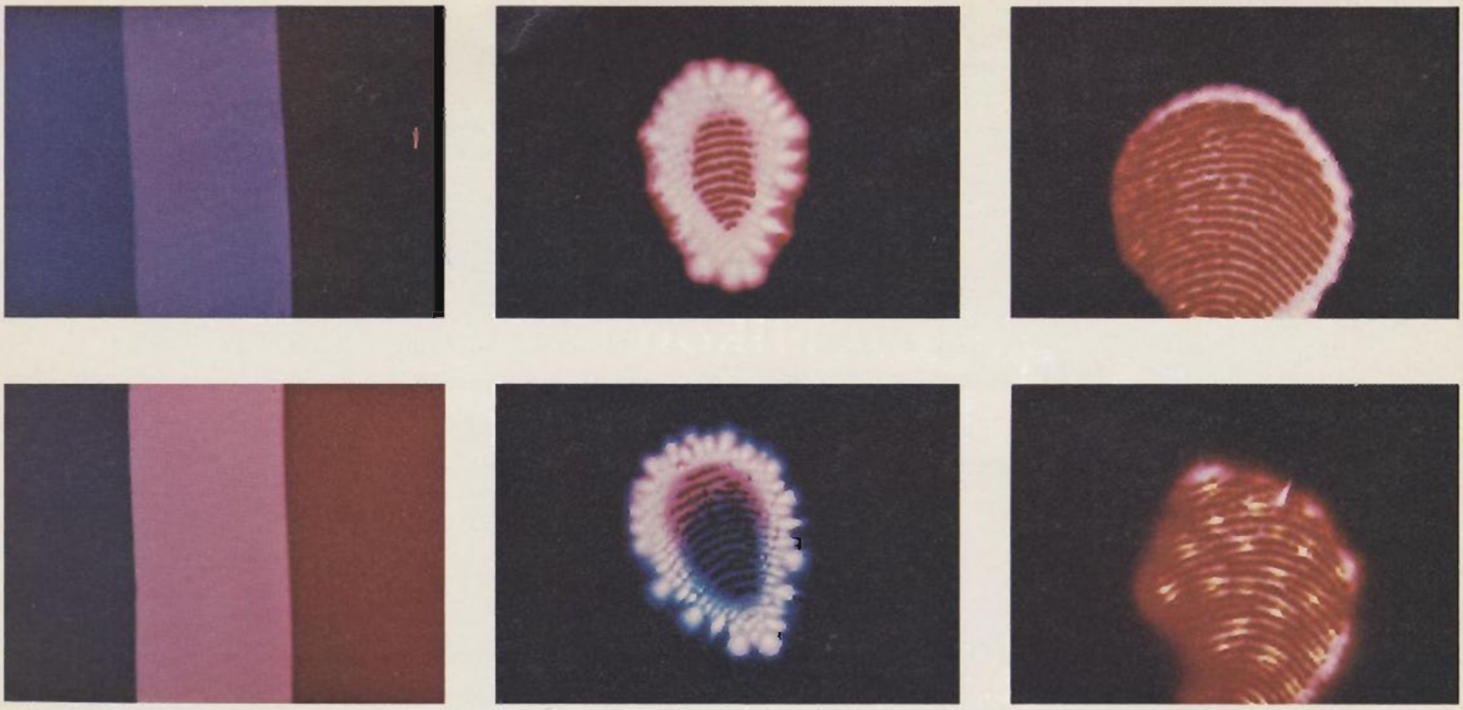
