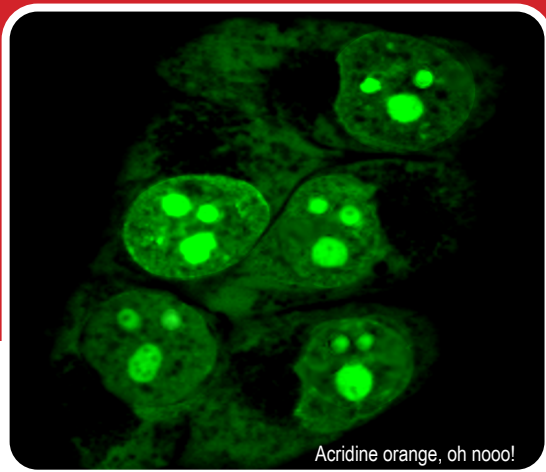


# How Safe is Your Gel Stain?



If it gets into living cells, is it really safe?

Many researchers seek safer alternatives to ethidium bromide for their DNA gels. A number of dyes have been marketed as being safe because they are not mutagenic in lab tests. But most of these so-called safe gel stains contain well-known, old-fashioned fluorescent dyes, many of which are highly membrane permeable, so they penetrate and bind DNA inside of live cells within minutes. Some of these dyes, like acridine orange, are known to be highly toxic to cells, and also can potentiate DNA damage by UV light and other mutagens. See Table 1, other side, for a comparison of the cell permeability, toxicity, and sensitivity of GelRed® and GelGreen® with other ethidium bromide alternatives.

GelRed® and GelGreen® were designed specifically to be cell membrane impermeable, and therefore non-toxic and non-mutagenic. They are classified as non-hazardous waste under California Title 22. In addition, they offer higher sensitivity and low background compared to competing gel stains.

For more information and references, download our white paper, [Comparison of Nucleic Acid Gel Stains: Cell Permeability, Safety, and Sensitivity](#) and the complete [Safety Report of GelRed® and GelGreen®](#) at [www.biotium.com](http://www.biotium.com).

Many so-called safe gel stains rapidly penetrate living cells

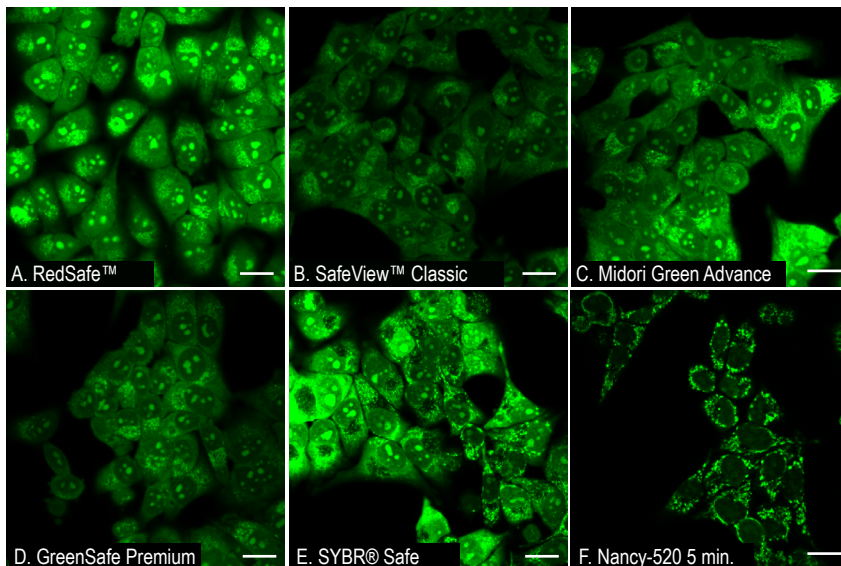


Figure 1. Acridine orange- and SYBR-based nucleic acid gel stains rapidly penetrate live cells to stain the nucleus, cytoplasm, and other organelles. HeLa cells were incubated with the indicated gel stain in cell culture medium at the manufacturer's recommended concentration for gel staining for five minutes at 37°C. Scale bars: 20  $\mu$ m.

## GelRed® & GelGreen® Advantages

- Non-toxic & non-mutagenic
- Non-hazardous for easy disposal
- Ultra-sensitive
- Stable at room temperature
- Use in precast gel or as a post-stain
- Compatible with standard instruments
- Compatible with cloning and sequencing
- GelRed® replaces EtBr
- GelGreen® replaces SYBR® Safe, EZ-Vision® RedSafe™, Midori Green, GreenSafe, SafeView™ Classic, and others

GelRed® and GelGreen® are designed to be excluded from living cells

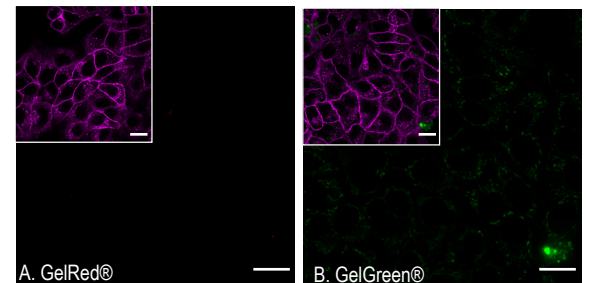


Figure 2. GelRed® and GelGreen® do not stain the nucleus in living cells after 30 minutes incubation at 37°C. HeLa cells were incubated with 3X GelRed® or 3X GelGreen® nucleic acid gel stains in cell culture medium. Insets show CF®640R WGA staining (magenta) of the same field of view to visualize cell outlines. Bright staining was observed only for sporadic dead cells on top of the cell monolayer. A. GelRed®. B. GelGreen®. Scale bars: 20  $\mu$ m.

