RadioGraphics

Floral Radiography: Using X rays to Create Fine Art[1]

Merrill C. Raikes, MD

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Introduction

It is no secret to the readers of *RadioGraphics* that a diagnostic x-ray machine is nothing more than a camera, albeit a specialized one. Visible light and x rays are part of the electromagnetic spectrum, but each has photons of differing wavelengths. Film can be exposed by multiple types of photons. The film in a standard photographic camera sees only reflected light from the surface of objects, but film that is exposed with x-ray apparatus allows for a different dimension of visualization. It sees the shadow of an object by differential transmission of photons rather than by reflection. Either exposed photographic or x-ray film can be used as a negative to make prints.

Not long after the development of x-ray imagery, pictures of floral material were produced. Several examples of prints made from x-ray exposures of floral material appear with this article. These prints were shown at the 2002 RSNA meeting.

Background

Floral radiography is not new. Images were published by Goby (1) in 1913 and by Hall-Edwards (2) in 1914. The process did not receive much attention until the 1930s with the work of Hazel Engelbrecht (3) and Dain Tasker, MD (4). Engelbrecht's work sprang from scientific research of botanical specimens, whereas Tasker was interested in artistic presentation. Tasker's images were entered into photographic exhibits and subsequently published in the prestigious *U S Camera* (4). A recent book about Tasker shows 20 prints of his flower x-ray images (5). Some of his original prints have been bought by art collectors for tens of thousands of dollars. Sporadically, people have played with the process. Albert Richards, a retired dental x-ray professor from the University of Michigan, did a lot of work in the 1960s and 1970s. He published a book called *The Secret Garden* with 100 floral prints (6,7). Similar work today is not rare, but it is uncommon. Steven Meyers (8), Albert Koetsier (9), and Judith McMillian (10) all have extensive portfolios and in 2001 had an exhibition of 40–50 pieces in southern California (11). Both Meyers and Koetsier have Web sites that display their work.

Creating the Image

Almost everyone appreciates the beauty of flowers, and they have been a major theme in fine art photography over the years. Some would consider the subject matter cliché.

If one wishes to exhibit photographs of flowers, it is best to use a studio setting, medium- or large-format cameras, various backdrops, several lighting arrangements, and professional film and processing. If an x-ray camera is used, a much smaller amount of equipment is needed. X-ray film, once exposed and developed, can be processed like most photographic negatives, yielding black-and-white prints. To a radiographer, the resultant prints may at first have a novelty effect, but if properly done, they rise out of the realm of "office art" to a level of fine art. The nonradiographer may have no idea of how the work was created, nor is it of great importance. As with any fine art photograph, one responds to the impact of the image. The composition, form, drama of lighting, and overall balance make an image powerful and pleasing. A mood is created, evoking a feeling of beauty. With the x-ray print, the viewer becomes excited about the exacting detail and depiction of delicacy and complexity of structure. The complicated framework upon which the whole is spread becomes lush and evocative. If one makes use of the anode heel effect prominently displayed on the x-ray image, an exciting drama of light is mimicked in the prints, enhancing what might otherwise be flat and uninteresting. Light is a cornerstone of photography.

Creating floral radiographic prints starts with the x-ray camera. The equipment most suited for this purpose should have a small focal spot with an output of 10–50 kV and a beryllium window. Standard diagnostic x-ray units usually do not operate below 60 kV and have inherent filtration that eliminates the desired soft radiation. Mammography equipment allows the use of low kilovoltage, but it is designed to work with cassettes and screens, has inherent filtration, and has subsecond timers. Some success may be achieved

with mammography equipment if the imaged material consists of large dense specimens, but the optimal situation is to use a specifically designed, low-kilovoltage, specimen radiographic unit. Images shown herein were obtained with a MicroFocus 50 x-ray unit (no longer manufactured). The unit has a fixed milliamperage and a 50-μ focal spot. Faxitron (Wheeling, Ill) is now a major producer of this type of equipment. Its units have small focal spots, low kilovoltage, low milliamperage, and timers designed for exposures of several seconds duration. All the images in this article were obtained between 15–30 kV at 8–12-second exposures.

