

## SER: Biological Stains – Visualization with Alternate Light Sources

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### Safety

#### SAFETY WARNING!

Do not look directly into the beam.

Safety glasses with the proper viewing filters must always be worn to protect the eyes from the intense light emitted by a forensic light source.

Some of the handheld units produce heat—do not leave on continuously for more than 30 minutes. If the unit becomes too hot to hold, turn it off.

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### Principle

Alternate light sources can cause certain materials of forensic interest to fluoresce for improved contrast and detection compared to normal lighting conditions.

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### Ultraviolet lamps

Ultraviolet lamps are generally classified as short- or long-wavelength. The short wavelength lamp irradiates samples with light that is intense at 200 to 300 nm. The long wavelength lamp irradiates samples with light that is intense from 300 to 400 nm.

Dried semen stains, some fibers, some dyes, minerals, and oils will fluoresce when illuminated with ultraviolet light. Other stains such as saliva and urine may weakly fluoresce.

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### The Blue Maxx™

The Blue Maxx™ uses a krypton bulb in combination with an excitation filter of 390 to 500 nanometers. The target material is illuminated with the Blue Maxx™ and resultant fluorescence is viewed through a barrier filter mounted at the top of the light source. The barrier filter blocks the excitation light so that only fluorescence at wavelength longer than 510 nm is visible.

Dried semen stains, urine, some fibers, some dyes, and oils will fluoresce when illuminated with the Blue Maxx™. Other stains such as saliva may weakly fluoresce.

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### Crime-lite™

Crime-lite™ is a series of LED handheld units that are filtered to emit specific bands of wavelengths. The available light colors are:

- violet
- blue
- blue-green
- green
- low intensity white light

Colored safety glasses (red, orange, or yellow) are worn to visualize fluorescence and to protect the eyes from the intense light emitted.

Camera filters of the same or near the same color as the safety glasses are used when photographing fluorescent evidence.

Choose the color of the safety glasses or camera filter that gives the best contrast between the background and the stain or object of interest.

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### Selection of Crime-lite™ wavelength, safety glasses and filters

There are numerous applications where alternate light sources assist in locating or visualizing physical evidence. The following chart shows the guidelines for selecting an excitation wavelength and corresponding safety glasses or filter type. NOTE: Other materials may or may not be visualized or enhanced using a filtered light source.

| Color      | Wavelength (nm) | Evidence type  | Safety glasses or filter color                   |
|------------|-----------------|--|--|
| Violet     | 400 – 430       | Physiological stains <ul style="list-style-type: none"> <li>• semen (fluoresces)</li> <li>• blood (absorbs light, does not fluoresce)</li> <li>• urine (weaker fluorescence than semen)</li> <li>• saliva (very weak fluorescence)</li> </ul>  | Yellow   |
| Blue       | 430 – 470       | <ul style="list-style-type: none"> <li>• Physiological stains <ul style="list-style-type: none"> <li>– semen (fluoresces)</li> <li>– blood (absorbs light, does not fluoresce)</li> <li>– urine (weaker fluorescence than semen)</li> <li>– saliva (very weak fluorescence)</li> </ul> </li> <li>• also, bite mark and bruise detection, photographic documentation</li> </ul> | Orange   |
| Blue/green | 460 – 510       | Trace evidence such as fibers and paint chips; surfaces treated with chemical dyes such as Rhodamine 6G.   | Orange   |
| Green      | 500 – 550       | Trace evidence in general.   | Red  |
| White      | 400 – 700       |  | Reduced output power for viewing without filters |

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**Additional notes**

The white Crime-lite™ is equipped with a red, green, and blue enhancing filters for improving contrast. A cylindrical lens can be used to produce an asymmetrical beam in a vertical or horizontal plane. This is used for oblique illumination of surfaces.

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**Leeds Spectral Vision system**

The Leeds Spectral Vision (LSV) system is an alternate light source with built-in image capture. It utilizes the following wavelengths:

- 365 nm (ultraviolet)
- 405 nm (violet)
- 455 nm (blue)
- 505 nm (green)
- 590 nm (orange)
- 850 nm (near infrared)
- 400-700 nm (5600 K white)

The LSV has the following built-in barrier filters:

- 400 nm (clear)
  - 550 nm
  - 570 nm
  - 610 nm
  - 830 nm.
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### Leeds Spectral Vision system examination

The following Leeds Spectral Vision wavelengths and barrier filters can be used to examine various fabrics. Note: generally, the amount of fluorescence increases as the light source is brought closer to the substrate.

- Semen

| Fabric type              | Color (wavelength)                    | Barrier filter (nm)   |
|--------------------------|---------------------------------------|-----------------------|
| Light fabric             | Violet (405), Blue (455), Green (505) | 550, 570, or 610      |
| Dark fabric <sup>1</sup> | Green (505), Orange (590), White      | 400, 550, 570, or 610 |
| Leather                  | UV (365), Violet (455), Blue (455)    | 550, 570, 610         |
| Denim <sup>1</sup>       | NA                                    | NA                    |

- Saliva

| Fabric type              | Color (wavelength)     | Barrier filter (nm) |
|--------------------------|------------------------|---------------------|
| Light fabric             | UV (365), Violet (405) | 400                 |
| Dark fabric <sup>1</sup> | NA                     | NA                  |
| Leather <sup>1</sup>     | NA                     | NA                  |
| Denim <sup>1</sup>       | NA                     | NA                  |

- Blood

| Fabric type               | Color (wavelength)     | Barrier filter (nm) |
|---------------------------|------------------------|---------------------|
| Light fabric <sup>2</sup> | Violet (405)           | 400, 550., 570      |
| Dark fabric               | IR (850)               | Any                 |
| Leather <sup>2</sup>      | Violet (405), white    | 400, 550            |
| Denim                     | Violet (405), IR (850) | 400                 |

<sup>1</sup>Other alternate light sources, such as CrimeLite may be more effective for detecting these body fluids on the listed substrate.

<sup>2</sup> A visual examination for possible blood on these substrates may be more effective than the LSV.

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### Recording

The location of stains illuminated with alternate light sources can be described in the case notes or photographed.

When photographing a stain, use the appropriate barrier filter for the wavelength being used. Long exposure times (approximately one minute) will be required.

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