS-5010-250		250 mg	$175
BNS-5010-B		Bulk	Inquire

DMT-Phosphate-Suc-CPG Synthesis Columns and Bulk CPGs

MW_{add} 78.99

DMT-Phosphate-Suc-CPG (O-DMT-2,2′-sulfonyldiethanol-Suc-CPG) allows for the preparation of oligonucleotides containing a 3′ Phosphate group using standard synthesis protocols. After removal of the DMT group from the support and coupling of a phosphoramidite, subsequent cleavage from the support yields a 3′ phosphate group. The 500 Å pore size is best suited for the synthesis of DNA sequences up to 50-mers in length. Thhis product is made on a 1000 Å CPG support.



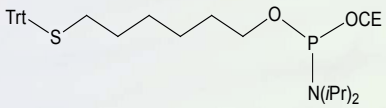
Catalog No.	Item Description	Size/Scale	Price
SCG1-5000-5	DMT-Phosphate-Suc-CPG SuperColumn; 1000 Å	50 nmol	$3
SCG1-5000-2		200 nmol	$4
SCG1-5000-1		1 µmol	$6
CG1-5000-5	DMT-Phosphate-Suc-CPG Synth. Column; 1000 Å	50 nmol	$3
CG1-5000-2		200 nmol	$4
CG1-5000-1		1 µmol	$6
BG5-5000-100	DMT-Phosphate-Suc-CPG; 500 Å	100 mg	$50
BG5-5000-1		1 g	$250
BG5-5000-B		Bulk	Inquire
BG1-5000-100	DMT-Phosphate-Suc-CPG; 1000 Å	100 mg	$50
BG1-5000-1		1 g	$250
BG1-5000-B		Bulk	Inquire

Thiol Modifier Amidites and CPG

Thiol-Modifier-C6-5′ Amidite

Thiol-ModifierC6-5′-Amidite (Trityl-6-Thiohexyl Amidite) is used to functionalize the 5′ end of an oligonucleotide with a thiol group. Thiol functionalization allows attachment to fluorescent dyes, maleimide compounds or conjugation to proteins through disulfide linkages. The lipophilic trityl group can be used as a handle for RP purification. It cannot be removed using normal acidic deblock methods.

MW_{true} 576.8
MW_{add} 195.21



References:

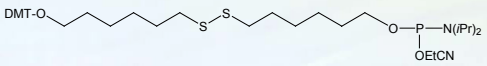
1. Connolly and Rider, *Nucleic Acids Res.*, 1985, **13**, 4485.
2. Sproat, Beijer, Rider, and Neuner, *Ibid*, 1987, **15**, 4837.
3. Zuckerman, Corey, and Shultz, *Ibid.*, 5305.
4. Li, et al., *Ibid*, 5275.

Catalog No.	Item Description	Size/Scale	Price
BNS-5019-50	Thiol-Modifier-C6-5′ Amidite	50 µmol	$24
BNS-5019-100		100 µmol	$45
BNS-5019-250		250 mg	$175
BNS-5019-B		Bulk	Inquire

Thiol-Modifier-C6-S-S-5′ Amidite

Thiol-Modifier-C6-S-S-5′ Amidite (DMT-7,8-dithiotetradecan-1,14-diol) is used to functionalize the 5′ terminus of an oligonucleotide with a thiol group. Thiol modifications have become significant in the production of diagnostic probes. Thiol functionalization allows attachment to fluorescent dyes, maleimide compounds or conjugation to proteins through disulfide linkages. The DMT group can be used as a handle for RP purification and later removed with 100 mM DTT.

MW_{true} 769.05
MW_{add} 195.21

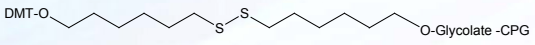


Catalog No.	Item Description	Size/Scale	Price
BNS-5042-100	Thiol-Modifier-C6-S-S-5′ Amidite	100 µmol	$135
BNS-5042-250		250 mg	$330
BNS-5042-B		Bulk	Inquire

Thiol-Modifier-C6-S-S-CPG

Thiol-Modifier-C6-S-S-CPG is used to functionalize the 3′ terminus of an oligonucleotide with a thiol group. Thiol functionalization allows attachment to fluorescent dyes, maleimide compounds or conjugation to proteins through disulfide linkages. The DMT group can be used as a handle for RP purification and later removed with 100 mM DTT. The1000 Å CPG support is suitable for oligomers over 100 bases.

MW_{add} 116.24



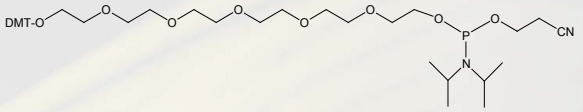
Catalog No.	Item Description	Size/Scale	Price
BG1-5003-1	Thiol-Modifier-C6-S-S-CPG; 1000 Å	1g	$350
BG1-5003-B		Bulk	Inquire

Spacer Modifier Amidites and CPGs

Spacer 18 Amidite

Spacer 18 amidite (DMT-Hexa(ethylene glycol)) is used to incorporate spacer arms into oligonucleotides and can be added sequentially to create longer spacer arms. This Spacer 18 amidite has a hexaethyleneglycol-based linker.

MW_{true} 784.93
MW_{add} 343.3

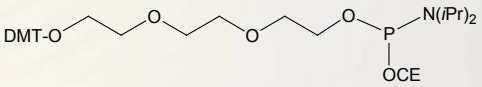


Catalog No.	Item Description	Size/Scale	Price
BNS-5036-100	Spacer 18 Amidite	100 µmol	$85
BNS-5036-250		250 mg	$225
BNS-5036-B		Bulk	Inquire

Spacer 9 Amidite

Spacer 9 amidite (DMT-Tri(ethylene glycol)) is used to incorporate spacer arms into oligonucleotides and can be added sequentially to create longer spacer arms. This Spacer 9 amidite has a triethyleneglycol-based linker .

MW_{true} 652.76
MW_{add} 211.14

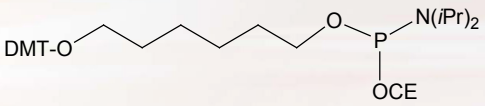


Catalog No.	Item Description	Size/Scale	Price
BNS-5035-100	Spacer 9 Amidite	100 µmol	$70
BNS-5035-250		250 mg	$220
BNS-5035-B		Bulk	Inquire

Spacer C6 Amidite

Spacer C6 amidite (DMT-1,6-Hexandiol) is used to incorporate a six carbon spacer arm into oligonucleotides and can be added sequentially to create longer spacer arms. This Spacer C6 amidite has an aliphatic linker .

MW_{true} 620.75
MW_{add} 179.15

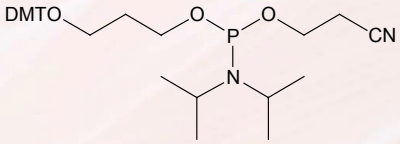


Catalog No.	Item Description	Size/Scale	Price
BNS-5034-100	Spacer C6 Amidite	100 µmol	$75
BNS-5034-250		250 mg	$240
BNS-5034-B		Bulk	Inquire

Spacer C3 Amidite

Spacer C3 amidite (DMT-1,3-Propanediol) is used to incorporate a three carbon spacer arm into oligonucleotides and can be added sequentially to create longer spacer arms. This Spacer C3 amidite has an aliphatic linker .

MW_{true} 578.68
MW_{add} 137.07

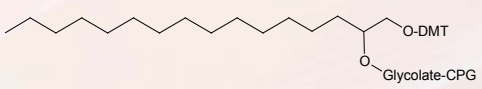


Catalog No.	Item Description	Size/Scale	Price
BNS-5041-100	Spacer C3 Amidite	100 µmol	$65
BNS-5041-250		250 mg	$210
BNS-5041-B		Bulk	Inquire

Spacer C16 Synthesis Columns and CPG

Spacer C16 CPG (1-DMT-2-Hexadecyl-Glyc-CPG) is a sixteen carbon hydroxyl spacer conjugated to CPG via glycolate linkage. The 3 ' carbon spacer inactivates the 3' OH towards enzymatic processing and may be used in lieu of 3' phosphate. The 1000 Å CPG support is suitable for oligomers over 100 bases.

MW_{add} 240.44



Catalog No.	Item Description	Size/Scale	Price
SCG1-5014-5	Spacer C16 CPG SuperColumn; 1000 Å	50 nmol	$4
SCG1-5014-2		200 nmol	$5
SCG1-5014-1		1 µmol	$6
CG1-5014-5	Spacer C16 CPG Synthesis Column; 1000 Å	50 nmol	$4
CG1-5014-2		200 nmol	$5
CG1-5014-1		1 µmol	$6
BG1-5014-100	Spacer C16 CPG ; 1000 Å	100 mg	$50
BG1-5014-1		1g	$300
BG1-5014-B		Bulk	Inquire

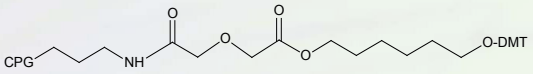
Spacer Modifier Amidites and CPGs

Spacer C6 Synthesis Columns and CPG

Spacer C6 CPG (DMT-1,6-Hexanediol-Glyc-CPG) allows for a six carbon spacer at the 3′ end of an oligonucleotide. The 3′ carbon spacer inactivates the 3′ OH towards enzymatic processing and may be used in lieu of 3′ phosphate. The 1000 Å CPG support is suitable for oligomers over 100 bases.

MW_{add} 100.17

Catalog No.	Item Description	Size/Scale	Price
SCG1-5013-5	Spacer C6 CPG SuperColumn; 1000 Å	50 nmol	$4
SCG1-5013-2		200 nmol	$6
SCG1-5013-1		1 µmol	$15
CG1-5013-5	Spacer C6 CPG Synthesis Column; 1000 Å	50 nmol	$4
CG1-5013-2		200 nmol	$6
CG1-5013-1		1 µmol	$15
BG1-5013-100	Spacer C6 CPG; 1000 Å	100 mg	$50
BG1-5013-1		1g	$300
BG1-5013-B		Bulk	Inquire

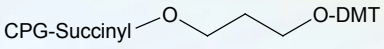


Spacer C3 Synthesis Columns and CPG

Spacer C3 CPG (DMT-1,3-Propanediol-Suc-CPG) allows for a three carbon spacer at the 3′ end of an oligonucleotide. The 3′ carbon spacer inactivates the 3′ OH towards enzymatic processing and may be used in lieu of 3′ phosphate. The 1000 Å CPG support is suitable for oligomers over 100 bases.

MW_{add} 58.09

Catalog No.	Item Description	Size/Scale	Price
SCG1-5011-2	Spacer C3-Suc-CPG SuperColumn; 1000 Å	200 nmol	$10
SCG1-5011-1		1 µmol	$18
CG1-5011-2	Spacer C3-Suc-CPG Synthesis Column; 1000 Å	200 nmol	$10
CG1-5011-1		1 µmol	$18
BG1-5011-100	Spacer C3-Suc-CPG; 1000 Å	100 mg	$50
BG1-5011-1		1g	$375
BG1-5011-B		Bulk	Inquire

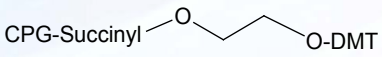


Spacer C2 CPG

Spacer C2 CPG (DMT-1,2-Etheyleneglycol-Suc-CPG) allows for a two carbon spacer at the 3′ end of an oligonucleotide.

MW_{add} 44.07

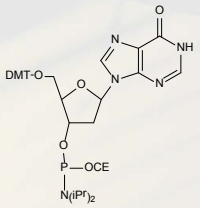
Catalog No.	Item Description	Size/Scale	Price
BG5-5019-100	Spacer C2-Suc-CPG; 500 Å	100 mg	$50
BG5-5019-1		1g	$375
BG5-5019-B		Bulk	Inquire



deoxyInosine and deoxyUridine Amidites and CPGs

DMT-dI Amidite

Inosine is used as a universal base, therefore it can be incorporated into any position in a synthetic oligonucleotide.

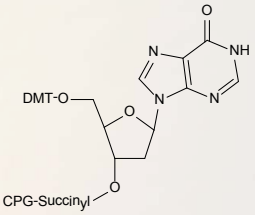


MW_{true} 754.81
MW_{add} 313.2

Catalog No.	Item Description	Size/Scale	Price
BNS-5030-100	DMT-dI Amidite	100 µmol	$50
BNS-5030-250		250 mg	$125
BNS-5030-1		1 g	$450
BNS-5030-B		Bulk	Inquire

DMT-dI Synthesis Columns and CPG

This column is packed with 5′-DMT-dI-Suc-CPG, which is used for the placement of dI on the the 3′ end of oligonucleotides. The 1000 Å CPG makes this product useful for the synthesis of oligonucleotides up to 100 residues in length.

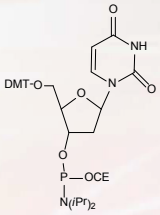


MW_{add} 234.23

Catalog No.	Item Description	Size/Scale	Price
CG1-5015-5	DMT-dI-Suc-CPG Synth. Column; 1000 Å	50 nmol	$4
CG1-5015-2		200 nmol	$5
CG1-5015-1		1 µmol	$6
BG1-5015-100	DMT-dI-Suc-CPG; 1000 Å	100 mg	$37.50
BG1-5015-1		1g	$300
BG1-5015-B		Bulk	Inquire

DMT-dU Amidite

5′-DMT-dU amidite is used for the placement of deoxy uridine either internally or on the 5′ end of oligonucleotides.

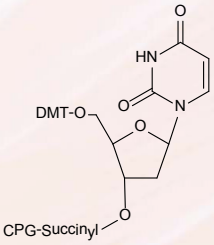


MW_{true} 730.31
MW_{add} 289.17

Catalog No.	Item Description	Size/Scale	Price
BNS-5031-100	DMT-dU Amidite	100 µmol	$50
BNS-5031-250		250 mg	$125
BNS-5031-1		1 g	$450
BNS-5031-B		Bulk	Inquire

DMT-dU Synthesis Columns and CPG

This column, packed with 5′-DMT-dU-Suc-CPG, is used for the placement of dU on the the 3′ end of oligonucleotides. The 1000 Å CPG makes this product useful for the synthesis of oligonucleotides up to 100-mers in length.



MW_{add} 210.2

Catalog No.	Item Description	Size/Scale	Price
CG1-5016-2	DMT-dU-Suc-CPG Synth. Column; 1000 Å	200 nmol	$5
CG1-5016-1		1 µmol	$6
BG1-5016-100	DMT-dU-Suc-CPG; 1000 Å	100 mg	$37.50
BG1-5016-1		1g	$300
BG1-5016-B		Bulk	Inquire

dA, dC, dG and T Columns and CPGs

These bases are available as 1000 Å CPG SuperColumns for use on high-throughput DNA synthesizers (MerMade or ABI 3900; upper pipette, lower luer fit), or as standard synthesis columns (ABI 394, Expedite, etc.; luer-luer fit) in a variety of CPG pore sizes.

The 500 Å CPG is useful for the synthesis of oligos up to 50 nucleotides in length, especially when larger amounts of product are desired, as it allows for greater nucleoside loading amounts (30-50 µmol/g) than do supports with larger pore sizes. The 1000 Å CPG support has a loading range of 30-40 µmol/g and is suitable for oligomers over 100 bases. The 1400 Å CPG support is best suited for the synthesis of DNA sequences of 100-150 bases, and the 2000 Å CPG support is best for the synthesis of DNA sequences over 150 bases.

Spectral properties are measured in water for the cleaved and deprotected nucleoside.

Please inquire for bulk pricing.

dA(Bz) Synthesis Columns and CPGs

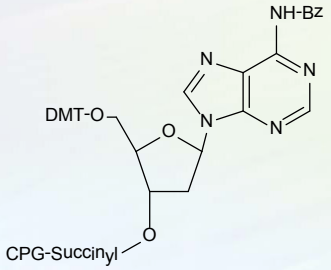
5′-DMT-dA(Bz)-Suc-CPG is used for the placement of dA on the 3′ end of oligonucleotides.