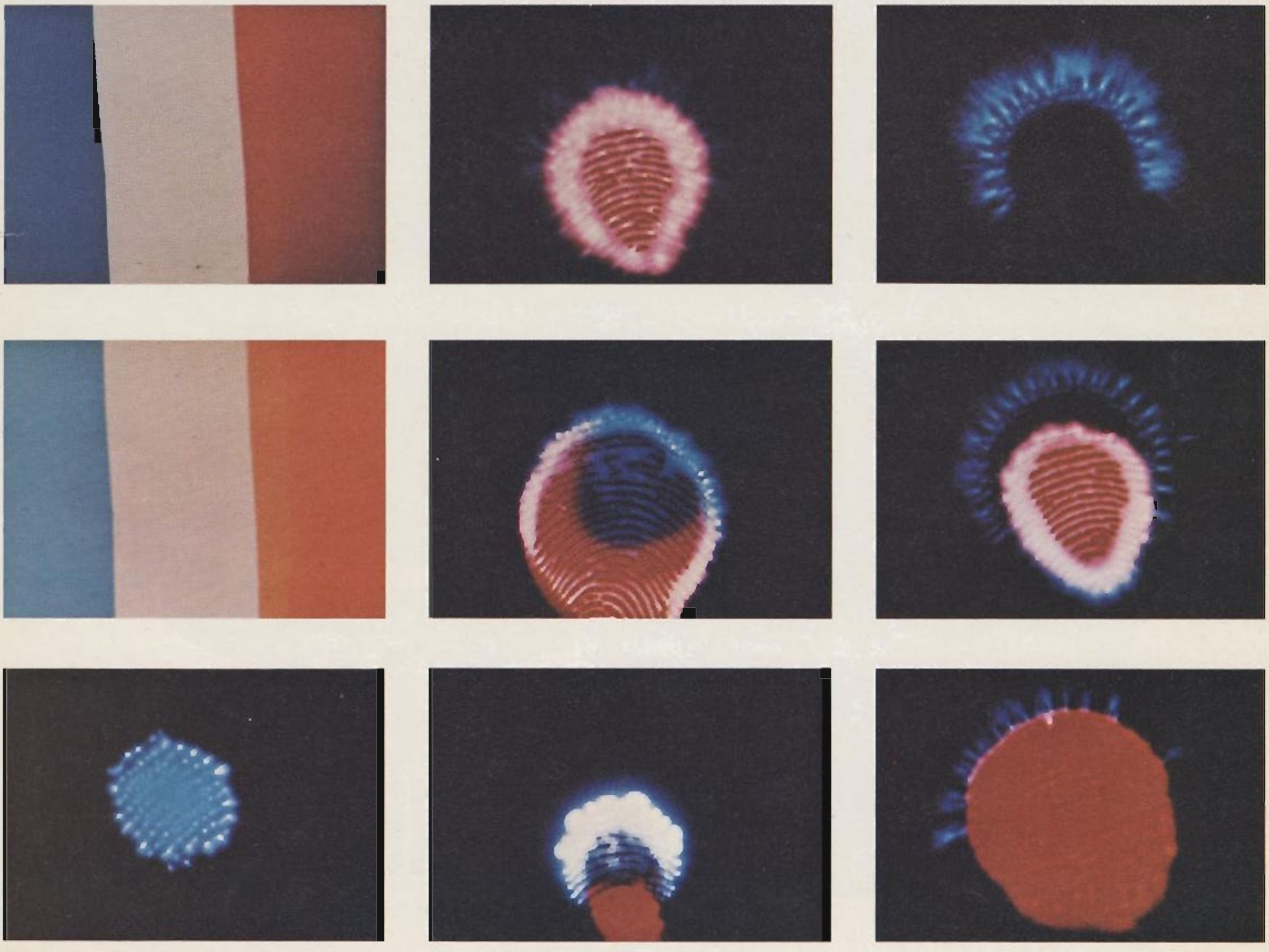


