

Figure 4.10 B-1370 fluorescein biotin.

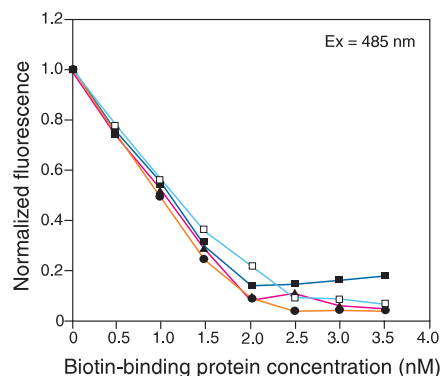


Figure 4.11 Quantitation of biotin-binding sites with 8 nM biotin-4-fluorescein (B-10570). Both the fluorescence and absorbance of biotin-4-fluorescein are quenched upon binding to one of the four biotin-binding sites of streptavidin (S-888, pink), avidin (A-887, A-2667; dark blue), or the streptavidin conjugates of the Alexa Fluor 633 dye (S-21375, orange) and alkaline phosphatase (S-921, light blue). As a result, when a known concentration of biotin-4-fluorescein is added to a known amount of streptavidin, one can quantitate the number of biotin-binding sites.

Our Diaminobenzidine Histochemistry Kit #3 (D-22187, Section 7.6) provides the reagents and a tested protocol for permanent histochemical staining of biotinylated probes.

4.3 Biotin and Desthiobiotin Conjugates

Molecular Probes prepares a wide array of biotin and desthiobiotin conjugates, all of which are included in this section's product list. We will also custom-conjugate biotin, desthiobiotin (DSB-X), fluorophores or other haptens to proteins or other biomolecules of interest. See Custom Immunogen Preparation for more information or contact our Custom and Bulk Sales Department to request a quote.

Fluorescent Biotin Derivatives

Fluorescein Biotin and Biotin-4-Fluorescein

Fluorescein biotin (B-1370, Figure 4.10) was developed by Molecular Probes as an alternative to radioactive biotin for detecting and quantitating biotin-binding sites by either fluorescence or absorbance.¹ A fluorescence polarization-based assay (see Fluorescence Polarization (FP) in Section 1.4) that employs competitive binding of fluorescein biotin to assess the degree of protein biotinylation has been reported.² A similar derivative was used for determining avidin and biotin concentrations by fluorescence depolarization.³ See the technical note Quantitation of Biotin and Avidin for other methods to quantitate avidin and biotin.

Our biotin-4-fluorescein (B-10570) offers a substantially improved method for quantitating biotin-binding sites. Biotin-4-fluorescein binds to avidin much faster than does conventional fluorescein biotin, allowing for rapid analysis.⁴ The strong quenching associated with avidin binding to biotin-4-fluorescein can be used to easily measure the concentration of avidin or streptavidin⁵ (Figure 4.11).

Other Fluorescent Biotin Derivatives

In addition to supplying nonfluorescent biocytin (ϵ -biotinoyl-L-lysine, B-1592, Section 4.2) and desthiobiocytin (ϵ -desthiobiotinoyl-L-lysine, D-20652, Section 4.2), we offer lucifer yellow cadaverine biotin-X⁶ (L-2601), lucifer yellow biocytin⁷ (L-6950), Alexa Fluor 488 biocytin (A-12924), Alexa Fluor 546 biocytin (A-12923), Alexa Fluor 594 biocytin⁷ (A-12922), Oregon Green 488 biocytin⁷ (O-12920) and tetramethylrhodamine biocytin⁷ (T-12921) — reagents that incorporate a fluorophore and biotin moiety in the same molecule. As with fluorescein biotin and biotin-4-fluorescein, which are described above, these reagents can be employed for detecting and quantitating biotin-binding proteins, but we anticipate that their principal use will be as polar cell tracers and as tracers for cell-cell communication (Section 14.3). It has been reported that our lucifer yellow cadaverine biotin-X is well-retained in aldehyde-fixed tissues, even after sectioning, extraction with detergents and several washes.⁸ Because these fluorescent biocytin conjugates contain free primary amines, they should be more efficiently fixed by formaldehyde and glutaraldehyde. Once these probes are fixed, the researcher can choose to detect them directly by fluorescence or indirectly with labeled avidin conjugates (Section 7.6, Table 7.17) or with labeled anti-fluorophore or anti-biotin antibodies (Section 7.4, Table 7.13, Table 7.14).