ε_{260} = ca 15,200 $M^{-1}cm^{-1}$

MW_{add} 233.24

Catalog No.	Item Description	Size/Scale	Price
SCG1-1000-5	dA(Bz)-Suc-CPG SuperColumn; 1000 Å	50 nmol	$1.79
SCG1-1000-2		200 nmol	$1.99
SCG1-1000-1		1 µmol	$3.89
CG5-1000-3	dA(Bz)-Suc-CPG Synthesis Column; 500 Å	3 µmol	$10
CG1-1000-5	dA(Bz)-Suc-CPG Synthesis Column; 1000 Å	50 nmol	$2.70
CG1-1000-2		200 nmol	$3.50
CG1-1000-1		1 µmol	$4
CG1-1000-15		1.5 µmol	$6
CG4-1000-2	dA(Bz)-Suc-CPG Synthesis Column; 1400 Å	200 nmol	$4
CG4-1000-1		1 µmol	$5
CG2-1000-5	dA(Bz)-Suc-CPG Synthesis Column; 2000 Å	50 nmol	$4.50
CG2-1000-2		200 nmol	$5
BG5-1000-1	dA(Bz)-Suc-CPG CPG, 500 Å	1 g	$40
BG5-1000-10		10 g	$350
BG1-1000-1	dA(Bz)-Suc-CPG CPG, 1000 Å	1 g	$40
BG1-1000-10		10 g	$350
BG4-1000-1	dA(Bz)-Suc-CPG CPG, 1400 Å	1 g	$40
BG4-1000-10		10 g	$350
BG2-1000-1	dA(Bz-Suc-CPG) CPG, 2000 Å	1 g	$75
BG2-1000-10		10 g	$600

Please inquire for bulk pricing.



dA(Bz) Inverted Linkage Synthesis Columns and CPGs

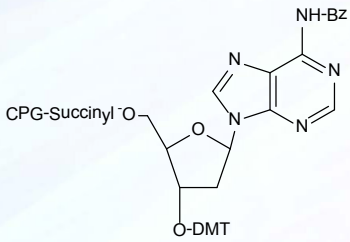
3′-DMT-dA(Bz)-Suc-CPG is an inverse linkage CPG used to create a 3′-3′ linkage on the end of an oligonucleotide. An inverted 3′-3′ linkage is desirable when needing to block polymerase extension through the 3′-terminus of a PCR probe; additionally, oligonucleotides with inverted 3′-linkages are used for some sequencing techniques.

ε_{260} = ca 15,200 $M^{-1}cm^{-1}$

MW_{add} 233.24

Catalog No.	Item Description	Size/Scale	Price
CG1-1000i-5	dA(Bz)-Suc-CPG Synthesis Column,	50 nmol	$4
CG1-1000i-2	inverse linkage; 1000 Å	200 nmol	$5
CG1-1000i-1		1 µmol	$6
BG5-1000i-1	dA(Bz)-Suc-CPG CPG, inverse linkage; 500 Å	1 g	$75
BG1-1000i-1	dA(Bz)-Suc-CPG CPG, inverse linkage; 1000 Å	1 g	$75

Please inquire for bulk pricing.



dA(Bz)-Q-Linker Synthesis Columns and CPGs

5′-DMT-dA(Bz)-3′-Q Linker-CPG uses a hydroquinone-0,0′-diacetic acid group (Q-linker) to attach the nucleoside to the CPG. These supports are advantageous because they require a very short amount of time for cleavage (can be cleaved in 2 minutes at room temperature), making them ideal for base-sensitive oligonucleotides or dye-labeled oligos.

ε_{260} = ca 15,200 $M^{-1}cm^{-1}$

Catalog No.	Item Description	Size/Scale	Price
SCG1-1000Q-2	dA(Bz)-Q-Linker-CPG SuperColumn; 1000 Å	200 nmol	$6
SCG1-1000Q-1		1 µmol	$8
CG1-1000Q-2	dA(Bz)-Q-Linker-CPG Synthesis Column;	200 nmol	$6
CG1-1000Q-1	1000 Å	1 µmol	$8
CG1-1000Q-15		1.5 µmol	$10
BG1-1000Q-1	dA(Bz)-Q-Linker-CPG; 1000 Å	1 g	$85

Please inquire for bulk pricing.

dA, dC, dG and T Columns and CPGs cont'd.

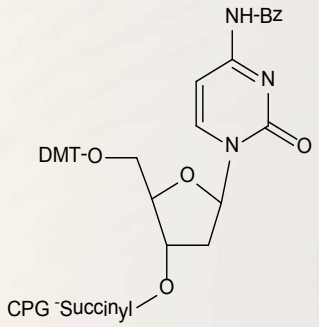
dC(Bz) Synthesis Columns and CPGs

5′-DMT-dC(Bz)-Suc-CPG is used for the placement of dC on the 3′ end of oligonucleotides.

ε_{260} = ca 7,050 $M^{-1}cm^{-1}$
MW_{add} 209.22

Catalog No.	Item Description	Size/Scale	Price
SCG1-1100-5	dC(Bz)-Suc-CPG SuperColumn; 1000 Å	50 nmol	$1.79
SCG1-1100-2		200 nmol	$1.99
SCG1-1100-1		1 µmol	$3.89
CG5-1100-3	dC(Bz)-Suc-CPG Synthesis Column; 500 Å	3 µmol	$10
CG1-1000-5	dC(Bz)-Suc-CPG Synthesis Column; 1000 Å	50 nmol	$2.70
CG1-1100-2		200 nmol	$3.50
CG1-1100-1		1 µmol	$4
CG4-1100-1	dC(Bz)-Suc-CPG Synthesis Column; 1400 Å	1 µmol	$5
CG2-1100-5	dC(Bz)-Suc-CPG Synthesis Column; 2000 Å	50 nmol	$4.50
CG2-1100-2		200 nmol	$5
BG5-1100-1	dC(Bz)-Suc-CPG CPG, 500 Å	1 g	$40
BG5-1100-10		10 g	$350
BG1-1100-1	dC(Bz)-Suc-CPG CPG, 1000 Å	1 g	$40
BG1-1100-10		10 g	$350
BG4-1100-1	dC(Bz)-Suc-CPG CPG, 1400 Å	1 g	$40
BG4-1100-10		10 g	$350

Please inquire for bulk pricing.



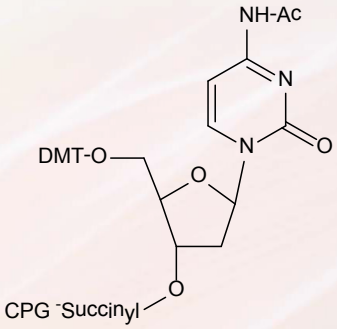
dC(Ac) Synthesis Columns and CPGs

5′-DMT-dC(Ac)-Suc-CPG is used for the placement of dC on the 3′ end of oligonucleotides.

ε_{260} = ca 7,050 $M^{-1}cm^{-1}$
MW_{add} 209.22

Catalog No.	Item Description	Size/Scale	Price
SCG1-1100A-5	dC(Ac)-Suc-CPG SuperColumn; 1000 Å	50 nmol	$1.79
SCG1-1100A-2		200 nmol	$1.99
SCG1-1100A-1		1 µmol	$3.89
CG5-1100A-3	dC(Ac)-Suc-CPG Synthesis Column; 500 Å	3 µmol	$10
CG1-1000A-5	dC(Ac)-Suc-CPG Synthesis Column; 1000 Å	50 nmol	$2.70
CG1-1100A-2		200 nmol	$3.50
CG1-1100A-1		1 µmol	$4
CG1-1100A-15		1.5 µmol	$6
CG4-1100A-2	dC(Ac)-Suc-CPG Synthesis Column; 1400 Å	200 nmol	$4
CG4-1100A-1		1 µmol	$5
CG2-1100A-5	dC(Ac)-Suc-CPG Synthesis Column; 2000 Å	50 nmol	$4.50
CG2-1100A-2		200 nmol	$5
BG5-1100A-1	dC(Ac)-Suc-CPG, 500 Å	1 g	$40
BG5-1100A-10		10 g	$350
BG1-1100-1	dC(Ac)-Suc-CPG, 1000 Å	1 g	$40
BG1-1100-10		10 g	$350
BG4-1100-1	dA(Ac)-Suc-CPG, 1400 Å	1 g	$40
BG4-1100-10		10 g	$350
BG2-1100A-1	dA(Ac)-Suc-CPG, 2000 Å	1 g	$75
BG2-1100A-10		5 g	$600

Please inquire for bulk pricing.



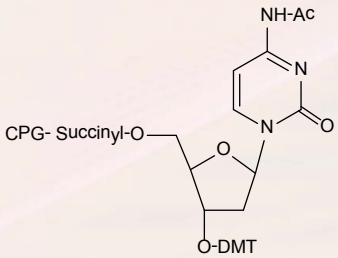
dC(Ac) Inverted Linkage Synthesis Columns and CPGs

3′-DMT-dC(Ac)-Suc-CPG is an inverse linkage CPG used to create a 3′-3′ linkage on the end of an oligonucleotide. An inverted 3′-3′ linkage is desirable when needing to block polymerase extension through the 3′-terminus of a PCR probe; additionally, oligonucleotides with inverted 3′-linkages are used for some sequencing techniques.

ε_{260} = ca 7,050 $M^{-1}cm^{-1}$
MW_{add} 209.22

Catalog No.	Item Description	Size/Scale	Price
CG1-1100i-5	dC(Ac)-Suc-CPG Synthesis Column,	50 nmol	$4
CG1-1100i-2	inverse linkage; 1000 Å	200 nmol	$5
CG1-1100i-1		1 µmol	$6
BG5-1100i-1	dC(Ac)-Suc-CPG, inverse linkage; 500 Å	1 g	$75
BG1-1100i-1	dC(Ac)-Suc-CPG, inverse linkage; 1000 Å	1 g	$75

Please inquire for bulk pricing.

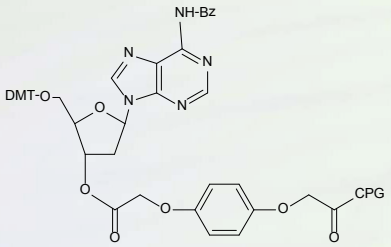


dA, dC, dG and T Columns and CPGs cont'd.

dC(Ac)-Q-Linker Synthesis Columns and CPGs

5′-DMT-dC(Ac)-3′-Q Linker-CPG uses a hydroquinone-0,0′-diacetic acid group (Q-linker) to attach the nucleoside to the CPG. These supports are advantageous because they require a very short amount of time for cleavage (can be cleaved in 2 minutes at room temperature), making them ideal for base-sensitive oligonucleotides or dye-labeled oligos.

ε_{260} = ca 7,050 $M^{-1}cm^{-1}$



Catalog No.	Item Description	Size/Scale	Price
SCG1-1100Q-2	dC(Ac)-Q-linker-CPG SuperColumn; 1000 Å	200 nmol	$6
SCG1-1100Q-1		1 µmol	$8
CG1-1100Q-2	dC(Ac)-Q-linker-CPG Synthesis Column; 1000 Å	200 nmol	$6
CG1-1100Q-1		1 µmol	$8
CG1-1100Q-15		1.5 µmol	$10
BG1-1100Q-1	dC(Ac)-Q-linker-CPG; 1000 Å	1 g	$85

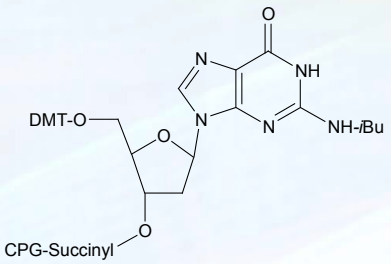
Please inquire for bulk pricing.

dG(iBu) Synthesis Columns and CPGs

5′-DMT-dG(iBu)-Suc-CPG is used for the placement of dG on the 3′ end of oligonucleotides.

ε_{260} = ca 12,010 $M^{-1}cm^{-1}$

MW_{add} 249.24



Catalog No.	Item Description	Size/Scale	Price
SCG1-1200-5	dG(iBu)-Suc-CPG SuperColumn; 1000 Å	50 nmol	$1.79
SCG1-1200-2		200 nmol	$1.99
SCG1-1200-1		1 µmol	$3.89
CG5-1200-3	dG(iBu)-Suc-CPG Synthesis Column; 500 Å	3 µmol	$10
CG1-1200-5	dG(iBu)-Suc-CPG Synthesis Column; 1000 Å	50 nmol	$2.70
CG1-1200-2		200 nmol	$3.50
CG1-1200-1		1 µmol	$4
CG1-1200-15		1.5 µmol	$6
CG4-1200-2	dG(iBu)-Suc-CPG Synthesis Column; 1400 Å	200 nmol	$4
CG4-1200-1		1 µmol	$5
CG2-1200-5	dG(iBu)-Suc-CPG Synthesis Column; 2000 Å	50 nmol	$4.50
CG2-1200-2		200 nmol	$5
BG5-1200-1	dG(iBu)-Suc-CPG CPG; 500 Å	1 g	$40
BG5-1200-10		10 g	$350
BG1-1200-1	dG(iBu)-Suc-CPG CPG; 1000 Å	1 g	$40
BG1-1200-10		10 g	$350
BG4-1200-1	dG(iBu)-Suc-CPG CPG; 1400 Å	1 g	$40
BG4-1200-10		10 g	$350
BG2-1200-1	dG(iBu)-Suc-CPG CPG; 2000 Å	1 g	$75
BG2-1200-10		10 g	$600

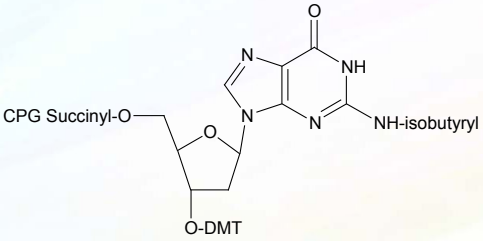
Please inquire for bulk pricing.

dG(iBu) Synthesis Columns and CPGs - Inverted Linkage

3′-DMT-dG(iBu)-Suc-CPG is an inverse linkage CPG used to create a 3′-3′ linkage on the end of an oligonucleotide. An inverted 3′-3′ linkage is desirable when needing to block polymerase extension through the 3′-terminus of a PCR probe; additionally, oligonucleotides with inverted 3′-linkages are used for some sequencing techniques.

ε_{260} = ca 12,010 $M^{-1}cm^{-1}$

MW_{add} 249.24



Catalog No.	Item Description	Size/Scale	Price
CG1-1200i-5	dG(iBu)-Suc-CPG Synthesis Column,	50 nmol	$4
CG1-1200i-2	inverse linkage; 1000 Å	200 nmol	$5
CG1-1200i-1		1 µmol	$6
BG5-1200i-1	dG(iBu)-Suc-CPG, inverse linkage; 500 Å	1 g	$75
BG1-1200i-1	dG(iBu)-Suc-CPG, inverse linkage; 1000 Å	1 g	$75

Please inquire for bulk pricing.

dA, dC, dG and T Columns and CPGs cont'd.

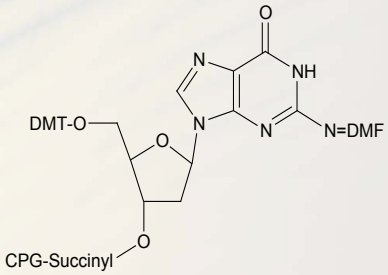
dG(dmf) Synthesis Columns and CPGs

5′-DMT-dG(dmf)-Suc-CPG is used for the placement of dG on the 3′ end of oligonucleotides.

ε_{260} = ca 12,010 $M^{-1}cm^{-1}$
MW_{add} 249.2

Catalog No.	Item Description	Size/Scale	Price
SCG1-1200F-5	dG(dmf)-Suc-CPG SuperColumn; 1000 Å	50 nmol	$4
SCG1-1200F-2		200 nmol	$5
SCG1-1200F-1		1 µmol	$6
CG1-1200F-5	dG(dmf)-Suc-CPG Synthesis Column; 1000 Å	50 nmol	$3.50
CG1-1200F-2		200 nmol	$4
CG1-1200F-1		1 µmol	$5
CG1-1200F-15		1.5 µmol	$6
BG1-1200F-1	dG(dmf)-Suc-CPG; 1000 Å	1 g	$60
BG1-1200F-10		10 g	$500

Please inquire for bulk pricing.



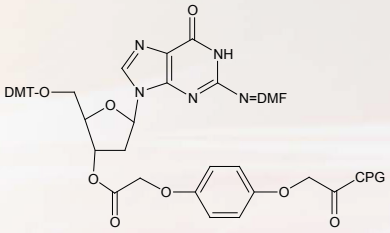
dG(dmf)-Q-Linker Synthesis Columns and CPGs

5′-DMT-dG(dmf)-3′-Q Linker-CPG uses a hydroquinone-0,0′-diacetic acid group (Q-linker) to attach the nucleoside to the CPG. These supports are advantageous because they require a very short amount of time for cleavage (can be cleaved in 2 minutes at room temperature), making them ideal for base-sensitive oligonucleotides or dye-labeled oligos.

ε_{260} = ca 12,010 $M^{-1}cm^{-1}$

Catalog No.	Item Description	Size/Scale	Price
SCG1-1200Q-2	dG(dmf)-Q-linker-CPG SuperColumn; 1000 Å	200 nmol	$6
SCG1-1200Q-1		1 µmol	$8
CG1-1200Q-2	dG(dmf)-Q-linker-CPG Synthesis Column; 1000 Å	200 nmol	$6
CG1-1200Q-1		1 µmol	$8
CG1-1200Q-15		1.5 µmol	$10
BG1-1200Q-1	dG(dmf)-Q-linker-CPG; 1000 Å	1 g	$85

Please inquire for bulk pricing.