the colors in KIRLIAN



Composite color print.

David G. Boyers and
William A. Tiller

Many articles have appeared on the subject of Kirlian photography which have revealed some rather remarkable color effects. Most of the authors seem delightfully mystified as to the source of these various colors but are firmly convinced that they are associated with basic energy changes in the living system being photographed. This is extremely important if true; however, it is too important to just assume it to be so. It seems equally possible that these color effects might be associated with the experimental design conditions. In any event, one must endeavor to find the needed proof and to understand the entire process no matter which mechanism is appropriate to account for the results.

In an earlier article[1], the present authors postulated that the generation of light in this photographic process was associated with the ionization of air by an electrical discharge between the metallic electrode and the biological electrode. This discharge produces primarily ultraviolet (UV) light. When color film is placed in the air gap between the fingerpad and the metal electrode, the air gap (and thus, electrical discharge) may form between the fingerpad and the front side (emulsion) of the film or between the metal electrode and the back side of the film or on both sides of the film as illustrated in Figures 1 (a), 1(b) and 1 (c), respectively. It is the predominantly ultraviolet light produced by the electrical discharge that exposes the color film.

When a discharge forms between the fingerpad and the front side of the film, as illustrated in Figure 1(a), uv light exposes the film from the front side producing a blue or white color (white is just a bleaching effect due to high light intensity). This can be understood by considering the multilayer construction of a color film depicted in Figure 2. The typical film is

PHOTOGRAPHY—
fact or artifact?

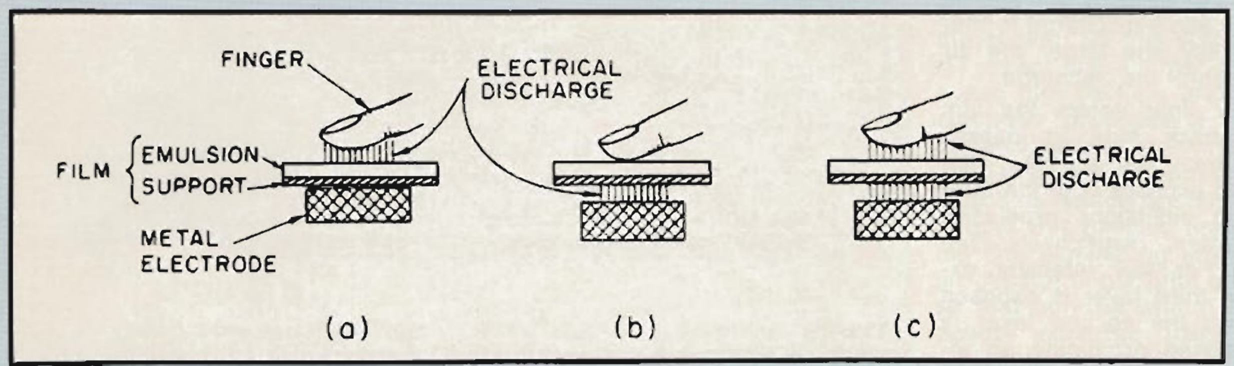


FIGURE 1

Exposure of film via light produced by the electrical discharge in air gaps between both film and finger and film and metal electrode.

(a) Only film-finger air gap discharge — produces ultraviolet light exposing film from front side leading to blue color;
(b) Only film-metal electrode gap discharge — produces ultraviolet light exposing film from back side leading to red, orange and yellow colors;
(c) Discharge through both gaps — produces UV light exposure of both sides of film leading to magenta, pink or white colors.

composed of three light-sensitive layers or emulsions, a filter layer between the blue and green layers and a support or backing. Exposure of the first layer produces a blue color upon development. Exposure of the second and third layers produces green and red colors, respectively, upon development.

Thus, blue, green or red light entering the emulsion side of the film will expose the blue, green or red layer, respectively. Although the first, second and third layers can be exposed by blue, green and red light, respectively, all layers can also be exposed just by blue or ultraviolet light. To prohibit this from happening, a yellow filter layer is placed between the first and second emulsion to block the blue and ultraviolet light entering the film from the front side from passing through to expose the second and third emulsions. Thus, as illustrated in Figure 2, ultraviolet light entering the film from the front side will produce a blue color in much the same way as would blue light.