TECHNICAL NOTE

Custom Immunogen Preparation

Low molecular weight molecules (<2000 daltons) or haptens generally will not elicit an immune response unless conjugated to a carrier protein such as bovine serum albumin (BSA) or keyhole limpet hemocyanin (KLH). Preparing these immunogens often requires introducing reactive groups into the haptens through chemical synthesis. Molecular Probes has considerable experience synthesizing reactive chemical species, including reactive forms of

drugs, natural products and herbicides. In addition to their use for preparing immunogens, these reactive haptens can be used to generate new detection reagents and site-selective probes, as well as affinity matrices for isolating antibodies and receptors. We provide our custom services on an exclusive or nondisclosure basis when requested. Please contact our Custom and Bulk Sales Department for further information.

Biotinylated Dextrans

In addition to the low molecular weight biotinylated tracers described above, Molecular Probes prepares biotinylated versions of a wide variety of dextrans (Figure 4.12, Table 14.4), including dextrans that are double-labeled with fluorophores and biotin moieties for correlated fluorescence and electron microscopy studies. See Section 14.5 for a discussion of the applications of these reagents, particularly as cell tracers.

Biotinylated and DSB-X Biotin-Labeled Proteins

Our biotinylated primary and secondary antibodies, F(ab')₂ fragments, phycobiliproteins and enzymes are invaluable detection reagents for a broad assortment of assays; for more information, see Chapter 6 and Chapter 7. Biotinylated R-phycoerythrin (P-811) and biotinylated horseradish peroxidase (P-917) can be used in combination with an avidin or streptavidin bridge to amplify the detection of biotinylated targets. Biotinylated transferrin (T-23363) can be used to follow the intracellular trafficking of this iron-carrying protein.⁹

Antibody Conjugates of DSB-X Biotin

In addition to our biotinylated antibodies, Molecular Probes has prepared conjugates of several secondary antibodies with DSB-X biotin (Figure 4.1). These are listed in the product list of this section and in Table 7.10. Targets complexed with DSB-X biotin-labeled antibodies can be selectively detected with avidin or streptavidin conjugates or isolated on affinity matrices, including streptavidin agarose (S-951, D-20658; Section 7.6) and Captivate ferrofluid streptavidin superparamagnetic particles (C-21476, Section 7.6), and then rapidly released with D-biotin (B-1595, B-20656; Section 4.2) under extremely gentle conditions (Figure 7.89). See Section 7.6 for a complete description of our unique DSB-X biotin technology.

Zenon Mouse Antibody Labeling Kits

Our exceptional Zenon antibody labeling technology (Section 7.2) includes mouse IgG₁ labeling kits (Z-25052, Z-25053) that effectively permit the rapid and quantitative formation of biotin-XX or DSB-X biotin (desthiobiotin) conjugates of even submicrograms of any mouse IgG₁ that contains an Fc portion (Table 7.1, Figure 7.32). Mouse IgG₁ antibodies to cell-surface proteins that are indirectly labeled with the Zenon One

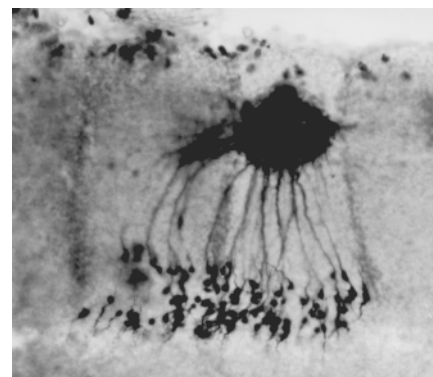


Figure 4.12 Motor neuron in a three-day chick embryo labeled with lysine-fixable biotinylated 3000 MW dextran (BDA-3000, D-7135). Filled neurons were detected with biotinylated horseradish peroxidase (P-917) and diaminobenzidine using standard avidin/streptavidin bridging techniques. Reprinted with permission from *J Neurosci Methods* 50, 95 (1993).