Screens are much too fast for this type of work. Direct exposure of the film works well and allows for maximum latitude. Single-emulsion mammography film can be used, but slower double-emulsion fine-grain industrial film works best to create high-quality x-ray negatives of floral material. There are multiple manufacturers of industrial film with varying speeds and grain size. Fuji IX25 (Stamford, Conn) was used for the images in this article. Choice of the best technical exposure factors becomes a matter of trial and error with each type of film. It is probably best to pick one film type and work with it rather than jumping around. After mastering use of one type, one can begin to experiment. The film needs a holder for light shielding; thin black plastic or light-protective paper of uniform composition works. Some of the industrial films come individually prepackaged in plastic, but they are expensive. Cassettes or cardboard attenuates too much of the x-ray beam.

Specimens are laid directly on the covered film surface to maximize sharpness. Minimizing the specimen-to-film distance is important, but do not sacrifice specimen form and shape to achieve this. Detecting lack of sharpness of some parts that do not touch the film plane requires high magnification and a trained eye. Because the inherent sharpness of x-ray film is less than that of photographic film, the x-ray negative should not be enlarged when it is printed. Contact printing minimizes the loss of sharpness.

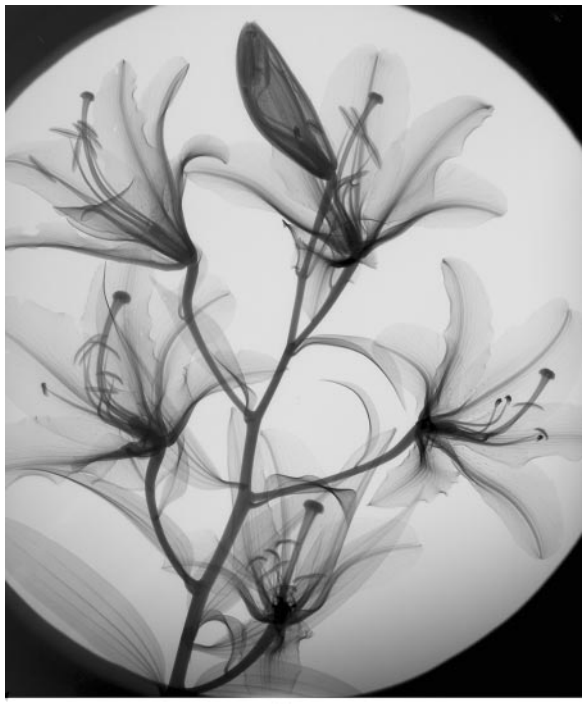
All the specimen x-ray units work as a closed box system with a limiting field size, usually around 12 inches. This limit is not a problem, since a 12-inch field and negative allows one to film most flowers at their actual size. Proper exposure becomes one of personal preference. Increasing kilovoltage achieves better penetration of thick parts but reduces definition of the thinnest parts. Increasing exposure time adds to overall film density without changing penetration. What might be an appealing image to see on the view box probably has too much density for the best photographic printing or digital copying (ie, keep the negative "thin" or on the underexposed side). Development of industrial film by hand is straightforward. Eastman Kodak (Rochester, NY) makes chemicals specifically for hand developing this film. Most diagnostic x-ray departments are not set up for automated processing of industrial film.

Once a negative is obtained, one can begin to apply all the darkroom magic at one's disposal in printing. A 10 × 12-inch piece of x-ray film makes nice contact prints. Do not dodge out all that decreased density at one end of the film from the anode heel effect. It will add interest to the print. A well-done silver print is a beauty to behold. If your cup of tea is the digital darkroom, you have a huge negative that lends itself to flatbed scanning.