But the marvelous reds, oranges, and yellows and magentas seen in the results of other investigators, when color film was located in the gap between the finger and metal electrode, must have some explanation — where do they come from? In our earlier paper[1],we explained the presence of these colors by differentiating the direction from which the light enters the film. These other colors are due to the ultraviolet light produced by a discharge between the back of the film and a metal electrode exposing the color film from the back side [see Figure 1(b)] or from both front and back side [see Figure 1(c)].

When the film is placed between the finger and a metal electrode, one normally imagines the electrical discharge to occur between the finger and the front surface of the film with the ultraviolet light produced exposing the film from the front side to produce a blue color. However, it is equally possible for a discharge to develop in a small air gap appearing between the metal electrode and the back side of the film with the ultraviolet light produced exposing the film from the back side. This air gap can be quite small, approximately the thickness of a sheet of paper (two to five thousandths of an inch), and still be sufficient to allow discharge formation. Generally, the larger the air gap, the brighter the discharge.

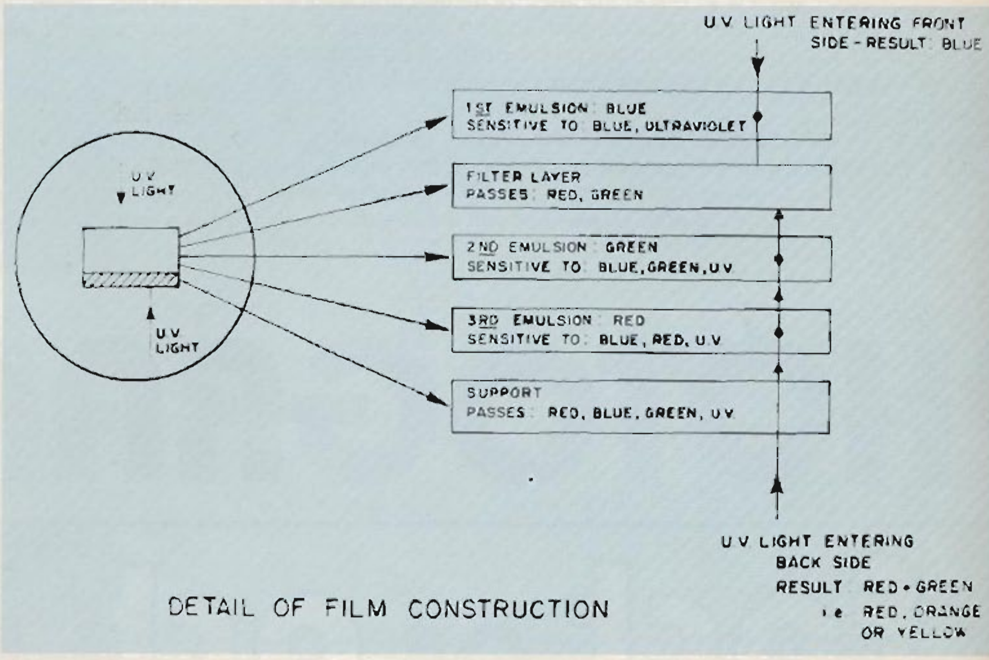
When UV light enters the film from the back side, it passes through the transparent film backing and exposes both the third and second emulsions producing red and green, respectively (see Figure 2). For low intensity exposure, the third layer is exposed strongly and the second layer is weakly exposed producing an almost pure red color.

The lack of exposure of the green emulsion for low light intensities is due to the strong attenuation of the uv light upon passing through the red layer. For more intense exposures, the second emulsion is exposed more and more, leading first to an orange and then to a yellow color. Thus, the origin of the red, orange and yellow colors is due to ultraviolet light entering the back side of the film. It should also be noted that areas exposed from both the front and the back side of the film, as illustrated in Figure 1(c), will develop to a magenta (mixture of blue and red) or a white (mixture of blue and yellow).