Our Zenon One technology for efficient antibody labeling permits the quantitative labeling of mouse IgG₁ antibodies with either biotin or DSB-X biotin. See Section 7.2 for a complete description of these products.

TECHNICAL NOTE

Quantitation of Biotin and Avidin

The amount of free biotin in solution has been measured by several methods, including a microplate reader-based assay in which free biotin competes with biotinylated bovine serum albumin (BSA) for binding avidin- β -galactosidase,¹ as well as a sensitive fluorometric displacement assay for the biotin-avidin interaction that employs 2,6-ANS² (A-50, Section 13.5). Biotin and low molecular weight biotin derivatives have also been quantitated by their fluorescence enhancement of fluorescein streptavidin (S-869, Section 7.6), a technique employed in an HPLC-based binding assay with a reported sensitivity of 97 pg and 149 pg for biotin and biocytin, respectively.³ We have determined that our Oregon Green 514 conjugate of streptavidin (S-6369, Section 7.6) has an approximately 15-fold increase in fluorescence on binding of biotin, which makes it our most sensitive reagent for biotin determination. In addition, the degree of protein biotinylation has been determined

using fluorescein biotin (B-1370) in a fluorescence polarization assay that can detect about 2–20 nM biotinylated BSA.⁴ Our biotin-4-fluorescein (B-10570) offers a substantially improved method for quantitating biotin-binding sites. Biotin-4-fluorescein binds avidin much faster than conventional fluorescein biotin, allowing for rapid analysis.⁵ The strong quenching associated with avidin binding to biotin-4-fluorescein can be used to easily measure avidin and streptavidin concentrations⁶ (Figure 4.11).

References

1. *Biotechniques* 13, 543 (1992);
2. *Anal Biochem* 151, 178 (1985);
3. *Anal Chem* 67, 1014 (1995);
4. *Clin Chem* 40, 2112 (1994);
5. *Biochim Biophys Acta* 1427, 33 (1999);
6. *Biochim Biophys Acta* 1427, 44 (1999).

DSB-X Biotin Mouse IgG₁ Labeling Kit (Z-25053) potentially can be used to selectively capture and release viable rare cells from a complex mixture with our Captivate ferrofluid streptavidin (C-21476, Section 7.6). The Zenon One technology is described in greater detail in Section 7.2.

DSB-X Biotin Agarose

DSB-X biotin agarose is the matrix provided in our DSB-X Bioconjugate Isolation Kit #2 (D-20659). The moderate affinity of avidin and streptavidin conjugates for DSB-X biotin agarose permits their selective isolation from solutions and facile release by either D-biotin or D-desthiobiotin. Protein–protein conjugations of avidins to enzymes, antibodies and phycobiliproteins can be separated from any unconjugated protein labels by adsorption onto DSB-X agarose and then released with a biotin derivative (Figure 7.95). The DSB-X Bioconjugate Isolation Kit #2 includes:

- DSB-X biotin agarose
- Separate solutions of D-biotin and D-desthiobiotin for elution of the column
- Unfilled chromatography columns
- A detailed protocol for isolation and release of (strept)avidin conjugates

Our DSB-X biotin agarose has a binding capacity of approximately 9 mg (~170 nmol) streptavidin per milliliter of sedimented gel. Solutions of D-biotin and D-desthiobiotin are also available separately (B-20656, D-20657; Section 4.2).

Biotinylated Microspheres

Biotinylated FluoSpheres microspheres have significant potential for signal-amplification techniques, as described in Section 6.5. Like biotinylated R-phycoerythrin (P-811, see above), they can be used with bridging techniques to detect biotinylated targets. Our intensely fluorescent FluoSpheres microspheres are much brighter and more photostable than low molecular weight dye conjugates.