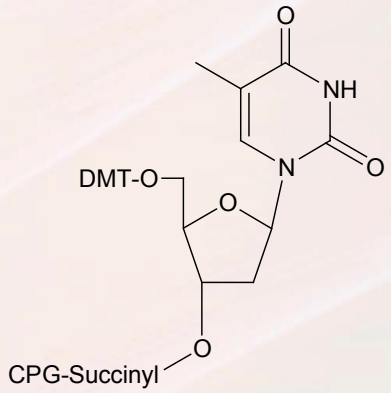
T Synthesis Columns and CPGs

5′-DMT-T-Suc-CPG is used for the placement of dG on the 3′ end of oligonucleotides.

ε_{260} = ca 8,400 $M^{-1}cm^{-1}$
MW_{add} 224.23

Catalog No.	Item Description	Size/Scale	Price
SCG1-1300-5	T-Suc-CPG SuperColumn; 1000 Å	50 nmol	$1.79
SCG1-1300-2		200 nmol	$1.99
SCG1-1300-1		1 µmol	$3.89
CG5-1300-3	T-Suc-CPG Synthesis Column; 500 Å	3 µmol	$10
CG1-1300-5	T-Suc-CPG Synthesis Column; 1000 Å	50 nmol	$2.70
CG1-1300-2		200 nmol	$3.50
CG1-1300-1		1 µmol	$4
CG1-1300-15		1.5 µmol	$6
CG4-1300-2	T-Suc-CPG Synthesis Column; 1400 Å	200 nmol	$4
CG4-1300-1		1 µmol	$5
CG2-1300-5	T-Suc-CPG Synthesis Column; 2000 Å	50 nmol	$4.50
CG2-1300-2		200 nmol	$5
BG5-1300-1	T-Suc-CPG; 500 Å	1 g	$40
BG5-1300-10		10 g	$350
BG1-1300-1	T-Suc-CPG; 1000 Å	1 g	$40
BG1-1300-10		10 g	$350
BG4-1300-1	T-Suc-CPG; 1400 Å	1 g	$40
BG4-1300-10		10 g	$350
BG2-1300-1	T-Suc-CPG; 2000 Å	1 g	$75
BG2-1300-10		10 g	$600

Please inquire for bulk pricing.

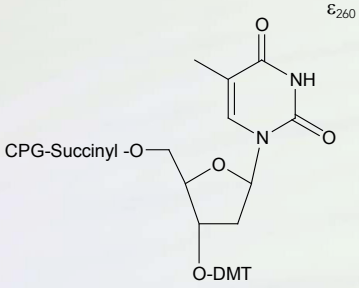


dA, dC, dG and T Columns and CPGs cont'd.

T Synthesis Columns and CPGs - Inverted Linkage

3′-DMT-T-Suc-CPG is an inverse linkage CPG used to create a 3′-3′ linkage on the end of an oligonucleotide. An inverted 3′-3′ linkage is desirable when needing to block polymerase extension through the 3′-terminus of a PCR probe; additionally, oligonucleotides with inverted 3′-linkages are used for some sequencing techniques.

ε_{260} = ca 8,400 $M^{-1}cm^{-1}$
MW_{add} 224.23



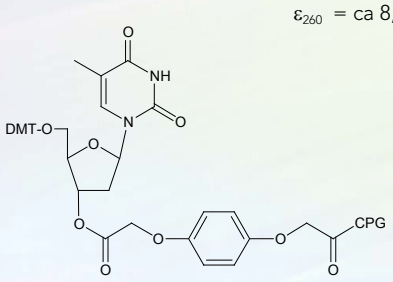
Catalog No.	Item Description	Size/Scale	Price
CG1-1300i-5	T-Suc-CPG Synthesis Column, inverse linkage;	50 nmol	$4
CG1-1300i-2	1000 Å	200 nmol	$5
CG1-1300i-1		1 µmol	$6
BG5-1300i-1	T-Suc-CPG, inverse linkage; 500 Å	1 g	$75
BG1-1300i-1	T-Suc-CPG, inverse linkage; 1000 Å	1 g	$75

Please inquire for bulk pricing.

T-Q-Linker Synthesis Columns and CPGs

5′-DMT-T-3′-Q Linker-CPG uses a hydroquinone-0,0′-diacetic acid group (Q-linker) to attach the nucleoside to the CPG. These supports are advantageous because they require a very short amount of time for cleavage (can be cleaved in 2 minutes at room temperature), making them ideal for base-sensitive oligonucleotides or dye-labeled oligos.

ε_{260} = ca 8,400 $M^{-1}cm^{-1}$



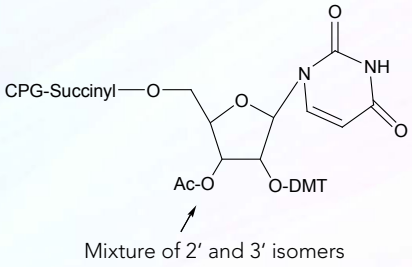
Catalog No.	Item Description	Size/Scale	Price
SCG1-1300Q-2	T-Q-linker-CPG SuperColumn; 1000 Å	200 nmol	$6
SCG1-1300Q-1		1 µmol	$8
CG1-1300Q-2	T-Q-linker-CPG Synthesis Column; 1000 Å	200 nmol	$6
CG1-1300Q-1		1 µmol	$8
CG1-1300Q-15		1.5 µmol	$10
BG1-1300Q-1	T-Q-linker-CPG; 1000 Å	1 g	$85

Please inquire for bulk pricing.

Universal Support Columns and CPGs

Universal Support Synthesis Columns and CPGs

Oligonucleotide synthesis using Universal Support CPG is performed using standard synthesis protocols for 1.0 µmol, 200 nmol or 50 nmol scale. The CPG support does not contribute to the base sequence; therefore, it may be necessary to include a nonsense base as the 3′ terminal base for sequence entry systems.



Mixture of 2′ and 3′ isomers

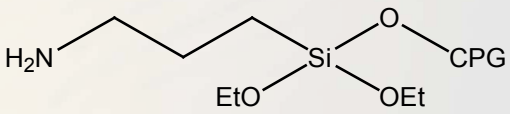
Catalog No.	Item Description	Size/Scale	Price
SCG5-3400-5	Universal Support CPG SuperColumn; 500 Å	50 nmol	$2
SCG5-3400-2		200 nmol	$2.25
SCG5-3400-1		1 µmol	$3.50
SCG1-3400-5	Universal Support CPG SuperColumn; 1000 Å	50 nmol	$2
SCG1-3400-2		200 nmol	$2.25
SCG1-3400-1		1 µmol	$3.5
CG1-3400-5	Universal Support CPG Synthesis Column; 1000 Å	50 nmol	$2.50
CG1-3400-2		200 nmol	$3
CG1-3400-1		1 µmol	$3.50
BG5-3400-1	Universal Support CPG; 500 Å	1 g	$60
BG1-3400-1	Universal Support CPG; 1000 Å	1 g	$60

Please inquire for bulk pricing.

Aminopropyl CPGs

Aminopropyl CPGs

This CPG has been derivitized with a short linker terminating in an amine group for further derivitization. Typical amine loadings are 150-200 µM/g for 500 Å CPG and 75-125 µM/g for 1000 Å CPG. Special care is taken to exhaustively cover all available silanol groups on the native glass. This results in minimal synthesis n-1 impurities due to side silanol reactions. This linker is suitable for most synthesis applications.



References:

1. K. Buettner et al., in *Peptides: Chemistry and Biology; Proceedings of the Tenth American Peptide Symposium* (G.R. Marshall, Ed.), ESCOM: Leiden, The Netherlands, 1988, 210.
2. R.M. Cook, J.H. Adams and D. Hudson. *Tetrahedron Lett.* 1994, 35, 6777-6780.

Catalog No.	Item Description	Size/Scale	Price
BG3-2000-1	Aminopropyl CPG; 300 Å	1 g	$15
BG3-2000-10		10 g	$120
BG5-2000-1	Aminopropyl CPG; 500 Å	1 g	$15
BG5-2000-10		10 g	$120
BG1-2000-1	Aminopropyl CPG; 1000 Å	1 g	$15
BG1-2000-10		10 g	$120
BG4-2000-1	Aminopropyl CPG; 1400 Å	1 g	$20
BG4-2000-10		10 g	$175
BG2-2000-1	Aminopropyl CPG; 2000 Å	1 g	$25
BG2-2000-10		10 g	$200

Please inquire for bulk pricing.

Mixed Base Synthesis Columns and CPGs

Biosearch offers mixed base controlled pore glass (CPG) and columns. Our mixed base columns are packed with 1000 Å CPG and are compatible with most DNA synthesizers. All nucleosides are linked by normal 3' succinate linkages unless otherwise specified. Mixed base synthesis columns for commonly used DNA synthesizers are available in the following scales: 50 nmol, 200 nmol and 1 µmol. The 1000 Å CPG support is suitable for oligomers over 100 bases.

B Mix		C	G	T
D Mix	A		G	T
H Mix	A	C		T
K Mix			G	T
M Mix	A	C		
N Mix	A	C	G	T
R Mix	A		G	
S Mix		C	G	
V Mix	A	C	G	
W Mix	A			T
Y Mix		C		T

B Mix Synthesis Columns

The B Mix synthesis column contains an equimolar mixture of bases C, G and T.

Catalog No.	Item Description	Size/Scale	Price
CG1-1418-5	B Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1418-2		200 nmol	$3.75
CG1-1418-1		1 µmol	$4.50

Please inquire for bulk pricing.

D Mix Synthesis Columns

The D Mix synthesis column contains an equimolar mixture of bases A, G and T.

Catalog No.	Item Description	Size/Scale	Price
CG1-1419-5	D Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1419-2		200 nmol	$3.75
CG1-1419-1		1 µmol	$4.50

Please inquire for bulk pricing.

H Mix Synthesis Columns

The H Mix synthesis column contains an equimolar mixture of bases A, C and T.

Catalog No.	Item Description	Size/Scale	Price
CG1-1415-5	H Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1415-2		200 nmol	$3.75
CG1-1415-1		1 µmol	$4.50

Please inquire for bulk pricing.

K Mix Synthesis Columns

The K Mix synthesis column contains an equimolar mixture of bases G and T.

Catalog No.	Item Description	Size/Scale	Price
CG1-1413-5	K Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1413-2		200 nmol	$3.75
CG1-1413-1		1 µmol	$4.50

Please inquire for bulk pricing.

M Mix Synthesis Columns

The M Mix synthesis column contains an equimolar mixture of bases A and C.

Catalog No.	Item Description	Size/Scale	Price
CG1-1412-5	M Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1412-2		200 nmol	$3.75
CG1-1412-1		1 µmol	$4.50

Please inquire for bulk pricing.

N Mix Synthesis Columns and CPG

The N Mix synthesis column contains an equimolar mixture of bases A, C, G and T.

Catalog No.	Item Description	Size/Scale	Price
SCG1-1400F-5	N Mix SuperColumn; 1000 Å	50 nmol	$3
SCG1-1400F-2		200 nmol	$3.75
SCG1-1400F-1		1 µmol	$4.50
CG1-1400-5	N Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1400-2		200 nmol	$3.75
CG1-1400-1		1 µmol	$4.50
CG1-1400-15		1.5 µmol	$6
BG1-1400-1	N Mix CPG; 1000 Å	1 g	$45

Please inquire for bulk pricing.

R Mix Synthesis Columns

The R Mix synthesis column contains an equimolar mixture of bases A and G.

Catalog No.	Item Description	Size/Scale	Price
CG1-1414-5	R Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1414-2		200 nmol	$3.75
CG1-1414-1		1 µmol	$4.50

Please inquire for bulk pricing.

Mixed Base Synthesis Columns and CPGs, cont'd.

S Mix Synthesis Columns

The S Mix synthesis column contains an equimolar mixture of bases C and G.

Catalog No.	Item Description	Size/Scale	Price
CG1-1416-5	S Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1416-2		200 nmol	$3.75
CG1-1416-1		1 µmol	$4.50

Please inquire for bulk pricing.

W Mix Synthesis Columns

The W Mix synthesis column contains an equimolar mixture of bases A and T.

Catalog No.	Item Description	Size/Scale	Price
CG1-1417-5	W Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1417-2		200 nmol	$3.75
CG1-1417-1		1 µmol	$4.50

Please inquire for bulk pricing.

V Mix Synthesis Columns

The V Mix synthesis column contains an equimolar mixture of bases A, C and G.

Catalog No.	Item Description	Size/Scale	Price
CG1-1410-5	V Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1410-2		200 nmol	$3.75
CG1-1410-1		1 µmol	$4.50

Please inquire for bulk pricing.

Y Mix Synthesis Columns

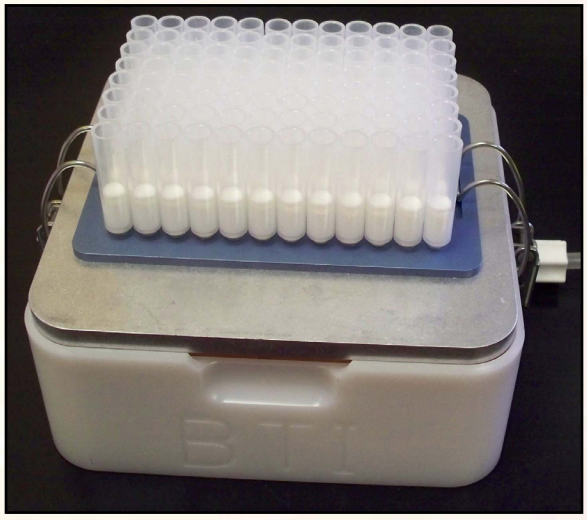
The Y Mix synthesis column contains an equimolar mixture of bases C and T.

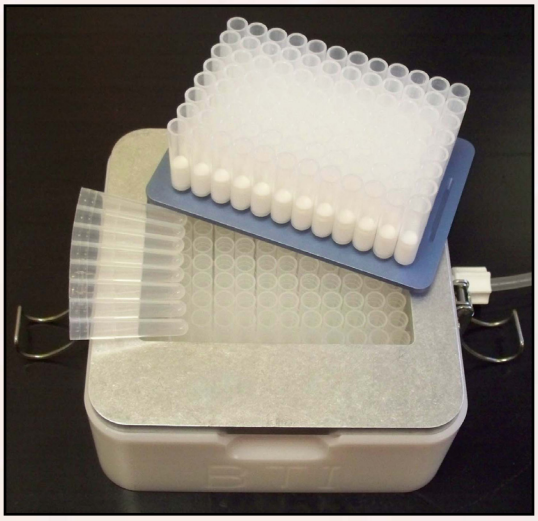
Catalog No.	Item Description	Size/Scale	Price
CG1-1411-5	Y Mix Synthesis Column; 1000 Å	50 nmol	$3
CG1-1411-2		200 nmol	$3.75
CG1-1411-1		1 µmol	$4.50

Please inquire for bulk pricing.

MicroSync II Solvent Resistant Vacuum Manifold System

Catalog No.	Item Description	Size	Price
MS-2000-1	MicroSync II Complete System	1	$950
MS-1036-20	Luer Plugs (PP)	20 pack	$10
MS-2015-1	Upper Gasket, MicroSync II (Silicone)	1	$10
MS-2016-1	Lower Gasket, MicroSync II (Silicone)	1	$10
MS-2020-1	Vacuum Box, MicroSync II (HDPE)	1	$450
MS-2025-1	Vacuum Box Top Cover, MicroSync II (Aluminum)	1	$250
MS-2031-1	Vacuum Line, PP, 1/4 in. ID	1	$15
MS-2032-1	Straight Connect Fitting	1	$1
MSP-1001-1	Vacuum Plate (Aluminum); 96 hole X 0.156 in. (Luer)	1	$75





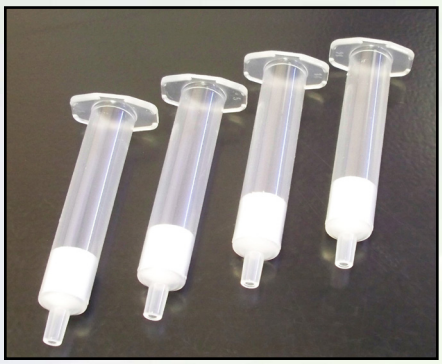
Purification Columns

MicroPure II Columns for Oligonucleotide Purification

Biosearch's MicroPure II columns (MP-1602) are intended for Reversed-phase purification of 5'-dimethoxytrityl protected oligonucleotides followed by on-column detritylation. The cartridge consists of a 5 mL syringe barrel packed with 200 mg of high performance hydrophobic polymeric resin. The method relies on strong binding between the 5'-DMT protected product and the resin, thus allowing separation from the most common impurities, truncated sequences, which do not bind. Treatment with acid removes the DMT group from the product, the desired product (free from organic residues) is eluted with 20% acetonitrile. The method is rapid, efficient and many samples can be purified simultaneously. At least 1 µmol or 50 O.D's of crude DNA can be applied to the column. The purified yield will depend, in each case, on sequence length and the quality of the crude sample.

