

DAPI Nucleic Acid Stain

Table 1. Contents and storage information.

Material	Amount	Storage	Stability
DAPI dihydrochloride (MW = 350.3)	10 mg	<ul style="list-style-type: none"> • Room temperature • Protect from light 	When stored as directed, product solids should be stable for at least 1 year.
DAPI dilactate (MW = 457.5)			
DAPI dihydrochloride, FluoroPure™ grade (≥98% pure)			
Approximate fluorescence excitation/emission maxima: 358/461 nm, bound to DNA			

Introduction

The blue-fluorescent DAPI nucleic acid stain preferentially stains dsDNA; it appears to associate with AT clusters in the minor groove.¹ Binding of DAPI to dsDNA produces a ~20-fold fluorescence enhancement, apparently due to the displacement of water molecules from both DAPI and the minor groove.² DAPI also binds RNA, however in a different binding mode—one thought to involve AU-selective intercalation.³ The DAPI/RNA complex exhibits a longer-wavelength fluorescence emission maximum than the DAPI/dsDNA complex (~500 nm versus ~460 nm) and a quantum yield that is only about 20% as high.⁴

DAPI is a popular nuclear counterstain for use in multicolor fluorescent techniques. Its blue fluorescence stands out in vivid contrast to green, yellow, or red fluorescent probes of other structures. When used according to our protocols, DAPI stains nuclei specifically, with little or no cytoplasmic labeling. Both DAPI and DAPI dilactate work well in these protocols. The DAPI dilactate form may be somewhat more water soluble. The counterstaining protocols are compatible with a wide range of cytological labeling techniques—direct or indirect antibody-based detection methods, mRNA *in situ* hybridization, or staining with fluorescent reagents specific for cellular structures. DAPI can also serve to fluorescently label cells for analysis in multicolor flow cytometry experiments. The following protocols can be modified for tissue staining or for staining unfixed cells or tissues.

Before You Begin

Materials Required but Not Provided

For fluorescence microscopy

- PBS
- *Optional:* antifade reagent

For flow cytometry

- PBS
- Absolute ethanol
- Staining buffer (see step 3.1)

For chromosome FISH staining

- PBS
- dH₂O
- Wax or nail polish
- *Optional:* antifade reagent

Preparing the DAPI Stock Solution

To make a 5 mg/mL DAPI stock solution (14.3 mM for the dihydrochloride or 10.9 mM for the dilactate), dissolve the contents of one vial (10 mg) in 2 mL of deionized water (dH₂O) or dimethylformamide (DMF). The less water-soluble DAPI dihydro-chloride may take some time to completely dissolve in water and sonication may be necessary.

Note: Neither of these DAPI derivatives is very soluble in phosphate-buffered saline (PBS).

For long-term storage the stock solution can be aliquoted and stored at $\leq -20^{\circ}\text{C}$. For short-term storage the solution can be kept at $2-6^{\circ}\text{C}$, protected from light. When handled properly, DAPI solutions are stable for at least six months.

Caution

DAPI is a known mutagen and should be handled with care. The dye must be disposed of safely and in accordance with applicable local regulations.

Fluorescence Spectral Characteristics

The excitation maximum for DAPI bound to dsDNA is 358 nm, and the emission maximum is 461 nm (Figure 1). DAPI can be excited with a xenon or mercury-arc lamp or with a UV laser. DAPI may be used in flow cytometry systems utilizing UV excitation sources.

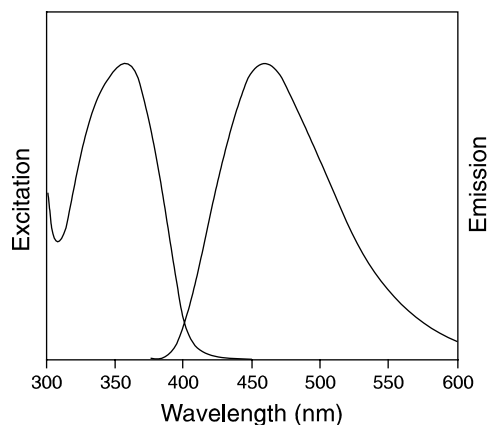


Figure 1. Fluorescence excitation and emission profiles of DAPI bound to dsDNA.

Experimental Protocols

Counterstaining Adherent Cells for Fluorescence Microscopy

Sample Preparation

Use the fixation protocol appropriate for your sample. DAPI staining is normally performed after all other staining. Note that fixation and permeabilization of the sample are not necessary for counterstaining with DAPI.