Surprisingly, the majority of Kirlian investigators did not like this theory, perhaps because it was too simple and did not leave much room for speculation. In any event, it seemed that more proof was needed, and that is what we wish to present here. We have performed two experiments; the first showing that we can produce, at will, any color in the Kirlian spectrum by following the teachings of our theory and, second, we can produce any type of fingerprint pattern and color just by altering the electrode-film spacings.

The purpose of the first experiment was to verify the film construction model shown in Figure 2, which predicts the result of exposing tne film with UV light. For each frame of a strip of Kodak High Speed Ektachrome film, one-third of the film was exposed from the front side, one-third was exposed from the back side and one-third was exposed from both sides as illustrated in Figures 3(a), 3(b) and 3(c), respectively. This was achieved by the use of a set of suitable opaque masks on the front and back sides

FIGURE 2



Simple model of color film construction illustrating the effects of UV light entering either the front or the back side of the film. Dot (·) indicates emulsion is exposed by the radiation.

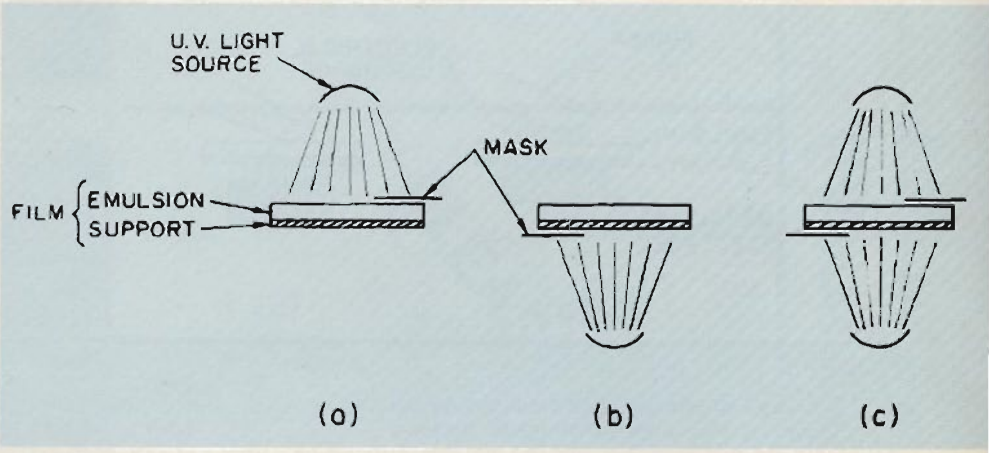


FIGURE 3

Exposure of film from front and/or back side with an UV light source. Analogous to Figure 1.

(a) Exposure of film from front side leading to blue color;

(b) Exposure of film from back side leading to red, orange or yellow color;

(c) Exposure of film from both front and back side leading to magenta, pink or white color.

of the film.

In order to show the shift of colors from red to orange to yellow predicted by our model, several frames were taken at different exposure levels yielding the results shown in the top four photographs of the left column in the color illustration. We note that the left one-third is exposed only from the front side producing blue, the middle one-third is exposed from both front and back yielding magenta, and the right one-third is exposed only from the back yielding red, orange or yellow. The exposure times from top to bottom were, respectively, 1/200 sec., 1/100 sec., 1/25 sec. and ½ sec.

All of these results are in accord with theory, i.e., that the red changes to orange and then to yellow plus the magenta changes to pink and then toward white as the exposure time increases and, finally, that all the colors tend to bleach out as the exposure time increases greatly. The color contrast is even more striking on the original color transparencies since the normal printing process tends to smooth out tonal differences on the prints.