Catalog No.	Item Description	Scale	Price
MP-1602-1	MicroPure II Column	1	$2.60
MP-1602-10		10	$23

Inquire for bulk pricing



MicroPure II Columns

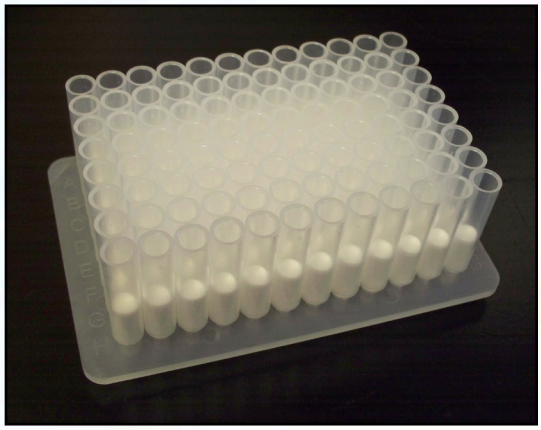
SuperPure Columns for Oligonucleotide Purification

Oligonucleotides (whether synthetic or natural) may be purified by a number of techniques, including polyacrylamide gel electrophoresis and high performance liquid chromatography (either by ion exchange or reverse-phase methods). Synthetic DNA can be conveniently de-salted and purified by reverse-phase low-pressure separation on SuperPure (SP-1000) and SuperPure *Plus* (SP-2000) columns. SuperPure Columns are intended for reverse-phase purification of 5'-DMT oligonucleotides followed by on-column detritylation. The method relies on strong binding between the 5'-DMT protected product and a hydrophobic optimized polymer packing (polystyrene), thus allowing separation from truncated sequences which, due to a lack of DMT group, do not bind. Treatment with acid removes the DMT group from the product, the desired product (free from organic residues) is eluted with 20% acetonitrile. The method is rapid, efficient and permits many samples to be purified simultaneously. Two versions of the SuperPure column are available: one has capacity to handle crude, cleaved DNA from a 50 nmol scale synthesis, and the SuperPure *Plus* can purify DNA from a 200 nmol synthesis. The purified yield will depend, in each case, on sequence length and the quality of the crude sample.

Catalog No.	Item Description	Scale	Price
SP-1000-1	SuperPure Column - ≤ 50 nmol	1	$1.75
SP-1000-96		96 well plate	$150
SP-2000-1	SuperPure *Plus* Column - ≥ 200 nmol	1	$2
SP-2000-96		96 well plate	$170

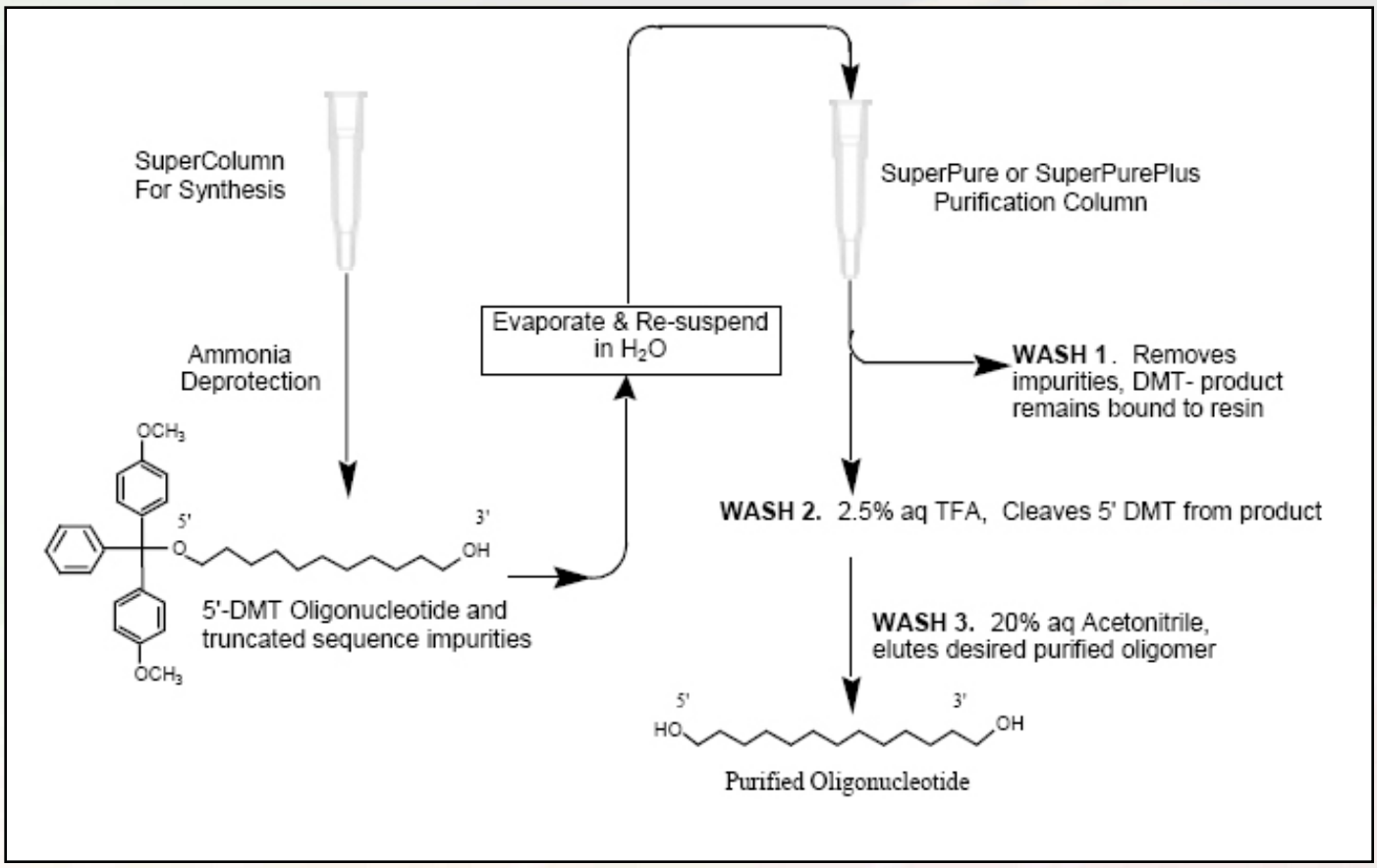
Inquire for bulk pricing

SuperPure Columns, 50 nmol



SuperPure *Plus* Columns, 200 nmol

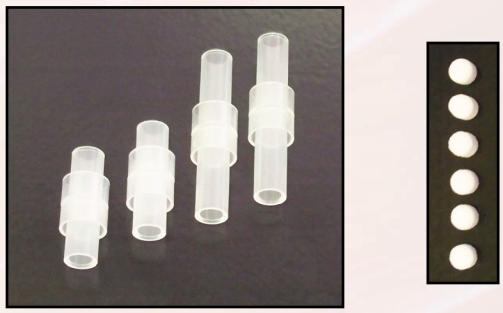
Schematic Outline of Oligo Purification on the SuperPure and SuperPure *Plus* Columns



Empty Columns and Accessories

Catalog No.	Item Description	Scale	Price
CL-1501-1	DNA Synthesis Column, Large, Empty	1	$2
CL-1501-10		10 Pack	$20
CL-1502-1	DNA Synthesis Column, Small, Empty	1	$1.50
CL-1502-10		10 Pack	$15
FR-1501-100	Frit, Column, 1/16 in. x 0.163	100 Pack	$8
FR-1502-100	Frit, Column, 1/8 in. x 0.163	100 Pack	$8
CL-1504-1	Male Tapered Luer Coupler	1	$0.30

Inquire for bulk pricing



Small and Large Empty Synthesis Columns and Column Frits

Appendix I: BHQ Dye and Probe Spectra

Absorption Spectra of BHQ Labeled Oligos

Below are examples of absorption spectra for four BHQ dyes: BHQ-1, BHQ-2 and BHQ-3. All spectra were collected from the reverse-phase HPLC (RP-HPLC) of BHQ-labeled 30-mer poly-T oligonucleotides. The oligos were purified by anion exchange HPLC (AX-HPLC) followed by RP-HPLC. The UV spectrum for each dye shows the major peak labeled with each dye's absorption maximum along with the noticeable minor peaks associated with each dye's spectrum. The large peak at ~266 nm results from the 30-mer poly-T oligo. **Note:** peak values for each BHQ dye may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis.

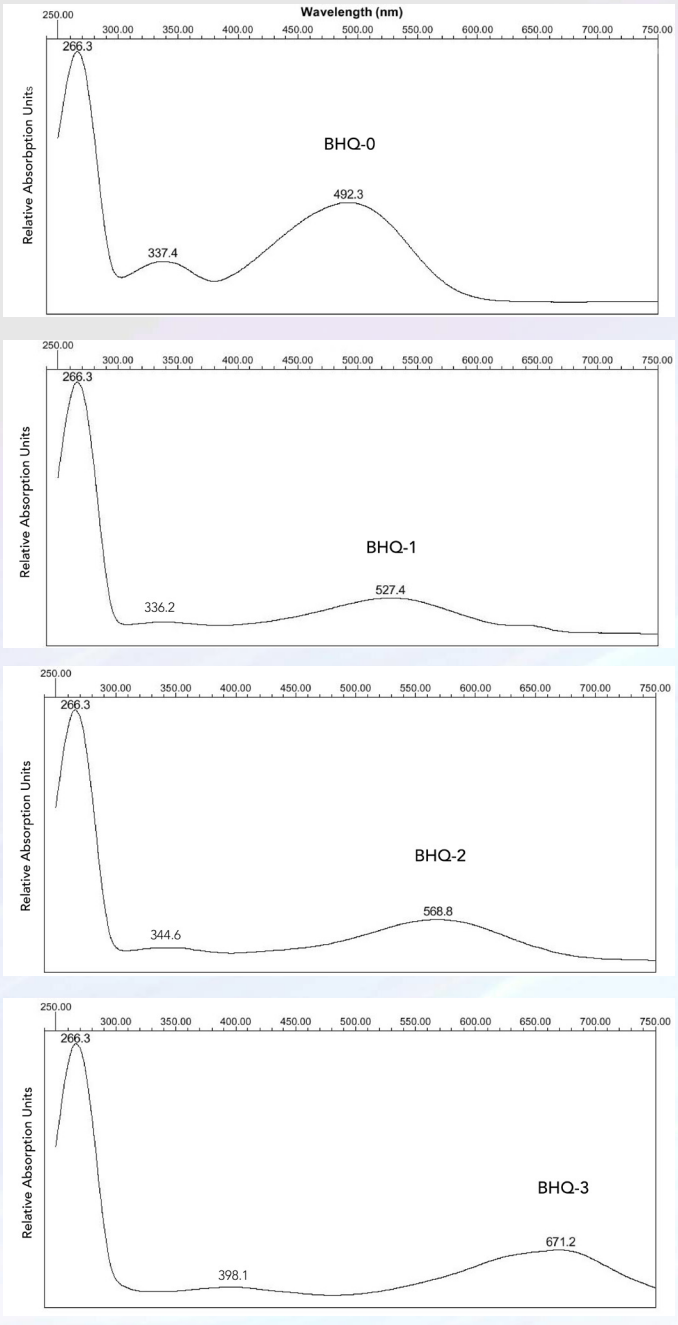


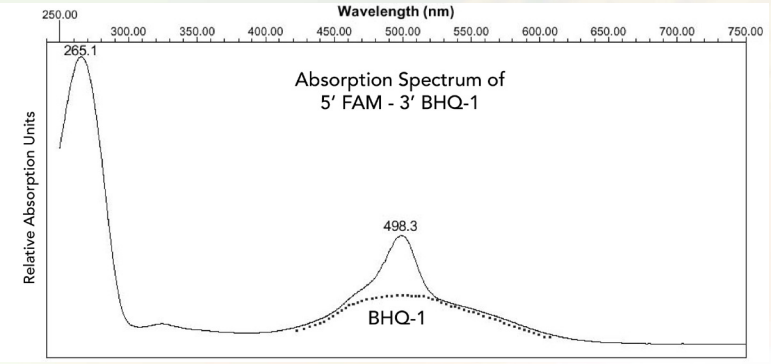
Figure 1:

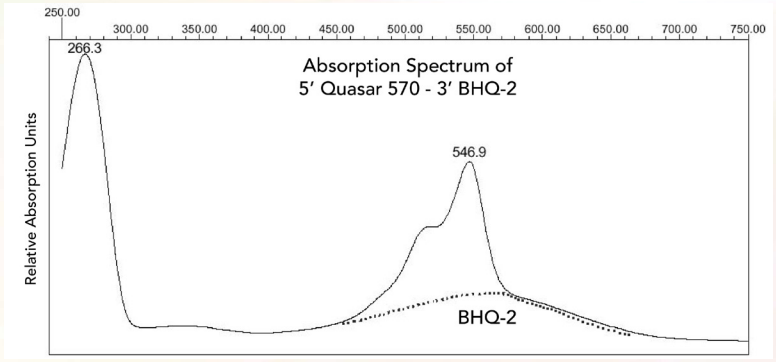
RP-HPLC Analysis of BHQ-labeled 30-mer poly-T oligos. The oligos were eluted on a Hamilton PRP-1 Column (50 x 4.1 mm, 3.0 um) with a linear gradient over 3 min of 0.1 M TEAA + 5% CH_3CN and CH_3CN from 90:10 to 35:65; flow rate = 1.4mL/min. Column Temp = 55°C. Data were collected with a waters 996 photodiode array detector.

Appendix I: BHQ Dye and Probe Spectra (cont'd.)

Absorption Spectra of Common Dual-labeled BHQ/Fluorophore Oligos

Below are representative absorption spectra of various BHQ-Fluorophore-labeled oligos. The contribution from the BHQ dye label is shown with a dotted line. All spectra were collected from the RP-HPLC of dual-labeled 30-mer poly-T oligonucleotides. The oligos were purified by AX-HPLC followed by RP-HPLC. The UV spectrum for the major peak is shown, with the relative absorbance maxima for the fluorophore labels indicated. Note: peak values for each BHQ dye may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis. Quasar 570 dye is a is a direct replacement for Cy3 dye and Quasar 670 dye is a direct replacement for Cy5 dye.





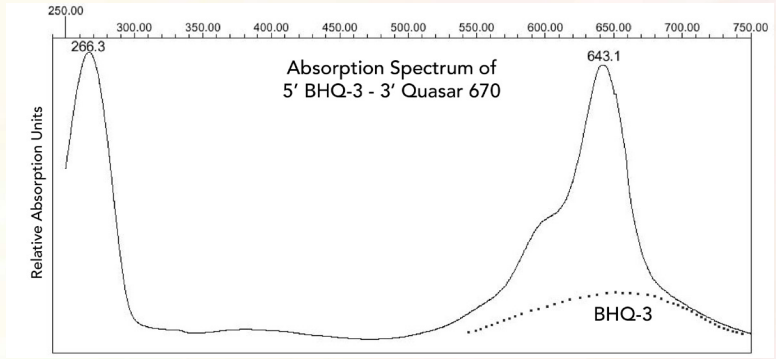


Figure2:

Absorption Spectra of BHQ-Fluorophore-labeled 30-mer poly-T oligos. Shown are the UV spectra of the major peak from RP-HPLC analysis of BHQ-Fluorophore-labeled 30-mer poly-T oligos. The oligos were eluted on a Hamilton PRP-1 Column (50 x 4.1 mm, 3.0 um) with a linear gradient over 3 min of 0.1 M TEAA + 5% CH_3CN and CH_3CN from 90:10 to 35:65; flow rate = 1.4mL/min. Column Temp = 55°C. Data were collected with a waters 996 photodiode array detector.

Appendix I: BHQ Dye and Probe Spectra (cont'd.)

Effect of Ground State Complex Formation on Absorption Spectra

As discussed earlier (see pages16-17), certain fluorophore and quencher combinations have a greater tendency to form ground-state complexes. This is readily demonstrated using AX-HPLC analysis which clearly shows each combination's unique spectral footprint. Although rarely seen using RP-HPLC analysis (where hydrophobic interactions between the dyes and separation media inhibit the formation of these complexes), AX-HPLC analysis uses buffers containing high levels of salt which disrupts the hydrophobic interactions and thus enhances the formation of ground state complexes. The cyanine and rhodamine dyes are particularly prone to forming ground state complexes.

As is demonstrated in Figures 1 and 2 below, analysis of a dual-labeled poly-T 30-mer probe by both AX and RP-HPLC generate subtle differences in the elution profile which can be attributed to the formation of a ground state complex.

