An Ultraviolet Primer for Fly Fishermen

First, a glossary of terms you should be aware of:

Ultraviolet (UV)– a form of electromagnetic radiation ranging in wavelength from 10 nm (nanometers) to 500 nm. Shorter in wavelength than visible light and higher energy but longer in wavelength than X rays. We cannot see UV and most mammals are in the same boat. In fact most mammals except for the primates cannot see the red and orange end of the spectrum either, being restricted to yellow, green, and blue (hence a hunter wearing an orange top doesn't have to worry that he will be easily seen by the deer he is stalking!) I did find one exception (and I am sure there are more!)—the Degu or Chilean brush tailed rat has highly UV reflective belly fur—go figure, and try and find that one in your local fly shop! Fish, birds and insects however, have a full range of colours they can see as well as seeing in UV as well.

Fluorescence—the property possessed by certain substances where they will emit visible light when stimulated by UV radiation.(this visible light is often a different colour from the original colour of the object--e.g. a bright pink thread will fluoresce bright orange). We can detect this property if we have access to a "black" or UV light. UV lights have violet visible light added to their glow (otherwise they would literally be black and could be dangerous if held near the eye). Substances with this property are said to be "UV Reactive".

Luminescence—the property of an object to produce its own light. E.g an ordinary light bulb is luminescent and so is the sun. Certain objects and organisms emit a form of light called "cold light" because they produce light without heat unlike the hot filaments or gases used to produce light in light bulbs. In living creatures we call this "bioluminescence". The glow-in-the-dark lures (usually greenish white in colour) are examples of cold light.

Phosphoresence—another name for cold light.

UV reactive—a word to describe substances which fluoresce under UV light.

UV reflective—a word to describe substances which reflect UV light. If substances don't reflect UV light, then they absorb it. (this can be important for fly tying because insects can have body parts that are UV relflective and other parts that are UV absorptive or a combination of both.)

UV—a term we see used on some fly tying materials.(e.g. UV Polar Chenille). This will mean that the material is UV reflective NOT UV reactive. Thus, we will not be able to detect this property in the materials by putting them under a UV lamp.

Some thoughts about UV and fly tying

- What materials are UV reactive?
    - Most UV reactive materials are various types of synthetics or natural materials that have been dyed with UV reactive dyes. Bucktail and polar bear hair wil not normally be reactive but can be made to be with the right dye. It seems that anything with a Chartreuse or Hot Pink colour will automatically be UV reactive including thread, flashabou, marabou, rabbit zonkers etc. You can check for reactance using a UV lamp.
- Why use UV reactive materials?
    - Although these materials are "unnatural" they still work to produce good flies.
    - This may be purely because they are brighter colours. However, as we heard in the Oishi workshop, UV light penetrates further in the water column than visible light. If you want a fish to see a yellow colour below 10 or 15 feet you are better to use a UV reactive material which fluoresces yellow than a regular yellow (because the non UV reactive material will look gray instead of-yellow). This also works "sideways" in the water—a UV reactive material may be more visible at 20 feet from a fish than a non reactive one—even on the surface. If you are casting to cruising trout on the flats, maybe a highlight of UV reactive material might be enough to get their attention where a non reactive fly might not.
- What materials are UV reflective?
    - Again, many synthetic materials are UV reflective, but you will have to take the manufacturers word for that since to test it yourself you will need a UV light source and a UV light meter or a camera with UV sensitive film (or CCD's in a digital camera) and these are rather expensive.
    - However, many natural fibers we use for fly tying are UV reflective!
      The majority of birds have UV reflective feathers somewhere on their body. This makes sense since they are able to see in the UV range. Birds with some UV reflective plumage include most song birds, most ground feeding game birds (pheasants, quail , jungle cock, peafowl, etc.), waterfowl (ducks, geese and swans), parrot family, and a lot of obscure birds we would never get feathers from!
    - The ostrich family, owls, hummingbirds and swifts have no UV reflective feathers.

- Generally the colour is related to the amount of reflectance.
1. Nearly all white feathers are highly UV reflective
2. The brightly coloured patches on birds tend to be UV reflective (e.g. cockatiel cheeks)
3. The darker the feather, generally the more non-reflective.
4. The general order from highest to lowest—white, blue, yellow/green, red, brown, black. (most white feathers reflects over 75% of UV while most black feathers reflect less than 5% of UV).
5. In waterfowl plumage the best UV reflectors are white, creams and grays.

- Animal fur is high in keratin, a protein which absorbs the majority of UV but reflects varying amounts of visible light. (the one exception being Degu belly fur) So animal fur would have to be dyed to produce any alteration in its UV characteristics.

- Why use UV reflective materials?
  - These materials used in the right combinations will catch fish where other materials won't.
  - These materials have been used for many years in some of the most successful patterns (the Royal Coachman has white feathers (highly UV reflective) and peacock herl (blue/green—next highest UV reflective).
  - Many insects have UV reflective parts to their bodies. If we can figure out what these parts are and tie flies with matching UV reflective parts, we will experience more success with our flies. I haven't been able to find too much on which parts of which insects we should be looking at although one site did say that Caddis bodies are UV reflective while Mayfly wings and head are UV reflective. Beetles, crickets and grasshoppers have no UV reflective body parts.
  - Studies done on other predator-prey relationships have shown that those predators which can distinguish UV reflected rays have an advantage when it comes to picking out their prey from the background because most background vegetation is not UV reflective. In trout, this means that an insect like a caddis with a UV reflective body is more easily distinguished from the weeds it is crawling on—so including a UV material in the dubbing will increase the success of the fly pattern.

These materials are put together from a mishmash of notes I took while web surfing looking at fish forums, commercial web sites and academic papers on ultra violet theory. I haven't given any credit to the original authors and I can't guarantee that everything I have said is

scientifically accurate. That being said, I still think that many of the points raised could be useful to us in our never ending search for the “Perfect Fly”!