ChromaTide Biotin-11-dUTP

Incorporation of ChromaTide biotin-11-dUTP (C-11411, Figure 4.8) by various enzymes has been extensively used for preparing biotinylated DNA probes, as described in Section 8.2. ChromaTide biotin-11-dUTP is also useful for biotinylating damaged DNA in the TUNEL assay of apoptosis (Section 15.5). Following incorporation of ChromaTide biotin-11-dUTP into DNA, the biotin derivative can be detected with one of our many fluorescent avidin derivatives (Section 7.6, Table 7.17).

Biotinylated Site-Selective Probes

Biotin conjugates of moderately low molecular weight ligands permit amplified detection of ligand binding. They may also be useful for immobilizing receptor ligands on streptavidin agarose (S-951, D-20658), CaptAvidin agarose (C-21386, Figure 7.85) or Captivate ferrofluid streptavidin (C-21476) for affinity isolation

of receptors. See Section 7.6 for a description of these products and affinity isolation methods that use biotin- or DSB-X biotin-labeled reagents.

Our biotinylated ligands include the:

- Biotin-X conjugate of annexin V (A-13204, Section 15.5), for detecting the externalization of phosphatidylserine, an early indicator of apoptosis
- Biotin-XX conjugate of α -bungarotoxin^{10,11} (B-1196, Section 16.2), for labeling the α -subunit of the acetylcholine receptor
- Biotin-XX conjugate of epidermal growth factor (EGF)^{12–15} (E-3477), as well as biotinylated EGF complexed with Alexa Fluor 488 streptavidin (E-13345, Figure 16.11) or with Texas Red streptavidin (E-3480, Figure 16.12), for labeling EGF receptors (Section 16.1)
- Biotin-XX conjugate of transferrin⁹ (T-23363, Section 16.1), for following intracellular trafficking of this iron-carrying protein
- Biotin-XX conjugate of phalloidin^{16,17} (B-7474, Section 11.1), for labeling F-actin
- Biotin-XX conjugate of isolectin IB₄ from *Griffonia simplicifolia*, for detecting α -galactosyl moieties in microglia and other glycoproteins (Section 7.7, Figure 7.99, Figure 7.100)
- Biotin-XX tyramide and DSB-X biotin tyramide, which are the amplification reagents used in six of our TSA Kits (Section 6.2, Table 6.1) for high-sensitivity detection of targets in cells and tissues. These reagents are not available separately.

Biotinylated Lipids

Our extensive selection of labeled phospholipids includes phospholipid derivatives of biotin and biotin-X (B-1550, B-1616). These biotinylated lipids, which are described in Section 5.2, can be used to prepare liposomes that retain high affinity for avidin conjugates.¹⁸

References

1. *Biochim Biophys Acta* 1381, 203 (1998);
2. *Clin Chem* 40, 2112 (1994);
3. *Anal Chem* 60, 853 (1988);
4. *Biochim Biophys Acta* 1427, 33 (1999);
5. *Biochim Biophys Acta* 1427, 44 (1999);
6. *J Neurosci Methods* 53, 23 (1994);
7. *Bioconjug Chem* 11, 584 (2000);
8. *J Neurosci Methods* 46, 59 (1993);
9. *J Cell Biol* 149, 901 (2000);
10. *J Cell Biol* 125, 661 (1994);
11. *J Biol Chem* 268, 25108 (1993);
12. *J Histochem Cytochem* 42, 307 (1994);
13. *J Histochem Cytochem* 41, 313 (1993);
14. *J Histochem Cytochem* 40, 1353 (1992);
15. *Anal Biochem* 188, 97 (1990);
16. *J Cell Biol* 130, 591 (1995);
17. *Anal Biochem* 200, 199 (1992);
18. *Methods Enzymol* 149, 119 (1987).

The full citations and, in most cases, links to PubMed for all references in this Handbook are available at our Web site (www.probes.com).