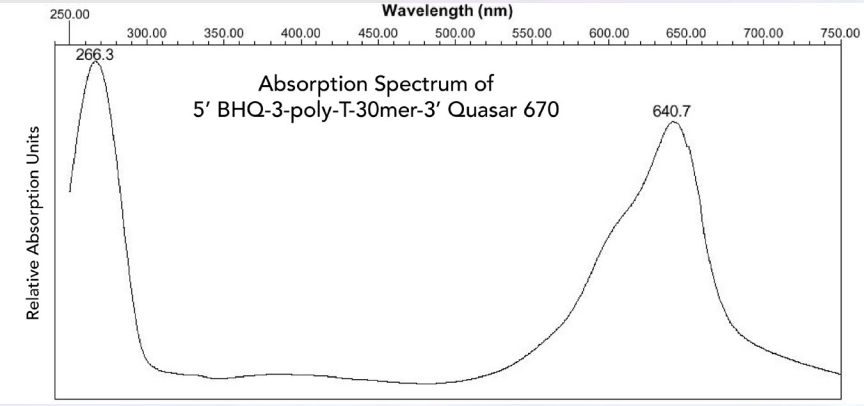


Figure 1:

Absorption spectrum of a BHQ-Fluorophore-labeled 30-mer poly-T oligo. Shown is the UV spectrum of the major peak from AX-HPLC Analysis. A 5µl aliquot of oligo was eluted on a Dionex DNAPac PA-100 (4 x 250 mm) column with a linear gradient over 8 min. of 10% to 70% B where A is 0.1M Tris + 15% ACN and B is A + 1M NaBr: flow rate = 3mL/min., Temp = 60°C. Data was collected with a Waters 996 photodiode array detector. The UV spectrum for the major peak is shown, with the relative absorbance maxima for the fluorophore label indicated. The full chromatogram was extracted at 254 nm.

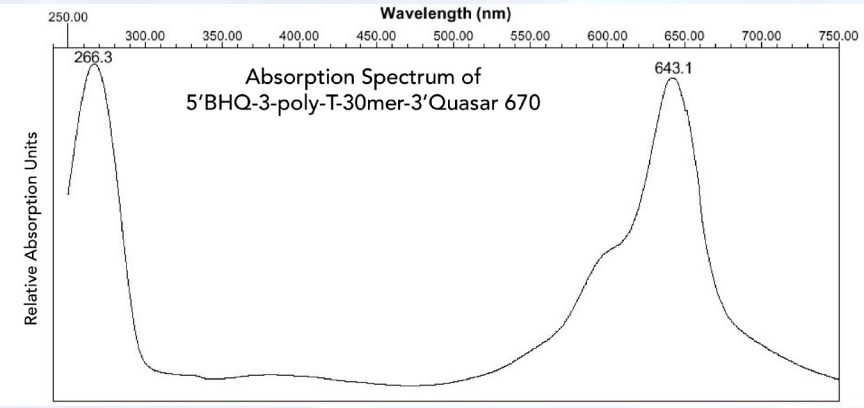


Figure 2:

Absorption spectrum of a BHQ-fluorophore-labeled 30-mer poly-T oligo. Shown is the UV spectrum of the major peak from RP-HPLC Analysis. The oligo was eluted on a Hamilton PRP-1 Column (50 x 4.1 mm, 3.0 um) with a linear gradient over 3 min of 0.1 M TEAA + 5% CH3CN and CH3CN from 90:10 to 35:65; flow rate = 1.4mL/min. Column Temp = 55°C. The UV spectrum for the major peak is shown, with the relative absorbance maxima for the fluorophore label indicated. Data were collected with a Waters 996 photodiode array detector.

Appendix II: Analysis of a Common BHQ-Labeled Oligo: 5′ FAM-3′ BHQ-1

FAM and BHQ-1 dyes are commonly used together as labels for fluorescence-quenched probes in genomics applications. In Appendix II we show typical characteristics of an unpurified oligo synthesized with FAM at the 5′ end and BHQ-1 at the 3′ end.

FAM–BHQ-1 Labeled Oligo Analysis by Anion Exchange HPLC Chromatography

Analysis of an oligonucleotide labeled with FAM at the 5′ end and BHQ-1 at the 3′ end is shown after DNA synthesis. Unpurified synthesis product was analyzed by AX-HPLC. One major peak, shown in the top figure, is observed along with some minor peaks corresponding to impurities of DNA synthesis. The absorption spectrum, shown in the bottom figure, corresponds to the major peak and shows absorption due to DNA, and the FAM and BHQ-1 labels. **Note:** the peak values for the FAM and BHQ dye labels may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis.

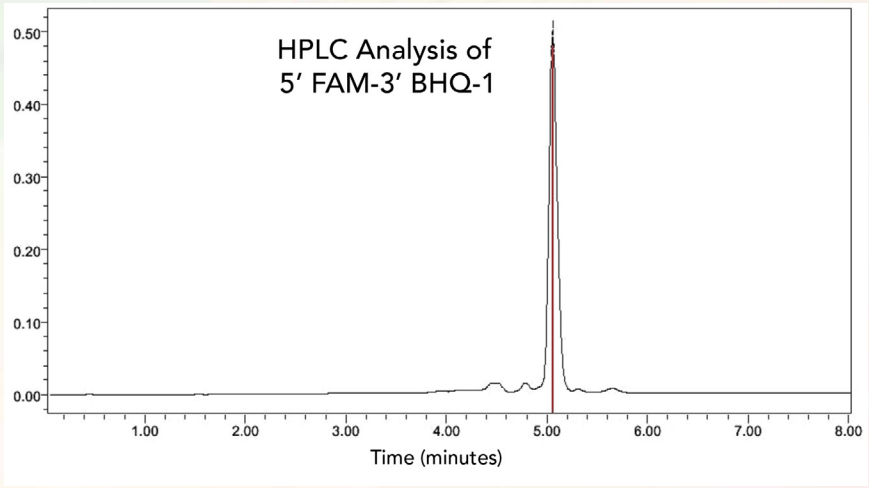


Figure 1:

AX-HPLC Analysis of 5′FAM–3′BHQ-1 labeled 30-mer poly-T oligo. The full chromatogram was extracted at 254 nm. Data was collected with a Waters 996 photodiode array detector.

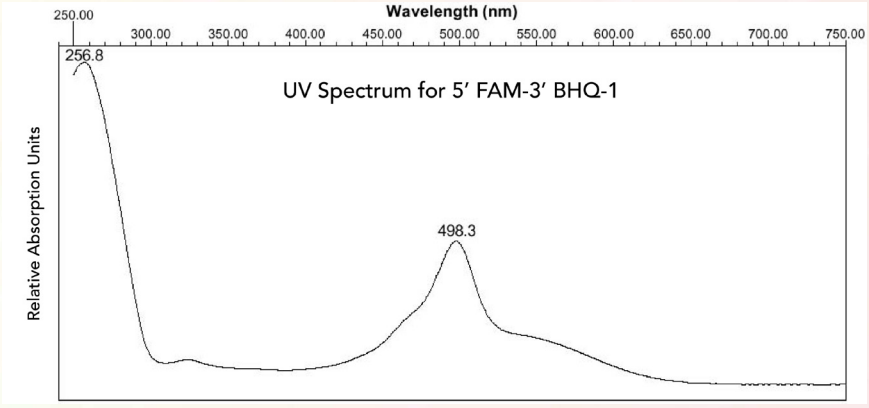


Figure 2:

The UV spectrum for the major peak of a 5′ FAM–3′ BHQ-1 labeled 30-mer poly-T oligo is shown.

Appendix II: Analysis of a BHQ-Labeled Oligo: 5′ FAM-3′ BHQ-1 (cont'd.)

FAM–BHQ-1 Labeled Oligo Analysis by Reverse Phase HPLC Chromatography

Analysis of an oligonucleotide labeled with FAM at the 5′ end and BHQ-1 at the 3′ end is shown after DNA synthesis. Unpurified synthesis product was analyzed by RP-HPLC. One major peak, shown in the top figure, is observed which corresponds to the dual-labeled oligonucleotide. The absorption spectrum, shown in the bottom figure, corresponds to the major peak and shows absorption due to DNA, and the FAM and BHQ-1 labels. **Note:** the peak values for the FAM and BHQ dye labels may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis.

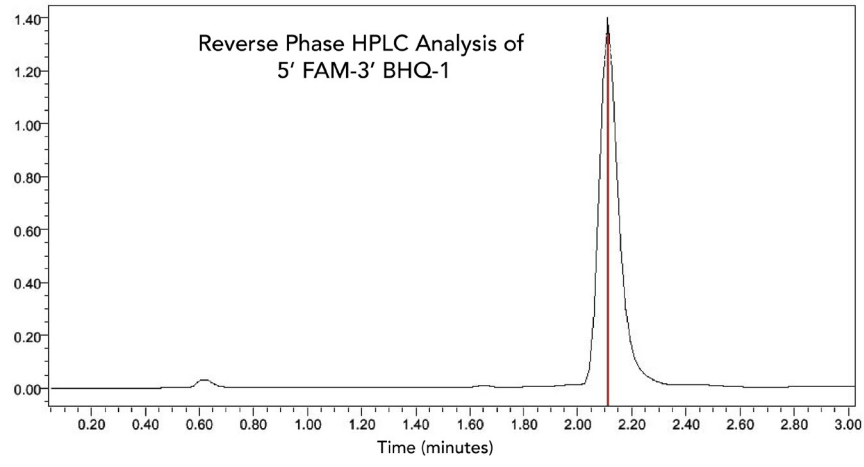


Figure 1:

AX-HPLC Analysis of 5′FAM–3′BHQ-1 labeled 30-mer poly-T oligo. The full chromatogram was extracted at 254 nm. Data was collected with a Waters 996 photodiode array detector.

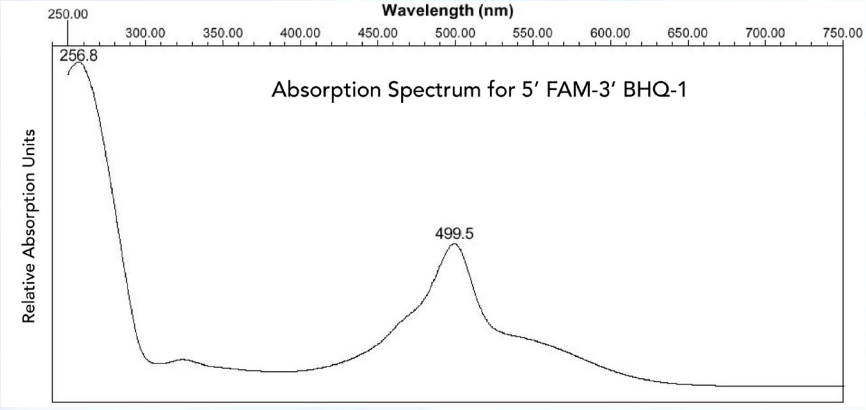


Figure 2:

The UV spectrum for the major peak of a 5′ FAM–3′ BHQ-1 labeled 30-mer poly-T oligo is shown.

Appendix III: Working with BHQ-3 Labeled Oligos

BHQ-3 is an excellent quencher for some applications. However we have discovered that synthesizing BHQ-3 labeled oligos requires attention to detail and an understanding of their characteristics under post synthesis work up conditions. The BHQ-3 dye shows some decomposition under the harsh conditions used in cleavage and deprotection. In Appendix III we show how BHQ-3 behaves under different conditions and circumstances.

5′ BHQ-3 Labeled Oligo Analysis by Anion Exchange HPLC Chromatography

Analysis of oligonucleotides labeled with BHQ-3 at the 5′ end are shown after DNA synthesis. Unpurified synthesis product was analyzed by AX-HPLC. Two major peaks are observed: an earlier peak (Peak 1) corresponding to the DNA alone and a later peak (Peak 2) which corresponds to the oligonucleotide coupled to the BHQ-3 dye. Absorption spectrum, shown in bottom figure A, corresponds to peak 1 and shows only absorption due to DNA. The absorption spectrum for peak 2, shown in bottom figure B, shows the absorption by the DNA and the BHQ-3 dye. **Note:** peak values for each BHQ dye may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis.

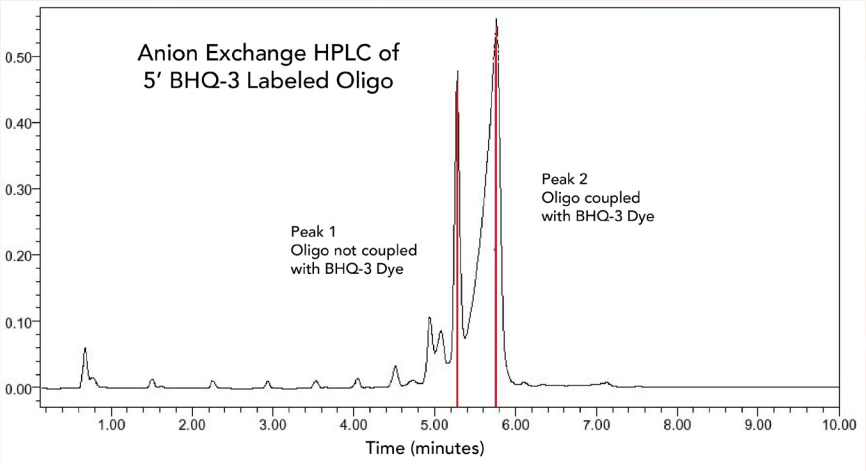


Figure 1:

AX-HPLC Analysis of 5′ BHQ-3-labeled 10-mer poly-T oligo. The full chromatogram was extracted at 254 nm. Data was collected with a Waters 996 photodiode array detector.

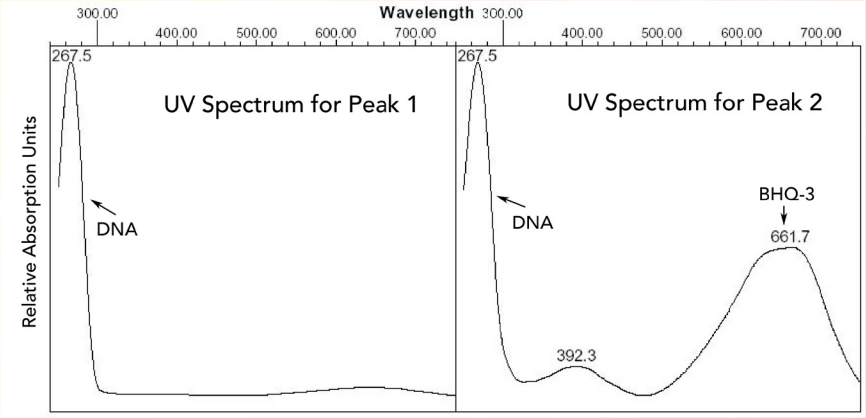


Figure 2:

The UV spectrum for the major peaks (#1 & 2) of a 5′ FAM–3′ BHQ-3 labeled 30-mer poly-T oligo are shown.

Appendix III: Working with BHQ-3 Labeled Oligos (cont'd.)

5′ BHQ-3 Labeled Oligo Analysis by Reverse Phase HPLC Chromatography

Analysis of oligonucleotides labeled with BHQ-3 at the 5′ end are shown after DNA synthesis. Unpurified synthesis product was analyzed by RP-HPLC. Two major peaks are observed: an earlier peak (Peak 1) corresponding to the DNA alone and a later peak (Peak 2) which corresponds to the oligonucleotide coupled to the BHQ-3 dye. The absorption spectrum shown in bottom figure A corresponds to peak 1 and shows only absorption due to DNA. The absorption spectrum shown in bottom figure B for peak 2 shows the absorption by the DNA and the BHQ-3. **Note:** peak values for each BHQ dye may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis.

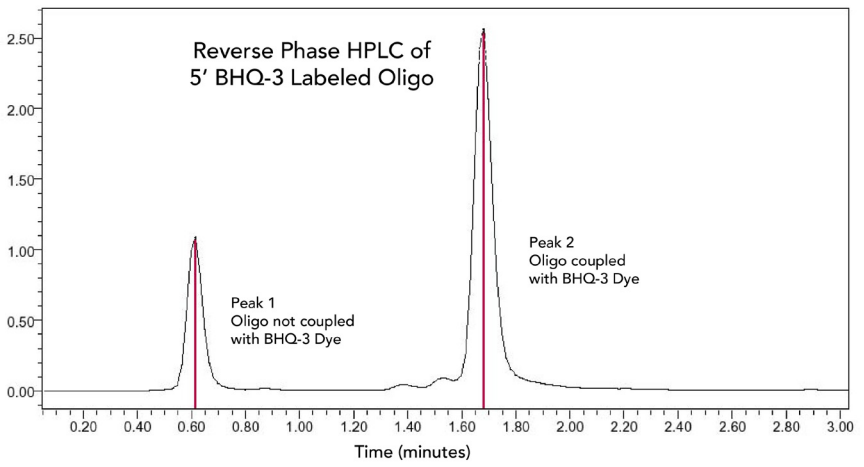


Figure 1:

Reverse Phase HPLC Analysis of 5′ BHQ-3-labeled 10-mer poly-T oligo. The full chromatogram was extracted at 254 nm. Data was collected with a Waters 996 photodiode array detector.