Counterstaining Protocol

- 1.1 Equilibrate the sample briefly with phosphate-buffered saline (PBS).
- 1.2 Dilute the DAPI stock solution to 300 nM in PBS. Add approximately 300 μ L of this dilute DAPI staining solution to the coverslip preparation, making certain that the cells are completely covered.
- 1.3 Incubate for 1–5 minutes.
- 1.4 Rinse the sample several times in PBS. Drain excess buffer from the coverslip and mount. We recommend using a mounting medium with an antifade reagent such as our *SlowFade*[®] Gold antifade reagent (S36936) or ProLong[®] Gold antifade reagent (P36930).
- 1.5 View the sample using a fluorescence microscope with appropriate filters.

Counterstaining Cells in Suspension for Flow Cytometry

Sample Preparation

Use the fixation protocol appropriate for your sample, or use the following protocol.

- 2.1 Collect a cell suspension of 2×10^5 to 1×10^6 cells.
- 2.2 Pellet the cells by centrifugation and discard the supernatant.

- 2.3 Tap the tube to resuspend the pellet in the residual liquid and add 1 mL of PBS at room temperature.
- 2.4 Transfer the full volume of resuspended cells to 4 mL of absolute ethanol at -20°C by pipetting the cell suspension slowly into the ethanol while vortexing at top speed. Leave the cells in ethanol at -20°C for 5–15 minutes.
- 2.5 Pellet the cells by centrifugation and discard the ethanol.
- 2.6 Tap the tube to loosen the pellet and add 5 mL of PBS at room temperature. Allow the cells to rehydrate for 15 minutes.

Counterstaining Protocol

- 3.1 Dilute the DAPI stock solution to $3\ \mu\text{M}$ in staining buffer (100 mM Tris, pH 7.4, 150 mM NaCl, 1 mM CaCl_2 , 0.5 mM MgCl_2 , 0.1% Nonidet P-40). A 1 mL volume will be required for each cell sample.
- 3.2 Centrifuge the cell suspension (from step 2.6) and discard the supernatant. Tap to loosen the pellet and add 1 mL of DAPI diluted in staining buffer.
- 3.3 Incubate for 15 minutes at room temperature.
- 3.4 Analyze by flow cytometry in the presence of the dye. If the cells are to be viewed by fluorescence microscopy, centrifuge the sample, remove the supernatant and resuspend cells in fresh buffer. Apply a drop of the suspension to a microscope slide, cover with a coverslip and view.

Chromosome FISH Counterstaining

Sample Preparation

Prepare the specimen according to standard procedures.^{5,6} Briefly rinse the final preparations in dH_2O before counterstaining to remove residual buffer salts from the slide. This final rinse will help reduce nonspecific background staining on the glass. Allow the preparation to air dry.

Counterstaining Protocol

- 4.1 Dilute the DAPI stock solution to 30 nM in PBS. Pipet 300 μL of this staining solution directly onto the specimen. A plastic coverslip can be used to distribute the dye evenly on the slide.
- 4.2 Incubate the specimen in the dark for 30 minutes at room temperature.
- 4.3 Carefully remove the coverslip and rinse the specimen briefly with PBS or dH_2O to remove unbound dye.
- 4.4 Remove excess liquid from the slide by gently blotting around the sample with an absorbent tissue.
- 4.5 Place a glass coverslip on the slide and seal the edges with wax or nail polish. Alternatively, the preparation can be mounted in an antifade reagent according to the manufacturer's directions.
- 4.6 View the sample using a fluorescence microscope with appropriate filters.

References

1. Biochemistry 26, 4545 (1987); 2. Biochem Biophys Res Commun 170, 270 (1990); 3. Biochemistry 31, 3103 (1992); 4. J Histochem Cytochem 38, 1323 (1990); 5. Methods Enzymol 168, 741 (1989); 6. Pardue, M.L. in *Nucleic Acid Hybridization, A Practical Approach*, B.D. Hames and S.J. Higgins, Eds., IRL Press, Oxford, England (1985).

Product List

Current prices may be obtained from our website or from our Customer Service Department.

Cat #	Product Name	Unit Size
D1306	4',6-diamidino-2-phenylindole, dihydrochloride (DAPI).....	10 mg
D3571	4',6-diamidino-2-phenylindole, dilactate (DAPI, dilactate)	10 mg
D21490	4',6-diamidino-2-phenylindole, dihydrochloride (DAPI) *FluoroPure™ grade*.....	10 mg

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