Data Table — 4.3 Biotin and Desthiobiotin Conjugates

| Cat # | MW | Storage | Soluble | Abs | EC | Em | Solvent | Notes |
|---------|-----------|---------|------------------------|------|---------|------|------------------|-------|
| A-12922 | 1141.31 | D,L | DMSO, H ₂ O | 591 | 80,000 | 618 | pH 7 | |
| A-12923 | 1209.66 | D,L | DMSO, H ₂ O | 556 | 99,000 | 572 | pH 7 | |
| A-12924 | 974.98 | D,L | DMSO, H ₂ O | 494 | 62,000 | 520 | pH 7 | |
| B-1196 | ~8400 | F,D | H ₂ O | <300 | | none | | 1 |
| B-1370 | 831.01 | L | DMF, pH >6 | 494 | 75,000 | 518 | pH 9 | 2 |
| B-1550 | 1019.45 | FF,D | see Notes | <300 | | none | | 3 |
| B-1616 | 1132.61 | FF,D | see Notes | <300 | | none | | 3 |
| B-7474 | ~1300 | F | MeOH, H ₂ O | <300 | | none | | 1, 4 |
| B-10570 | 644.70 | L | DMSO | 494 | 68,000 | 523 | pH 9 | 2 |
| C-11411 | ~861 | FF | H ₂ O | <300 | | none | | 5, 6 |
| E-3477 | ~6600 | FF,D | H ₂ O | <300 | | none | | 1 |
| E-3480 | see Notes | FF,D,L | H ₂ O | 596 | ND | 612 | pH 7 | 7, 8 |
| E-13345 | see Notes | FF,D,L | H ₂ O | 497 | ND | 520 | pH 8 | 7, 9 |
| L-2601 | 873.10 | D,L | H ₂ O | 428 | 11,000 | 531 | H ₂ O | |
| L-6950 | 850.03 | D,L | H ₂ O | 428 | 11,000 | 532 | pH 7 | |
| O-12920 | 887.39 | L | DMSO, H ₂ O | 495 | 66,000 | 522 | pH 9 | 10 |
| T-12921 | 869.09 | D,L | DMSO | 554 | 103,000 | 581 | pH 7 | |

For definitions of the contents of this data table, see "How to Use This Book" on page viii.

Notes

1. α -bungarotoxin, EGF and phallotoxin conjugates have approximately one label per peptide.
2. Absorption and fluorescence of fluorescein derivatives are pH dependent. Extinction coefficients and fluorescence quantum yields decrease markedly at pH <7.
3. Chloroform is the most generally useful solvent for preparing stock solutions of phospholipids (including sphingomyelins). Glycerophosphocholines are usually freely soluble in ethanol. Most other glycerophospholipids (phosphoethanolamines, phosphatidic acids and phosphoglycerols) are less soluble in ethanol, but solutions up to 1–2 mg/mL should be obtainable, using sonication to aid dispersion if necessary. Labeling of cells with fluorescent phospholipids can be enhanced by addition of cyclodextrins during incubation (J Biol Chem 274, 35359 (1999)).
4. Although this phallotoxin is water soluble, storage in water is not recommended, particularly in dilute solution.
5. The molecular weight (MW) of this product is approximate because the salt form has not been conclusively established.
6. This product is supplied as a ready-made solution in the solvent indicated under **Soluble**.
7. ND = not determined.
8. E-3480 is a complex of E-3477 with Texas Red streptavidin, which typically incorporates 3 dyes/streptavidin (MW ~52,800).
9. E-13345 is a complex of E-3477 with Alexa Fluor 488 streptavidin, which typically incorporates 4 dyes/streptavidin (MW ~52,800).
10. Absorption and fluorescence of Oregon Green 488 derivatives are pH dependent only in moderately acidic solutions (pH <5).