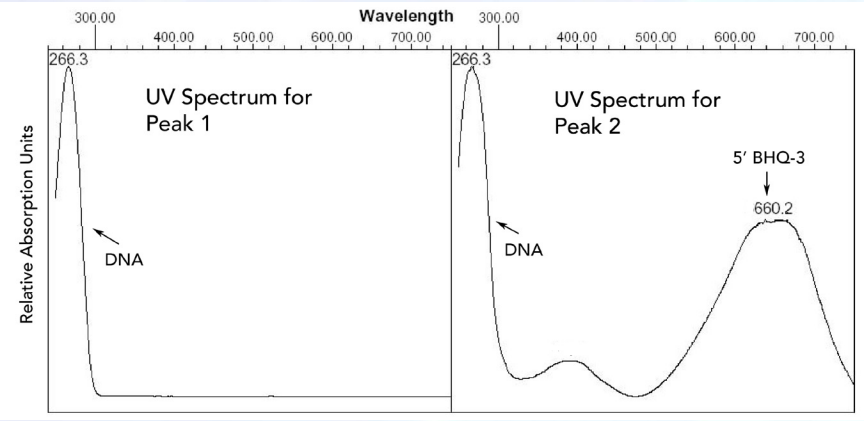


Figure 2:

The UV absorption spectra for the major peaks (#1 & 2) of a 5′ BHQ-3-labeled 10-mer poly-T oligo are shown.

Appendix III: Working with BHQ-3 Labeled Oligos (cont'd.)

3′ BHQ-3 Labeled Oligo Analysis by Anion Exchange HPLC Chromatography

Analysis of oligonucleotides labeled with BHQ-3 at the 3′ end are shown after DNA synthesis. Unpurified synthesis product was analyzed by AX-HPLC. Two major peaks are observed: an earlier peak corresponding to impurities commonly associated with cleavage and deprotection, and a later peak which corresponds to the oligonucleotide coupled to the BHQ-3 dye. The absorption spectrum shown in bottom Figure 2 for Peak 1 shows absorption by the DNA and 3′ BHQ-3 dye. The absorption spectrum shown in bottom Figure 2 for Peak 2 also shows the absorption by the DNA and 3′ BHQ-3 dye. **Note:** peak values for each BHQ dye may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis.

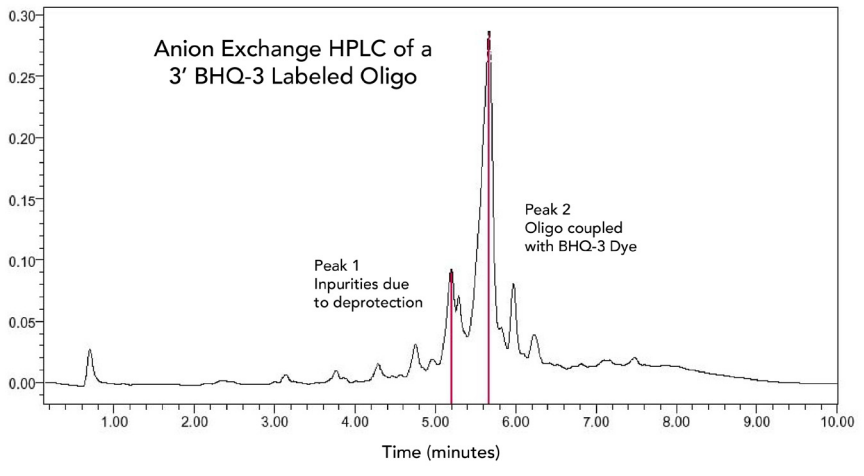


Figure 1:

Anion Exchange HPLC Analysis of a 3′ BHQ-3-labeled 10-mer poly-T oligo. The full chromatogram was extracted at 254 nm. Data was collected with a Waters 996 photodiode array detector.

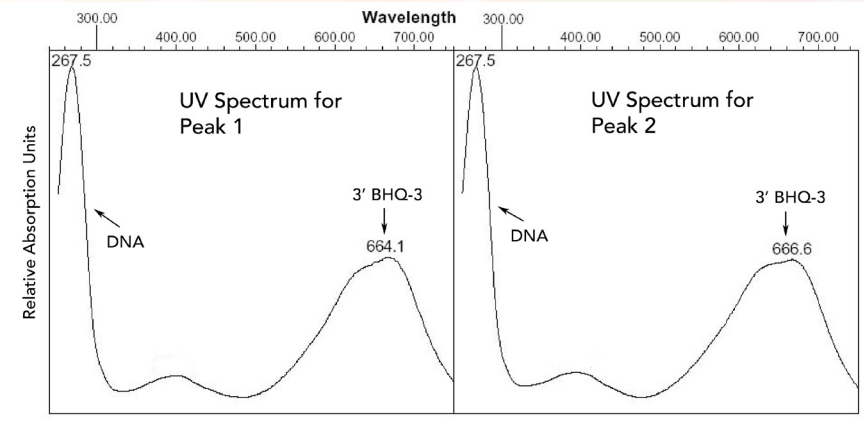


Figure 2:

The UV spectra for the major peaks (#1 and #2) of a 3′ BHQ-3-labeled 10-mer poly-T oligo are shown.

Appendix III: Working with BHQ-3 Labeled Oligos (cont'd.)

3′ BHQ-3 Labeled Oligo Analysis by Reverse Phase HPLC Chromatography

Analysis of oligonucleotides labeled with BHQ-3 at the 3′ end are shown after DNA synthesis. Unpurified synthesis product was analyzed by RP-HPLC. Four peaks are noted: peak 1 correspond to unlabeled DNA; peak 2 corresponds to impurities commonly associated with cleavage and deprotection; peak 3 is due to the oligonucleotide coupled to the BHQ-3 dye; and peak 4 corresponds to uncoupled BHQ-3 dye. Absorption spectra corresponding to each peak are shown in the bottom figure. Note: peak values for each BHQ dye may differ slightly from published values resulting from differences in experimental conditions used in HPLC analysis.

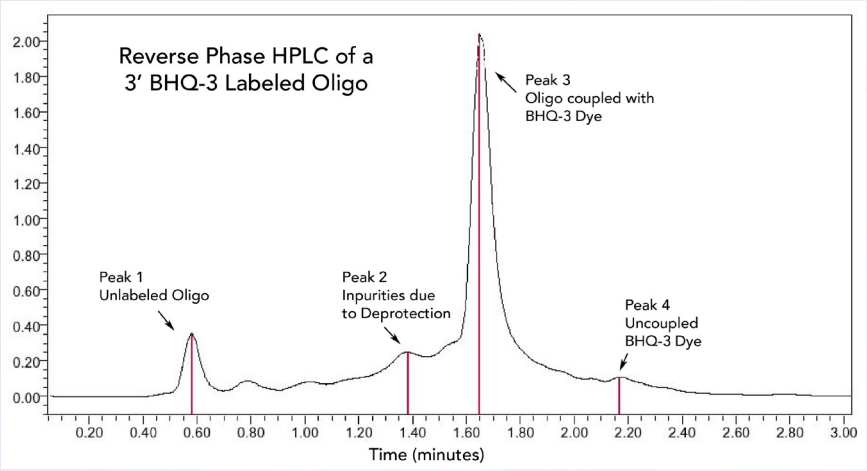


Figure 1:

RP-HPLC Analysis of a 3′ BHQ-3-labeled 10-mer poly-T oligo. The full chromatogram was extracted at 254 nm. Data was collected with a Waters 996 photodiode array detector.

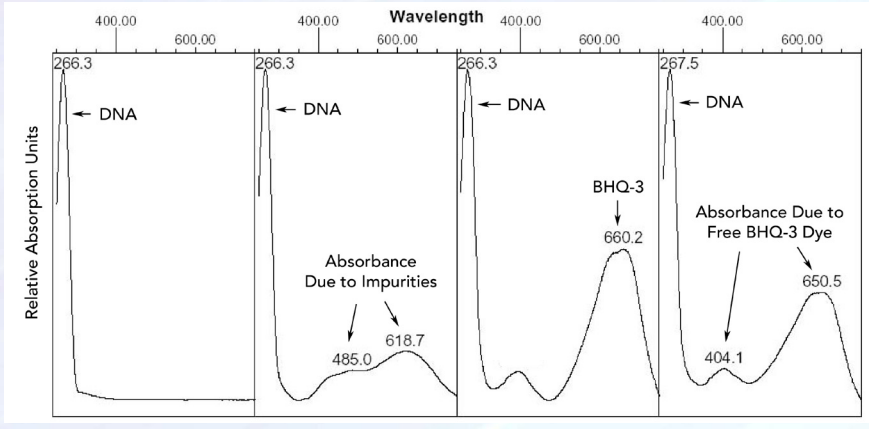


Figure 2:

The UV absorption spectra for the major peaks of a 3′ BHQ-3-labeled 10-mer poly-T oligo are shown.

Appendix IV: BHQ Fragmentation by MALDI-TOF MS

Oligonucleotides labeled with BHQ dyes are readily analyzed by MALDI-TOF mass spectroscopy. The molecular ion peak for the oligo-BHQ conjugate is usually accompanied by a peak at lower m/z. This peak results from fragmentation of the BHQ dye and corresponds to the mass of the oligo plus that of the dye fragment still attached to the oligo (**Figure 1**). Typical results for oligos labeled with each dye are shown in the spectra below (**Figure 2**).

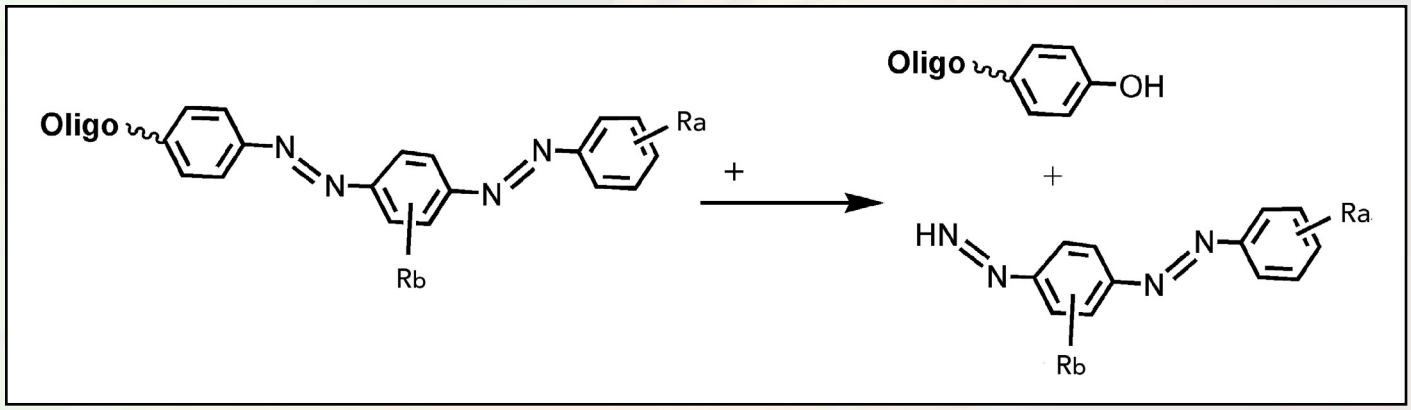


Figure 1:

Fragmentation of BHQ Dyes

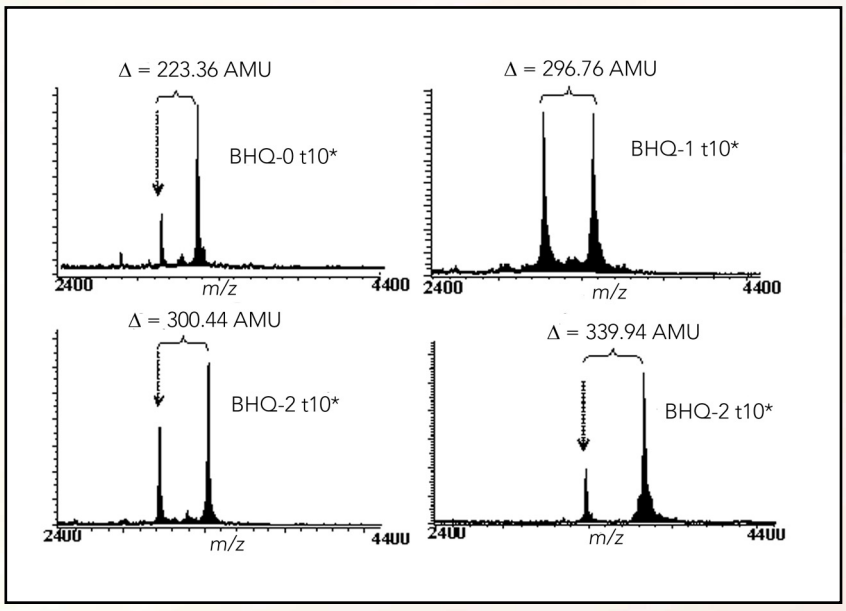


Figure 2:

Mass spectra for the four BHQ Dyes: Bhq-0, BHQ-1, BHQ-2 and BHQ-3. *t10 refers to a 10-mer oligo comprised of only T nucleotides.

Appendix V: Cleavage and Deprotection Conditions for BHQ Dyes

Cleavage and Deprotection Conditions Chart

	Cleavage	Deprotection*
FAM/BHQ-1	NH_4OH, 30min @60°C	NH_4OH, 2 hours @ 60°C
TET/BHQ-1	NH_4OH, 30min @60°C	NH_4OH, 2 hours @ 60°C
HEX-BHQ-1	NH_4OH, 30min @60°C	NH_4OH, 2 hours @ 60°C
T Amine/BHQ-1	NH_4OH, 30min @60°C	NH_4OH, 2 hours @ 60°C
TAMRA/BHQ-2	TAMRA cocktail, 1 hour at room temp.	6 hours at 60°C
Quasar-570/BHQ-2	NH_4OH, 30min @60°C	NH_4OH, 2 hours @ 60°C
T Amine/BHQ-2	NH_4OH, 30min @60°C	NH_4OH, 2 hours @ 60°C
Cy5/BHQ-3[1]	NH_4OH, 40-45 min. @ 60°C (Cleavage and deprotection are performed in a single step)	
*Deprotection times assume fast-deprotecting amidites are being used. Increase times based on experience.		

Standard Deprotection vs. Fast Deprotection Conditions Chart

Synthesis Systems			Compatibility of Deprotection Conditions with Dual-Labeled Oligos:			
Standard Protection:			FAM—BHQ-1	TAM—BHQ-2	Quasar 570—BHQ-2	Quasar 670—BHQ-3[1] (or BHQ-2)
A^{Bz}, C^{Bz}, G^{iBu}, T						
Reagent	Temp.	Time				
NH_4OH	60°C	4h	Yes	No	Yes	No
TBA*	60°C	15h	N/A	Yes	Yes	No
NH_4OH	Room Temp.	18h	Yes	No	Yes	No
Fast Deprotection:						
A^{Bz}, C^{Ac} (or PAC), G^{DMF} (or PAC),T						
Reagent	Temp.	Time				
NH_4OH	60°C	1 h	Yes	No	Yes	Yes
TBA*	60°C	6h	N/A	Yes	Yes	No
NH_4OH	Room Temp.	12h	Yes	No	Yes	Yes

*TBA= t-butylamine/water (1:3)

[1] K_2CO_3 and TBA Deprotection systems are NOT compatible with BHQ-3: BHQ-1 and BHQ-2 can be used with most deprotection systems. BHQ-3 is incompatible with some of the mild deprotection systems (it degrades in K_2CO_3 and TBA).

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The Black Hole Quencher dye technology is protected by U.S. patents and continuations numbered 7,019,129, 7,019,129 B1 and 7,019,312 B2, and the CAL Fluor dye technology is protected by U.S. Patent 7,344,701 issued to Biosearch Technologies, Inc. The Quasar dye technology is covered by U.S.P.T.O. patent application number US2005/0214833A1. The Pulsar dye technology is covered by U.S.P.T.O. patent application US2004/0146895A1.

Black Hole Quencher, CAL Fluor, Quasar and Pulsar dyes for incorporation into dual-labeled fluorogenic probes are available only through Biosearch Technologies, Inc. and selected licensed vendors.

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Index

Categorical Index, cont'd.

Categorical Index, cont'd.

Categorical Index, cont'd.