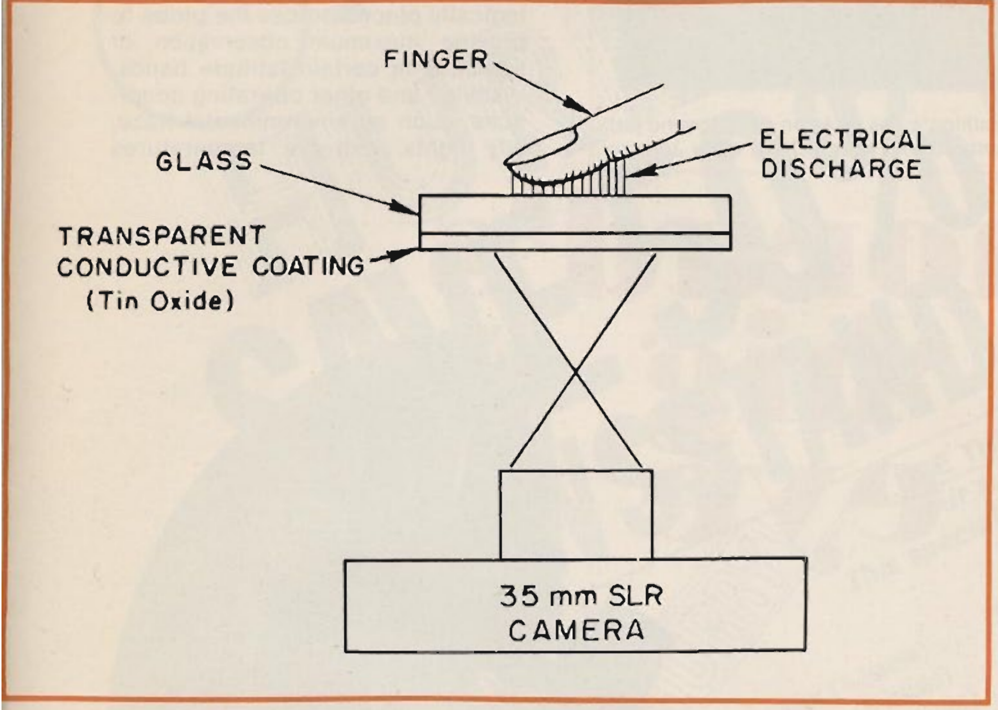
The purpose of the second experiment was to show that, by varying the finger-film-electrode spacing as depicted in Figure 1, the resulting colors are consistent with the above model. A strip of High Speed Ektachrome film (ASA 160), identical to the type used in Experiment #1, was placed in the air gap between the fingerpad and the metal electrode. The metal electrode was connected to a 100-kHz high-voltage, low-current power supply. A suitable insulated film stage and movable metal electrode enabled one to change the distance between the back side of the film and the metal electrode. The distance between the finger and the front side of the film was controlled only by moving the finger toward, or away from, the film surface. The final criterion for determining where the discharges occurred was to observe the discharge as it occurred in a darkened room.

We took a number of exposures, with author D.G.B. as subject, while attempting to explore a representative sample of finger-electrode-film spacing combinations. Some of these results are shown in the central and right-hand columns of the color illustration. In the *central column*, from top to bottom, we note the following: (1) the red center indicates predominantly back side exposure, peripheral regions magenta indicating both back side and front side exposure; (2) the red top region indicates predominantly back side exposure and the blue bottom region indicates predominantly front side exposure; (3) a similar situation to (1) but the filamentary blue outermost periphery indicates a front side exposure in that region; (4) the top blue region indicates a predominantly front side exposure whereas the bottom red region indicates predominantly back side exposure; (5) the top blue region shows exposure only from the front side whereas the bottom red region shows exposure only from the back side.

It is interesting to note the color of the fingerprint serrations in the upper blue portion of this picture. They are blue-white separated by black strips. The black strips correspond to intimate contact with the film and no discharge, whereas the blue-white strips correspond to the grooves providing small air spaces wherein discharge can take place.