Product List — 4.3 Biotin and Desthiobiotin Conjugates

| Cat # | Product Name | Unit Size |
|---------|--|-------------|
| A-12924 | Alexa Fluor [®] 488 biocytin, disodium salt (biocytin Alexa Fluor [®] 488) | 250 μ g |
| A-12923 | Alexa Fluor [®] 546 biocytin, sodium salt (biocytin Alexa Fluor [®] 546) | 250 μ g |
| A-12922 | Alexa Fluor [®] 594 biocytin, sodium salt (biocytin Alexa Fluor [®] 594) | 250 μ g |
| A-13204 | annexin V, biotin-X conjugate *100 assays* | 500 μ L |
| A-21301 | anti-bromodeoxyuridine, mouse IgG ₁ , monoclonal PRB-1, biotin-XX conjugate (anti-BrdU, biotin conjugate) | 350 μ L |
| A-6435 | anti-dinitrophenyl-KLH, rabbit IgG fraction, biotin-XX conjugate *2 mg/mL* | 0.5 mL |
| A-982 | anti-fluorescein/Oregon Green [®] , rabbit IgG fraction, biotin-XX conjugate *1 mg/mL* | 0.5 mL |
| A-21272 | anti-HuC/HuD neuronal protein (human), mouse IgG _{2b} , monoclonal 16A11, biotin-XX conjugate | 100 μ g |
| A-5751 | anti-lucifer yellow, rabbit IgG fraction, biotin-XX conjugate *3 mg/mL* | 0.5 mL |
| A-21371 | anti- α -tubulin (bovine), mouse IgG ₁ , monoclonal 236-10501, biotin-XX conjugate | 50 μ g |
| B-10570 | biotin-4-fluorescein | 5 mg |
| B-1370 | 5-((N-(5-(N-(6-(biotinoyl)amino)hexanoyl)amino)pentyl)thioureidyl)fluorescein (fluorescein biotin) | 5 mg |
| B-1616 | N-((6-(biotinoyl)amino)hexanoyl)-1,2-dihexadecanoyl- <i>sn</i> -glycero-3-phosphoethanolamine, triethylammonium salt (biotin-X DHPE) | 5 mg |
| B-1550 | N-(biotinoyl)-1,2-dihexadecanoyl- <i>sn</i> -glycero-3-phosphoethanolamine, triethylammonium salt (biotin DHPE) | 10 mg |
| B-11027 | biotin-XX F(ab') ₂ fragment of goat anti-mouse IgG (H+L) *2 mg/mL* | 250 μ L |
| B-21078 | biotin-XX F(ab') ₂ fragment of goat anti-rabbit IgG (H+L) *2 mg/mL* | 250 μ L |
| B-2763 | biotin-XX goat anti-mouse IgG (H+L) *2 mg/mL* | 0.5 mL |
| B-2770 | biotin-XX goat anti-rabbit IgG (H+L) *2 mg/mL* | 0.5 mL |
| B-7474 | biotin-XX phalloidin | 50 U |
| B-21066 | biotin-XX rabbit anti-mouse IgG (H+L) *2 mg/mL* | 0.5 mL |
| B-1196 | α -bungarotoxin, biotin-XX conjugate | 500 μ g |
| C-11411 | ChromaTide™ biotin-11-dUTP *1 mM in TE buffer* | 25 μ L |
| D-7135 | dextran, biotin, 3000 MW, lysine fixable (BDA-3000) | 10 mg |
| D-1956 | dextran, biotin, 10,000 MW, lysine fixable (BDA-10,000) | 25 mg |
| D-1957 | dextran, biotin, 70,000 MW, lysine fixable (BDA-70,000) | 25 mg |
| D-7142 | dextran, biotin, 500,000 MW, lysine fixable (BDA-500,000) | 10 mg |
| D-7146 | dextran, DMNB-caged fluorescein and biotin, 10,000 MW, lysine fixable | 5 mg |