U

V

W

X

Y

Product Catalog Numbers Sorted Alphabetically by Product

BNS-5026	(5 and 6)-FAM, Mixed Isomers Amidite
BNS-5027	(5 and 6)-TAMRA, Mixed Isomers Amidite
BNS-5010	5′ Phosphate Amidite II
BNS-5009	5′ Phosphorylating Amidite
BNS-5024	5-FAM, Single Isomer Amidite
RD-5025	6-FAM T10 Calibration Standard
BNS-5025	6-FAM, Single Isomer Amidite
BNS-5047	6-FAM, Single Isomer T Amidite (Fluorescein T Amidite)
SCG5-5017	6-FAM-Phos-CPG SuperColumn; 500 Å
CG5-5017	6-FAM-Phos-CPG Synthesis Column; 500 Å
BG1-5017A	6-FAM-Phos-CPG; 1000 Å
BG5-5017B	6-FAM-Phos-CPG; 500 Å
BNS-5032	6-HEX, Single Isomer 5′ Amidite
SCG5-5012	5-TAMRA-Suc-CPG, Single Isomer SuperColumn; 500 Å
CG5-5012	5-TAMRA-Suc-CPG, Single Isomer Synthesis Column; 500 Å
BG5-5012	5-TAMRA-Suc-CPG; 500 Å
SCG5-5008	6-TAMRA-Phos-CPG, Single Isomer SuperColumn; 500 Å
CG5-5008	6-TAMRA-Phos-CPG, Single Isomer Synthesis Column; 500 Å
CG1-5008	6-TAMRA-Phos-CPG, Single Isomer Synthesis Column; 1000 Å
BG5-5008B	6-TAMRA-Phos-CPG; 500 Å
BG1-5008B	6-TAMRA-Phos-CPG; 1000 Å
BNS-5027B	6-TAMRA, Single Isomer 5′ Amidite
BNS-5060B	6-TAMRA-C12, Single Isomer 5′ Amidite
BNS-5033	6-TET, Single Isomer 5′ Amidite
BNS-5039	Amino Modifier C12 MMT Amidite
BNS-5015	Amino Modifier C6 MMT Amidite
BNS-5017	Amino Modifier C6 TFA 5′ Amidite
SCG5-5010	Amino Modifier C6 DMT-T-Phos-CPG SuperColumn; 500 Å
CG5-5010	Amino Modifier C6 DMT-T-Phos-CPG Synthesis Column; 500 Å
BG5-5010	Amino Modifier C6 DMT-T-Phos-CPG; 500 Å
CG5-5009	Amino Modifier C6 DMT-T-Suc-CPG Synthesis Column; 500 Å
BG5-5009	Amino Modifier C6 DMT-T-Suc-CPG; 500 Å
BNS-5040	Amino Modifier C6 T Amidite
SCG1-5002	Amino Modifier Suc-CPG SuperColumn; 1000 Å
CG1-5002	Amino Modifier Suc-CPG Synthesis Column; 1000 Å
CG5-5002	Amino Modifier Suc-CPG Synthesis Column; 500 Å
BG1-5002	Amino Modifier Suc-CPG; 1000 Å
BG5-5002	Amino Modifier Suc-CPG; 500 Å
BNS-5044	Amino Modifier TEG mdC DMT Amidite
BG1-2000	Aminopropyl CPG; 1000 Å
BG4-2000	Aminopropyl CPG; 1400 Å
BG2-2000	Aminopropyl CPG; 2000 Å
BG3-2000	Aminopropyl CPG; 300 Å
BG5-2000	Aminopropyl CPG; 500 Å
CG1-1418	B Mix Synthesis Column; 1000 Å
BG1-5040G	BHQ-0 CPG; 1000 Å
BG5-5040G	BHQ-0 CPG; 500 Å
SCG5-5040G	BHQ-0 SuperColumn; 500 Å
CG5-5040G	BHQ-0 Synthesis Column; 500 Å
BNS-5051N	BHQ-1 Amidite
BG1-5041G	BHQ-1 CPG; 1000 Å
BG5-5041G	BHQ-1 CPG; 500 Å
BNS-5051	BHQ-1 DMT Amidite
SCG5-5041G	BHQ-1 SuperColumn; 500 Å
CG1-5041G	BHQ-1 Synthesis Column; 1000 Å
CG5-5041G	BHQ-1 Synthesis Column; 500 Å
BNS-5051T	BHQ-1 T Linker Amidite
BNS-5052N	BHQ-2 Amidite
BG1-5042G	BHQ-2 CPG; 1000 Å
BG5-5042G	BHQ-2 CPG; 500 Å
BNS-5052	BHQ-2 DMT Amidite
SCG5-5042G	BHQ-2 SuperColumn; 500 Å
CG1-5042G	BHQ-2 Synthesis Column; 1000 Å

Product Catalog Numbers Sorted Alphabetically by Product, cont'd.

CG5-5042G	BHQ-2 Synthesis Column; 500 Å
BNS-5052T	BHQ-2 T Linker Amidite
BNS-5053N	BHQ-3 Amidite
BG5-5043G	BHQ-3 CPG; 500 Å
BNS-5053	BHQ-3 DMT Amidite
SCG5-5043G	BHQ-3 SuperColumn; 500 Å
CG5-5043G	BHQ-3 Synthesis Column; 500 Å
BNS-5021	Biotin 5' Amidite
SCG1-5004	Biotin-C3-Suc-CPG SuperColumn; 1000 Å
CG1-5004	Biotin-C3-Suc-CPG Synthesis Column; 1000 Å
BG1-5004	Biotin-C3-Suc-CPG; 1000 Å
BNS-5022	Biotin-C6-T-5' Amidite
BNS-5021A	Biotin-Pip-5' Amidite
BNS-5080	CAL Fluor Gold 540 Amidite
BNS-5081	CAL Fluor Orange 560 Amidite
BNS-5081T	CAL Fluor Orange 560 C6 T Amidite
BG5-5081	CAL Fluor Orange 560 CPG, 500 Å
CG5-5081	CAL Fluor Orange 560 Synthesis Column, 500 Å
BNS-5083	CAL Fluor Red 590 Amidite
BNS-5082	CAL Fluor Red 610 Amidite
BNS-5082T	CAL Fluor Red 610 C6 T Amidite
BNS-5084	CAL Fluor Red 635 Amidite
CG1-1419	D Mix Synthesis Column; 1000 Å
BG1-1000i	dA(Bz) CPG, inverse linkage; 1000 Å
BG5-1000i	dA(Bz) CPG, inverse linkage; 500 Å
BG1-1000Q	dA(Bz) CPG, Q-linker; 1000 Å
BG1-1000	dA(Bz) CPG; 1000 Å
BG4-1000	dA(Bz) CPG; 1400 Å
BG2-1000	dA(Bz) CPG; 2000 Å
BG5-1000	dA(Bz) CPG; 500 Å
SCG1-1000Q	dA(Bz) SuperColumn, Q-linker; 1000 Å
SCG1-1000	dA(Bz) SuperColumn; 1000 Å
CG1-1000i	dA(Bz) Synthesis Column, inverse linkage; 1000 Å
CG1-1000Q	dA(Bz) Synthesis Column, Q-linker; 1000 Å
CG1-1000	dA(Bz) Synthesis Column; 1000 Å
CG4-1000	dA(Bz) Synthesis Column; 1400 Å
CG2-1000	dA(Bz) Synthesis Column; 2000 Å
CG5-1000	dA(Bz) Synthesis Column; 500 Å
CG5-5026	Dabcyl-C3-Suc-CPG Synthesis Column; 500 Å
BG5-5026	Dabcyl-C3-Suc-CPG; 500 Å
SCG5-5025S	Dabcyl-Suc-CPG SuperColumn; 500 Å
CG5-5025S	Dabcyl-Suc-CPG Synthesis Column; 500 Å
BG1-5025S	Dabcyl-Suc-CPG; 1000 Å
BG5-5025S	Dabcyl-Suc-CPG; 500 Å
BNS-5061	Dabsyl Amidite (T Linker Arm)
SCG1-1100	dC(Bz) SuperColumn; 1000 Å
BG1-1100	dC(Bz) CPG; 1000 Å
CG1-1100	dC(Bz) Synthesis Column; 1000 Å
BG4-1100	dC(Bz) CPG; 1400 Å
CG4-1100	dC(Bz) Synthesis Column; 1400 Å
CG2-1100	dC(Bz) Synthesis Column; 2000 Å
CG5-1100	dC(Bz) Synthesis Column; 500 Å
BG1-1100i	dC(Ac) CPG, inverse linkage; 1000 Å
BG5-1100i	dC(Ac) CPG, inverse linkage; 500 Å
BG1-1100Q	dC(Ac) CPG, Q-linker; 1000 Å
BG1-1100A	dC(Ac) CPG; 1000 Å
BG4-1100A	dC(Ac) CPG; 1400 Å
BG2-1100A	dC(Ac) CPG; 2000 Å
BG5-1100A	dC(Ac) CPG; 500 Å
SCG1-1100Q	dC(Ac) SuperColumn, Q-linker; 1000 Å
SCG1-1100A	dC(Ac) SuperColumn; 1000 Å
CG1-1100i	dC(Ac) Synthesis Column, inverse linkage; 1000 Å
CG1-1100Q	dC(Ac) Synthesis Column, Q-linker; 1000 Å
CG1-1100A	dC(Ac) Synthesis Column; 1000 Å
CG4-1100A	dC(Ac) Synthesis Column; 1400 Å
CG2-1100A	dC(Ac) Synthesis Column; 2000 Å
CG5-1100A	dC(Ac) Synthesis Column; 500 Å
BG1-1200Q	dG(dmf) CPG, Q-linker; 1000 Å
BG1-1200F	dG(dmf) CPG; 1000 Å

Product Catalog Numbers Sorted Alphabetically by Product, cont'd.

SCG1-1200Q	dG(dmf) SuperColumn, Q-linker; 1000 Å
SCG1-1200F	dG(dmf) SuperColumn; 1000 Å
CG1-1200Q	dG(dmf) Synthesis Column, Q-linker; 1000 Å
CG1-1200F	dG(dmf) Synthesis Column; 1000 Å
BG1-1200i	dG(iBu) CPG, inverse linkage; 1000 Å
BG5-1200i	dG(iBu) CPG, inverse linkage; 500 Å
BG1-1200	dG(iBu) CPG; 1000 Å
BG4-1200	dG(iBu) CPG; 1400 Å
BG2-1200	dG(iBu) CPG; 2000 Å
BG5-1200	dG(iBu) CPG; 500 Å
SCG1-1200	dG(iBu) SuperColumn; 1000 Å
CG1-1200i	dG(iBu) Synthesis Column, inverse linkage; 1000 Å
CG1-1200	dG(iBu) Synthesis Column; 1000 Å
CG4-1200	dG(iBu) Synthesis Column; 1400 Å
CG2-1200	dG(iBu) Synthesis Column; 2000 Å
CG5-1200	dG(iBu) Synthesis Column; 500 Å
BNS-5030	dI Amidite
BG1-5015	dI CPG; 1000 Å
CG1-5015	dI Synthesis Column; 1000 Å
SCG1-5000	DMT-Phosphate-Suc-CPG SuperColumn; 1000 Å
CG1-5000	DMT-Phosphate-Suc-CPG Synthesis Column; 1000 Å
BG1-5000	DMT-Phosphate-Suc-CPG; 1000 Å
BG5-5000	DMT-Phosphate-Suc-CPG; 500 Å
CL-1501	DNA Synthesis Column, Large, Empty
CL-1502	DNA Synthesis Column, Small, Empty
BNS-5031	dU Amidite
BG1-5016	dU CPG; 1000 Å
CG1-5016	dU Synthesis Column; 1000 Å
BNS-5047	Fluorescein T Amidite (6-FAM, Single Isomer T Amidite)
FR-1501	Frit, Column, 1/16 in. x 0.163
FR-1502	Frit, Column, 1/8 in. x 0.163
CG1-1415	H Mix Synthesis Column; 1000 Å
CG1-1413	K Mix Synthesis Column; 1000 Å
CG1-1412	M Mix Synthesis Column; 1000 Å
CL-1504	Male Tapered Luer Coupler
MP-1602	MicroPure II Column
MS-2000	MicroSync II Solvent Resistant Vacuum Manifold, Complete System
MS-1036	MicroSync II Luer Plugs
MS-2015	MicroSync II Upper Gasket, Silicone
MS-2016	MicroSync II Lower Gasket, Silicone
MS-2020	MicroSync II Vacuum Box, HDPE
MS-2025	MicroSync II Vacuum Box Cover, Aluminum
MS-2031	MicroSync II Vacuum Line, PP, 1/4 in. ID
MS-2032	MicroSync II Straight Connect Fitting
MSP-1001	MicroSync II Vacuum Plate, Aluminum; 96 holes X 0.156 in. (Luer)
BG1-1400	N Mix CPG; 1000 Å
SCG1-1400F	N Mix SuperColumn; 1000 Å
CG1-1400	N Mix Synthesis Column; 1000 Å
BG1-5070	Pulsar 650 CPG, 1000 Å
BG5-5070	Pulsar 650 CPG, 500 Å
SCG5-5070	Pulsar 650 Super Column, 500 Å
SCG1-5070	Pulsar 650 SuperColumn, 1000 Å
CG1-5070	Pulsar 650 Synthesis Column, 1000 Å
CG5-5070	Pulsar 650 Synthesis Column, 500 Å
BNS-5063	Quasar 570 Amidite
BNS-5063T	Quasar 570 C6 T Amidite
BG5-5063	Quasar 570 CPG, 500 Å
SCG5-5063	Quasar 570 Super Column, 500 Å
CG5-5063	Quasar 570 Synthesis Column, 500 Å
BNS-5065	Quasar 670 Amidite
BNS-5065T	Quasar 670 C6 T Amidite
BG5-5065	Quasar 670 CPG, 500 Å
SCG5-5065	Quasar 670 Super Column, 500 Å
CG5-5065	Quasar 670 Synthesis Column, 500 Å
BNS-5067	Quasar 705 Amidite
BG5-5067	Quasar 705 CPG, 500 Å
SCG5-5067	Quasar 705 Super Column, 500 Å
CG5-5067	Quasar 705 Synthesis Column, 500 Å
CG1-1414	R Mix Synthesis Column; 1000 Å

Product Catalog Numbers Sorted Alphabetically by Product, cont'd.

CG5-5021	ROX-Phos-CPG Synthesis Columns; 500 Å
BG5-5021	ROX-Phos CPG; 500 Å
CG1-1416	S Mix Synthesis Column; 1000 Å
BNS-5036	Spacer 18 Amidite
BNS-5035	Spacer 9 Amidite
SCG1-5014	Spacer C16 CPG SuperColumn; 1000 Å
BG1-5014	Spacer C16 CPG; 1000 Å
BG5-5019	Spacer C2 CPG; 500 Å
BNS-5041	Spacer C3 Amidite
SCG1-5011	Spacer C3 CPG SuperColumn; 1000 Å
CG1-5011	Spacer C3 CPG Synthesis Column; 1000 Å
BG1-5011	Spacer C3 CPG; 1000 Å
BNS-5034	Spacer C6 Amidite
SCG1-5013	Spacer C6 CPG SuperColumn; 1000 Å
CG1-5013	Spacer C6 CPG Synthesis Column; 1000 Å
BG1-5013	Spacer C6 CPG; 1000 Å
SP-1000	SuperPure Column - ≥ 50 nmol
SP-2000	SuperPure *Plus* Column - ≥ 200 nmol
BG1-1300i	T CPG, inverse linkage; 1000 Å
BG5-1300i	T CPG, inverse linkage; 500 Å
BG1-1300Q	T CPG, Q-linker; 1000 Å
BG1-1300	T CPG; 1000 Å
BG4-1300	T CPG; 14000 Å
BG2-1300	T CPG; 2000 Å
BG5-1300	T CPG; 500 Å
SCG1-1300Q	T SuperColumn, Q-linker; 1000 Å
SCG1-1300	T SuperColumn; 1000 Å
CG1-1300i	T Synthesis Column, inverse linkage; 1000 Å
CG1-1300Q	T Synthesis Column, Q-linker; 1000 Å
CG1-1300	T Synthesis Column; 1000 Å
CG4-1300	T Synthesis Column; 1400 Å
CG2-1300	T Synthesis Column; 2000 Å
CG5-1300	T Synthesis Column; 500 Å
BNS-5019	Thiol-Modifier-C6-5' Amidite
BNS-5042	Thiol-Modifier-C6-S-S-5' Amidite
BG1-5003	Thiol-Modifier-C6-S-S-CPG; 1000 Å
BG1-3400	Universal Support CPG; 1000 Å
BG5-3400	Universal Support CPG; 500 Å
SCG1-3400	Universal Support SuperColumn; 1000 Å
SCG5-3400	Universal Support SuperColumn; 500 Å
CG1-3400	Universal Support Synthesis Column; 1000 Å
CG1-1410	V Mix Synthesis Column; 1000 Å
CG1-1417	W Mix Synthesis Column; 1000 Å
CG1-1411	Y Mix Synthesis Column; 1000 Å