In the *right-hand column* from top to bottom we have the following: (1) the large center region shows predominantly back side exposure, the narrow peripheral region shows both back side and front side exposure, the grooves in the fingerprint show both front side and back side exposure (in contrast to the above); (2) this is the same as (1) except that a larger spacing between film backing and the metal electrode produces a number of strong localized streamers yielding intense localized exposure from the back side (yellow spots); (3) the fingerpad was pressed tightly against the film eliminating any back side air gaps or finger print groove gaps so that only peripheral region exposure occurred from the front side; (4) the fingerpad was not pressed tightly against the film so that both front side and back side exposure occurred, the outer peripheral region shows front side exposure, the inner peripheral region shows both back side and front side exposure, the central region shows back side exposure and the magenta fingerprint grooves show both back side and front side exposure; (5) the metal electrode was backed off to increase the gap size at the back side of the film, some outer peripheral front side exposure, main central region shows *only* back side exposure.

FIGURE 4



Illustrating the taking of a Kirlian photograph with a camera via a transparent electrode.

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From the above commentary, we see that these results are fully consistent with the proposed model. The model may be farther checked by noting that it predicts that one should never see a green color alone (with this type of film) — a result that is observed. Additional confirmation is that the fingerprint grooves produce blue color from purely front side exposure and shift red to magenta when coupled with back side exposure. This is caused by the grooves allowing a small air gap to form at the front side.

Additional support for this overall explanation of the source of color came when we used a transparent electrode and externally photographed the light coming through the electrode as illustrated in Figure 4. This electrode, made by coating one side of a quartz or glass plate with tin oxide, is both electrically conductive and transparent. Provided the electrode was kept clean of organic deposits, we observed only blue (and white) color patterns. This is shown in the color composite (left-hand column, bottom picture) where the discharge from a subject's finger has been photographed by the arrangement of Figure 4 using the superposition of five 100-microsecond pulses (note that the discharge is from a network of points rather than uniformly from the whole electrode).

These two experiments show that it is possible to reproduce the interesting Kirlian color effects, heretofore attributed to altered energy states of the living system, by simple changes in the electrode-film configuration. Further, they have shown that these color effects can indeed be produced by ultraviolet light in the manner proposed earlier by the authors[1].

They support the postulate that the mechanism of light generation in Kirlian photography is a purely physical one associated with the electrical discharge. They neither confirm nor deny that non-physical energies are operative in carefully controlled Kirlian photography because it is felt that any detector designed to respond to five-physical-senses type of information is incapable of directly revealing information of a non-physical nature.

Thus, Kirlian photography would be incapable of directly revealing the aura that clairvoyants see. Finally, these experiments show that most work done to date on Kirlian photography has not been done carefully enough to stand as proof of energy changes in living systems associated with healers, changes of mental states or emotional states, etc. Future work in this area will require much more exacting control of the experimental configuration in order to provide meaningful results.

Acknowledgements

This work was partially supported by the Ernest Holmes Research Foundation.

Reference

1. D. G. Boyers and W. A. Tiller, "On Corona Discharge Photography," *Journal of Applied Physics*, page 3102, July 1973.

Kodak enters instant photo market

Eastman Kodak Company has officially entered the instant photography market, with two instant film cameras and a film for self-developing color prints based on reversal color imaging techniques.

Development of the litter-free prints takes place outside the camera in daylight or room light within about eight minutes, with an image beginning to appear in a minute or two. Prints feature a Satinlux finish to protect the prints from smudges and fingerprints.

Kodak instant print film, with an image size of 2⅝x3-9/16 inches, is exposed through the back of the film and, during development, imaging dyes are released for direct migration to the front or viewing surface. A film pack with ten picture units lists at $7.45.

The EK6 and EK4 cameras share three-element 137mm f/11 plastic lenses with antireflection coatings, electronic shutter with speeds from 1/300 to 1/20 and two apertures, f/16 and f/11, controlled by an IC containing a silicon photosensor. They both use flipflash for flash exposures. EK6 ($69.50) ejects the print automatically after the shutter is released, while the EK4 ($53.50) features a hand crank to transport the exposed film through the high-precision rollers which spread the sealed photochemicals and eject the print.

A folding model, EK8, produced in Germany, will be available later at a list of about $140.

Introduction to the U.S. market of the instant line is set for June.