Product List — 4.3 Biotin and Desthiobiotin Conjugates — continued

| Cat# | Product Name | Unit Size |
|-------------|--|------------------|
| D-7156 | dextran, fluorescein and biotin, 3000 MW, anionic, lysine fixable (micro-emerald) | 5 mg |
| D-7178 | dextran, fluorescein and biotin, 10,000 MW, anionic, lysine fixable (mini-emerald) | 10 mg |
| D-7162 | dextran, tetramethylrhodamine and biotin, 3000 MW, lysine fixable (micro-ruby) | 5 mg |
| D-3312 | dextran, tetramethylrhodamine and biotin, 10,000 MW, lysine fixable (mini-ruby) | 10 mg |
| D-20659 | DSB-X™ Bioconjugate Isolation Kit #2 *with DSB-X™ biotin agarose* *5 isolations* | 1 kit |
| D-20698 | DSB-X™ biotin donkey anti-goat IgG (H+L) *2 mg/mL* | 0.5 mL |
| D-20699 | DSB-X™ biotin donkey anti-sheep IgG (H+L) *2 mg/mL* | 0.5 mL |
| D-20692 | DSB-X™ biotin F(ab') ₂ fragment of goat anti-mouse IgG (H+L) *2 mg/mL* | 250 µL |
| D-20696 | DSB-X™ biotin F(ab') ₂ fragment of goat anti-rabbit IgG (H+L) *2 mg/mL* | 250 µL |
| D-20701 | DSB-X™ biotin goat anti-chicken IgG (H+L) *2 mg/mL* | 0.5 mL |
| D-20700 | DSB-X™ biotin goat anti-human IgG (H+L) *2 mg/mL* | 0.5 mL |
| D-20690 | DSB-X™ biotin goat anti-mouse IgG (H+L) *2 mg/mL* | 0.5 mL |
| D-20691 | DSB-X™ biotin goat anti-mouse IgG (H+L) *highly cross-adsorbed* *2 mg/mL* | 0.5 mL |
| D-20693 | DSB-X™ biotin goat anti-mouse IgM (µ chain) *2 mg/mL* | 250 µL |
| D-20694 | DSB-X™ biotin goat anti-rabbit IgG (H+L) *2 mg/mL* | 0.5 mL |
| D-20695 | DSB-X™ biotin goat anti-rabbit IgG (H+L) *highly cross-adsorbed* *2 mg/mL* | 0.5 mL |
| D-20697 | DSB-X™ biotin goat anti-rat IgG (H+L) *2 mg/mL* | 0.5 mL |
| E-3477 | epidermal growth factor, biotin-XX conjugate (biotin EGF) | 20 µg |
| E-13345 | epidermal growth factor, biotinylated, complexed to Alexa Fluor® 488 streptavidin (Alexa Fluor® 488 EGF complex) | 100 µg |
| E-3480 | epidermal growth factor, biotinylated, complexed to Texas Red® streptavidin (Texas Red® EGF complex) | 100 µg |
| F-8766 | FluoSpheres® biotin-labeled microspheres, 0.04 µm, yellow-green fluorescent (505/515) *1% solids* | 0.4 mL |
| F-8767 | FluoSpheres® biotin-labeled microspheres, 0.2 µm, yellow-green fluorescent (505/515) *1% solids* | 0.4 mL |
| F-8769 | FluoSpheres® biotin-labeled microspheres, 1.0 µm, nonfluorescent *1% solids* | 0.4 mL |
| F-8768 | FluoSpheres® biotin-labeled microspheres, 1.0 µm, yellow-green fluorescent (505/515) *1% solids* | 0.4 mL |
| I-21414 | isolectin GS-IB ₄ from <i>Griffonia simplicifolia</i> , biotin-XX conjugate | 500 µg |
| L-6950 | lucifer yellow biocytin, potassium salt (biocytin lucifer yellow) | 5 mg |
| L-2601 | lucifer yellow cadaverine biotin-X, dipotassium salt | 10 mg |
| O-12920 | Oregon Green® 488 biocytin (biocytin Oregon Green® 488) | 5 mg |
| P-917 | peroxidase from horseradish, biotin-XX conjugate | 10 mg |
| P-811 | R-phycoerythrin, biotin-XX conjugate *4 mg/mL* | 0.5 mL |
| T-12921 | 5-(and-6)-tetramethylrhodamine biocytin (biocytin TMR) | 5 mg |
| T-23363 | transferrin from human serum, biotin-XX conjugate | 5 mg |
| Z-25052 | Zenon™ One Biotin-XX Mouse IgG ₁ Labeling Kit *50 labelings* | 1 kit |
| Z-25053 | Zenon™ One DSB-X™ Biotin Mouse IgG ₁ Labeling Kit *50 labelings* | 1 kit |



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