Product Catalog Numbers Sorted Alphabetically by Catalog Number

BG1-1000	dA(Bz) CPG; 1000 Å
BG1-1000i	dA(Bz) CPG, inverse linkage; 1000 Å
BG1-1000Q	dA(Bz) CPG, Q-linker; 1000 Å
BG1-1100	dC(Bz) CPG; 1000 Å
BG1-1100A	dC(Ac) CPG; 1000 Å
BG1-1100i	dC(Ac) CPG, inverse linkage; 1000 Å
BG1-1100Q	dC(Ac) CPG, Q-linker; 1000 Å
BG1-1200	dG(iBu) CPG; 1000 Å
BG1-1200F	dG(dmf) CPG; 1000 Å
BG1-1200i	dG(iBu) CPG, inverse linkage; 1000 Å
BG1-1200Q	dG(dmf) CPG, Q-linker; 1000 Å
BG1-1300	T CPG; 1000 Å
BG1-1300i	T CPG, inverse linkage; 1000 Å
BG1-1300Q	T CPG, Q-linker; 1000 Å
BG1-1400	N Mix CPG; 1000 Å
BG1-2000	Aminopropyl CPG; 1000 Å
BG1-3400	Universal Support CPG; 1000 Å
BG1-5000	DMT-Phosphate-Suc-CPG; 1000 Å
BG1-5002	Amino Modifier Suc-CPG; 1000 Å
BG1-5003	Thiol-Modifier-C6-S-S-CPG; 1000 Å
BG1-5004	Biotin-C3-Suc-CPG; 1000 Å
BG1-5008B	6-TAMRA-Phos-CPG; 1000 Å
BG1-5011	Spacer C3 CPG; 1000 Å
BG1-5013	Spacer C6 CPG; 1000 Å
BG1-5014	Spacer C16 CPG; 1000 Å
BG1-5015	dI CPG; 1000 Å
BG1-5016	dU CPG; 1000 Å
BG1-5017A	6-FAM-Phos-CPG; 1000 Å
BG1-5025S	Dabcyl-Suc-CPG; 1000 Å
BG1-5040G	BHQ-0 CPG; 1000 Å
BG1-5041G	BHQ-1 CPG; 1000 Å
BG1-5042G	BHQ-2 CPG; 1000 Å
BG1-5070	Pulsar 650 CPG, 1000 Å
BG2-1000	dA(Bz) CPG; 2000 Å
BG2-1100A	dC(Ac) CPG; 2000 Å
BG2-1200	dG(iBu) CPG; 2000 Å
BG2-1300	T CPG; 2000 Å
BG2-2000	Aminopropyl CPG; 2000 Å
BG3-2000	Aminopropyl CPG; 300 Å
BG4-1000	dA(Bz) CPG; 1400 Å
BG4-1100	dC(Bz) CPG; 1400 Å
BG4-1100A	dC(Ac) CPG; 1400 Å
BG4-1200	dG(iBu) CPG; 1400 Å
BG4-1300	T CPG; 14000 Å
BG4-2000	Aminopropyl CPG; 1400 Å
BG5-1000	dA(Bz) CPG; 500 Å
BG5-1000i	dA(Bz) CPG, inverse linkage; 500 Å
BG5-1100A	dC(Ac) CPG; 500 Å
BG5-1100i	dC(Ac) CPG, inverse linkage; 500 Å
BG5-1200	dG(iBu) CPG; 500 Å
BG5-1200i	dG(iBu) CPG, inverse linkage; 500 Å
BG5-1300	T CPG; 500 Å
BG5-1300i	T CPG, inverse linkage; 500 Å
BG5-2000	Aminopropyl CPG; 500 Å
BG5-3400	Universal Support CPG; 500 Å
BG5-5000	DMT-Phosphate-Suc-CPG; 500 Å
BG5-5002	Amino Modifier Suc-CPG; 500 Å
BG5-5008B	6-TAMRA-Phos-CPG; 500 Å
BG5-5009	Amino Modifier C6 DMT-T-Suc-CPG; 500 Å
BG5-5010	Amino Modifier C6 DMT-T-Phos-CPG; 500 Å
BG5-5012	5-TAMRA-Suc-CPG; 500 Å
BG5-5017B	6-FAM-Phos-CPG; 500 Å
BG5-5019	Spacer C2 CPG; 500 Å
BG5-5021	ROX-Phos CPG; 500 Å
BG5-5025S	Dabcyl-Suc-CPG; 500 Å
BG5-5026	Dabcyl-C3-Suc-CPG; 500 Å
BG5-5040G	BHQ-0 CPG; 500 Å
BG5-5041G	BHQ-1 CPG; 500 Å
BG5-5042G	BHQ-2 CPG; 500 Å
BG5-5043G	BHQ-3 CPG; 500 Å
BG5-5063	Quasar 570 CPG, 500 Å
BG5-5065	Quasar 670 CPG, 500 Å
BG5-5067	Quasar 705 CPG, 500 Å

Product Catalog Numbers Sorted Alphabetically by Catalog Number, cont'd.

BG5-5070	Pulsar 650 CPG, 500 Å
BG5-5081	CAL Fluor Orange 560 CPG, 500 Å
BNS-5009	5' Phosphorylating Amidite
BNS-5010	5' Phosphate Amidite II
BNS-5015	Amino Modifier C6 MMT Amidite
BNS-5017	Amino Modifier C6 TFA 5' Amidite
BNS-5019	Thiol-Modifier-C6-5' Amidite
BNS-5021	Biotin 5' Amidite
BNS-5021A	Biotin-Pip-5' Amidite
BNS-5022	Biotin-C6-T-5' Amidite
BNS-5024	5-FAM, Single Isomer Amidite
BNS-5025	6-FAM, Single Isomer Amidite
BNS-5026	(5 and 6)-FAM, Mixed Isomers Amidite
BNS-5027	(5 and 6)-TAMRA, Mixed Isomers Amidite
BNS-5027B	6-TAMRA, Single Isomer 5' Amidite
BNS-5030	dI Amidite
BNS-5031	dU Amidite
BNS-5032	6-HEX, Single Isomer 5' Amidite
BNS-5033	6-TET, Single Isomer 5' Amidite
BNS-5034	Spacer C6 Amidite
BNS-5035	Spacer 9 Amidite
BNS-5036	Spacer 18 Amidite
BNS-5039	Amino Modifier C12 MMT Amidite
BNS-5040	Amino Modifier C6 T Amidite
BNS-5041	Spacer C3 Amidite
BNS-5042	Thiol-Modifier-C6-S-S-5' Amidite
BNS-5044	Amino Modifier TEG mdC DMT Amidite
BNS-5047	6-FAM, Single Isomer T Amidite (Fluorescein T Amidite)
BNS-5047	Fluorescein T Amidite (6-FAM, Single Isomer T Amidite)
BNS-5051	BHQ-1 DMT Amidite
BNS-5051N	BHQ-1 Amidite
BNS-5051T	BHQ-1 T Linker Amidite
BNS-5052	BHQ-2 DMT Amidite
BNS-5052N	BHQ-2 Amidite
BNS-5052T	BHQ-2 T Linker Amidite
BNS-5053	BHQ-3 DMT Amidite
BNS-5053N	BHQ-3 Amidite
BNS-5060B	6-TAMRA-C12, Single Isomer 5' Amidite
BNS-5061	Dabsyl Amidite (T Linker Arm)
BNS-5063	Quasar 570 Amidite
BNS-5063T	Quasar 570 C6 T Amidite
BNS-5065	Quasar 670 Amidite
BNS-5065T	Quasar 670 C6 T Amidite
BNS-5067	Quasar 705 Amidite
BNS-5080	CAL Fluor Gold 540 Amidite
BNS-5081	CAL Fluor Orange 560 Amidite
BNS-5081T	CAL Fluor Orange 560 C6 T Amidite
BNS-5082	CAL Fluor Red 610 Amidite
BNS-5082T	CAL Fluor Red 610 C6 T Amidite
BNS-5083	CAL Fluor Red 590 Amidite
BNS-5084	CAL Fluor Red 635 Amidite
CG1-1000	dA(Bz) Synthesis Column; 1000 Å
CG1-1000i	dA(Bz) Synthesis Column, inverse linkage; 1000 Å
CG1-1000Q	dA(Bz) Synthesis Column, Q-linker; 1000 Å
CG1-1100	dC(Bz) Synthesis Column; 1000 Å
CG1-1100A	dC(Ac) Synthesis Column; 1000 Å
CG1-1100i	dC(Ac) Synthesis Column, inverse linkage; 1000 Å
CG1-1100Q	dC(Ac) Synthesis Column, Q-linker; 1000 Å
CG1-1200	dG(iBu) Synthesis Column; 1000 Å
CG1-1200F	dG(dmf) Synthesis Column; 1000 Å
CG1-1200i	dG(iBu) Synthesis Column, inverse linkage; 1000 Å
CG1-1200Q	dG(dmf) Synthesis Column, Q-linker; 1000 Å
CG1-1300	T Synthesis Column; 1000 Å
CG1-1300i	T Synthesis Column, inverse linkage; 1000 Å
CG1-1300Q	T Synthesis Column, Q-linker; 1000 Å

Product Catalog Numbers Sorted Alphabetically by Catalog Number, cont'd.

CG1-1400	N Mix Synthesis Column; 1000 Å
CG1-1410	V Mix Synthesis Column; 1000 Å
CG1-1411	Y Mix Synthesis Column; 1000 Å
CG1-1412	M Mix Synthesis Column; 1000 Å
CG1-1413	K Mix Synthesis Column; 1000 Å
CG1-1414	R Mix Synthesis Column; 1000 Å
CG1-1415	H Mix Synthesis Column; 1000 Å
CG1-1416	S Mix Synthesis Column; 1000 Å
CG1-1417	W Mix Synthesis Column; 1000 Å
CG1-1418	B Mix Synthesis Column; 1000 Å
CG1-1419	D Mix Synthesis Column; 1000 Å
CG1-3400	Universal Support Synthesis Column; 1000 Å
CG1-5000	DMT-Phosphate-Suc-CPG Synthesis Column; 1000 Å
CG1-5002	Amino Modifier Suc-CPG Synthesis Column; 1000 Å
CG1-5004	Biotin-C3-Suc-CPG Synthesis Column; 1000 Å
CG1-5008	6-TAMRA-Phos-CPG, Single Isomer Synthesis Column; 1000 Å
CG1-5011	Spacer C3 CPG Synthesis Column; 1000 Å
CG1-5013	Spacer C6 CPG Synthesis Column; 1000 Å
CG1-5015	dI Synthesis Column; 1000 Å
CG1-5016	dU Synthesis Column; 1000 Å
CG1-5041G	BHQ-1 Synthesis Column; 1000 Å
CG1-5042G	BHQ-2 Synthesis Column; 1000 Å
CG1-5070	Pulsar 650 Synthesis Column, 1000 Å
CG2-1000	dA(Bz) Synthesis Column; 2000 Å
CG2-1100	dC(Bz) Synthesis Column; 2000 Å
CG2-1100A	dC(Ac) Synthesis Column; 2000 Å
CG2-1200	dG(iBu) Synthesis Column; 2000 Å
CG2-1300	T Synthesis Column; 2000 Å
CG4-1000	dA(Bz) Synthesis Column; 1400 Å
CG4-1100	dC(Bz) Synthesis Column; 1400 Å
CG4-1100A	dC(Ac) Synthesis Column; 1400 Å
CG4-1200	dG(iBu) Synthesis Column; 1400 Å
CG4-1300	T Synthesis Column; 1400 Å
CG5-1000	dA(Bz) Synthesis Column; 500 Å
CG5-1100	dC(Bz) Synthesis Column; 500 Å
CG5-1100A	dC(Ac) Synthesis Column; 500 Å
CG5-1200	dG(iBu) Synthesis Column; 500 Å
CG5-1300	T Synthesis Column; 500 Å
CG5-5002	Amino Modifier Suc-CPG Synthesis Column; 500 Å
CG5-5008	6-TAMRA-Phos-CPG, Single Isomer Synthesis Column; 500 Å
CG5-5009	Amino Modifier C6 DMT-T-Suc-CPG Synthesis Column; 500 Å
CG5-5010	Amino Modifier C6 DMT-T-Phos-CPG Synthesis Column; 500 Å
CG5-5012	5-TAMRA-Suc-CPG, Single Isomer Synthesis Column; 500 Å
CG5-5017	6-FAM-Phos-CPG Synthesis Column; 500 Å
CG5-5021	ROX-Phos-CPG Synthesis Columns; 500 Å
CG5-5025S	Dabcyl-Suc-CPG Synthesis Column; 500 Å
CG5-5026	Dabcyl-C3-Suc-CPG Synthesis Column; 500 Å
CG5-5040G	BHQ-0 Synthesis Column; 500 Å
CG5-5041G	BHQ-1 Synthesis Column; 500 Å
CG5-5042G	BHQ-2 Synthesis Column; 500 Å
CG5-5043G	BHQ-3 Synthesis Column; 500 Å
CG5-5063	Quasar 570 Synthesis Column, 500 Å
CG5-5065	Quasar 670 Synthesis Column, 500 Å
CG5-5067	Quasar 705 Synthesis Column, 500 Å
CG5-5070	Pulsar 650 Synthesis Column, 500 Å
CG5-5081	CAL Fluor Orange 560 Synthesis Column, 500 Å
CL-1501	DNA Synthesis Column, Large, Empty
CL-1502	DNA Synthesis Column, Small, Empty
CL-1504	Male Tapered Luer Coupler
FR-1501	Frit, Column, 1/16 in. x 0.163
FR-1502	Frit, Column, 1/8 in. x 0.163
MP-1602	MicroPure II Column

Product Catalog Numbers Sorted Alphabetically by Catalog Number, cont'd.

MS-2000	MicroSync II Solvent Resistant Vacuum Manifold, Complete System
MS-1036	MicroSync II Luer Plugs
MS-2015	MicroSync II Upper Gasket, Silicone
MS-2016	MicroSync II Lower Gasket, Silicone
MS-2020	MicroSync II Vacuum Box, HDPE
MS-2025	MicroSync II Vacuum Box Cover, Aluminum
MS-2031	MicroSync II Vacuum Line, PP, 1/4 in. ID
MS-2032	MicroSync II Straight Connect Fitting
MSP-1001	MicroSync II Vacuum Plate, Aluminum; 96 holes X 0.156 in. (Luer)
RD-5025	6-FAM T10 Calibration Standard
SCG1-1000	dA(Bz) SuperColumn; 1000 Å
SCG1-1000Q	dA(Bz) SuperColumn, Q-linker; 1000 Å
SCG1-1100	dC(Bz) SuperColumn; 1000 Å
SCG1-1100A	dC(Ac) SuperColumn; 1000 Å
SCG1-1100Q	dC(Ac) SuperColumn, Q-linker; 1000 Å
SCG1-1200	dG(iBu) SuperColumn; 1000 Å
SCG1-1200F	dG(dmf) SuperColumn; 1000 Å
SCG1-1200Q	dG(dmf) SuperColumn, Q-linker; 1000 Å
SCG1-1300	T SuperColumn; 1000 Å
SCG1-1300Q	T SuperColumn, Q-linker; 1000 Å
SCG1-1400F	N Mix SuperColumn; 1000 Å
SCG1-3400	Universal Support SuperColumn; 1000 Å
SCG1-5000	DMT-Phosphate-Suc-CPG SuperColumn; 1000 Å
SCG1-5002	Amino Modifier Suc-CPG SuperColumn; 1000 Å
SCG1-5004	Biotin-C3-Suc-CPG SuperColumn; 1000 Å
SCG1-5011	Spacer C3 CPG SuperColumn; 1000 Å
SCG1-5013	Spacer C6 CPG SuperColumn; 1000 Å
SCG1-5014	Spacer C16 CPG SuperColumn; 1000 Å
SCG1-5070	Pulsar 650 SuperColumn, 1000 Å
SCG5-3400	Universal Support SuperColumn; 500 Å
SCG5-5008	6-TAMRA-Phos-CPG, Single Isomer SuperColumn; 500 Å
SCG5-5010	Amino Modifier C6 DMT-T-Phos-CPG SuperColumn; 500 Å
SCG5-5012	5-TAMRA-Suc-CPG, Single Isomer SuperColumn; 500 Å
SCG5-5017	6-FAM-Phos-CPG SuperColumn; 500 Å
SCG5-5025S	Dabcyl-Suc-CPG SuperColumn; 500 Å
SCG5-5040G	BHQ-0 SuperColumn; 500 Å
SCG5-5041G	BHQ-1 SuperColumn; 500 Å
SCG5-5042G	BHQ-2 SuperColumn; 500 Å
SCG5-5043G	BHQ-3 SuperColumn; 500 Å
SCG5-5063	Quasar 570 Super Column, 500 Å
SCG5-5065	Quasar 670 Super Column, 500 Å
SCG5-5067	Quasar 705 Super Column, 500 Å
SCG5-5070	Pulsar 650 Super Column, 500 Å
SP-1000	SuperPure Column - ≥ 50 nmol
SP-2000	SuperPure *Plus* Column - ≥ 200 nmol

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