**Table 1. Comparison of non-mutagenic ethidium bromide alternatives**

Product	Manufacturer	Cat. #	Dye identity*	Cell permeable?	Dye toxicity*	Sensitivity**
GelRed®	Biotium	41003	GelRed	No	Non-toxic	0.625-1.25 ng
GelGreen®	Biotium	41005	GelGreen	No	Non-toxic	0.625-1.25 ng
EZ-Vision® In-Gel Dye	AMRESCO	N391	DAPI	No	Non-toxic	5 ng
SafeView™ FireRed	Applied Biological Materials	G926	Propidium iodide	No	Toxic to cells with prolonged exposure	0.625-1.25 ng
RedSafe™	iNtRON Biotechnology	21141	Acridine orange	Yes	Toxic to cells, potentiates other mutagens	2.5 ng
SafeView™ Classic	Applied Biological Materials	G108	Acridine orange	Yes	Toxic to cells, potentiates other mutagens	2.5 ng
Midori Green Advance	Nippon Genetics	MG 04	Acridine orange + DAPI	Yes	Toxic to cells, potentiates other mutagens (acridine orange)	2.5 ng
GreenSafe Premium	NZYTech	MB13201	Acridine orange + DAPI	Yes	Toxic to cells, potentiates other mutagens (acridine orange)	2.5 ng
SYBR® Safe	Thermo Fisher Scientific	S33102	Thiazole orange derivative	Yes	Toxic to cells at working concentration	2.5 ng
Nancy-520	Sigma-Aldrich	01494	SYBR® derivative	Yes	No data	1.25 ng

\* For details of chemical analysis and dye toxicity references, download the [Comparison of Nucleic Acid Gel Stains: Cell Permeability, Safety, and Sensitivity](http://www.biotium.com) at [www.biotium.com](http://www.biotium.com).

\*\* Detection of 500 bp dsDNA fragment by gel electrophoresis.

### GelRed® and GelGreen® also have superior sensitivity

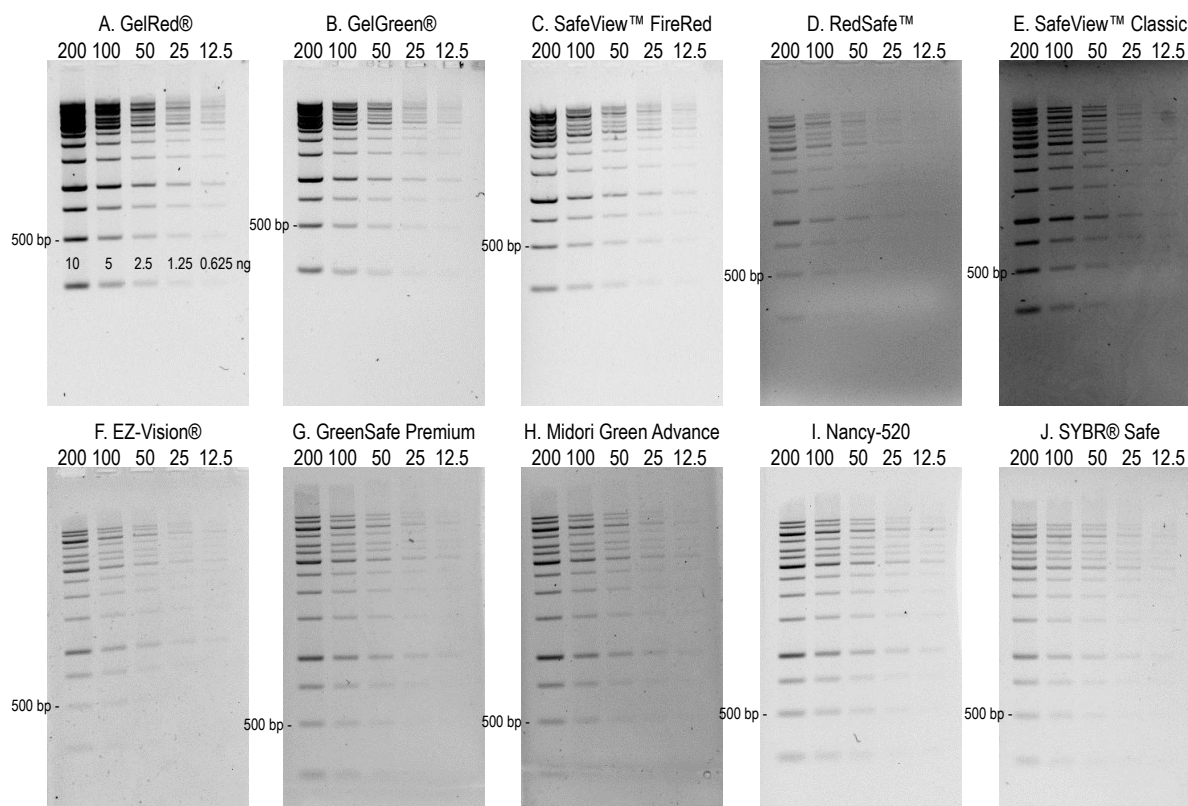


Figure 3. Comparison of nucleic acid gel stains by gel electrophoresis. Biotium's 1 kb DNA ladder was loaded on agarose gels in two-fold dilutions ranging from 200 ng to 12.5 ng total ladder per lane. A. GelRed® precast gel. The mass of the 500 bp band in each lane is labeled. B. GelGreen® precast gel. C. SafeView FireRed precast gel. D. RedSafe precast gel. E. SafeView Classic post-stained gel. F. EZ-Vision post-stained gel. G. GreenSafe Premium post-stained gel. H. Midori Green Advance post-stained gel. I. Nancy-520 post-stained gel. J. SYBR Safe post-stained gel.