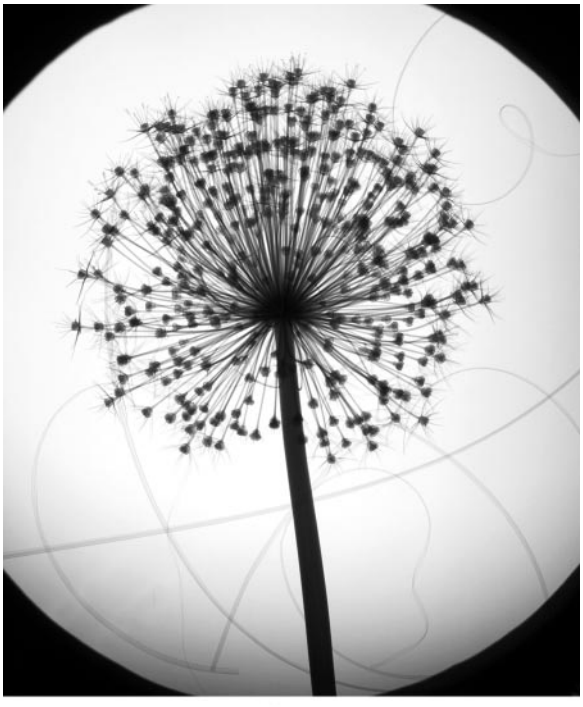
Conclusions

Fine art black-and-white floral photographic prints can be made from x-ray films of flowers. Optimum technique for making the x-ray image would use unscreened fine-grain industrial x-ray film covered by thin light-protective plastic. The film is exposed at low kilovoltage for multiple seconds with the floral material laying on the light-protected film in specimen radiographic equipment. The film is hand developed. Once the x-ray image is created, it can be used like any photographic negative to make a print or digital image.

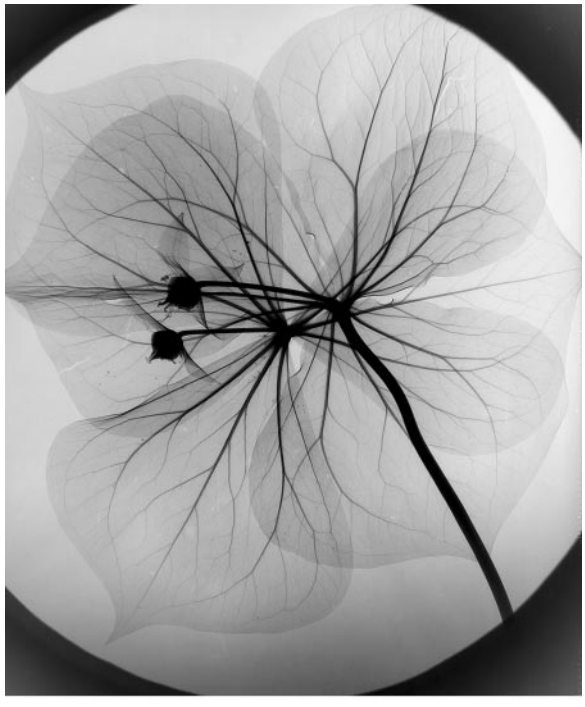
Sunflower



Lilies



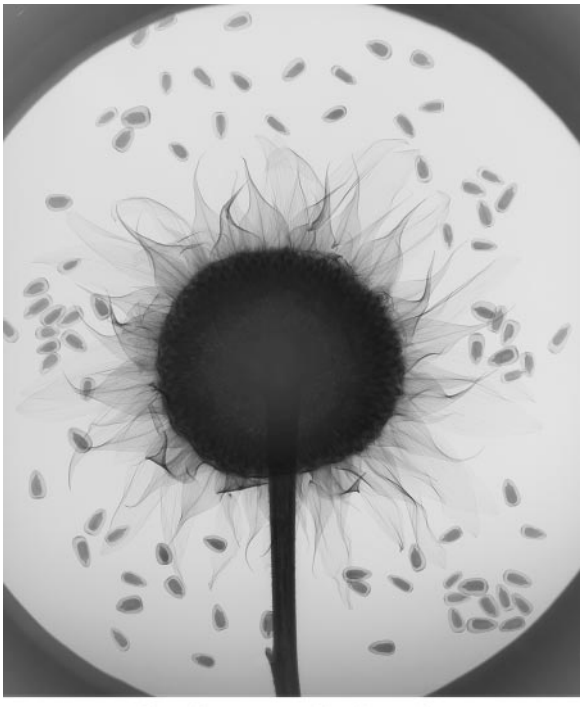
Allium



Trillium

Cone Flowers

Sweet Pea



Sunflower with Seeds

Oriental Poppy

Meadow Flowers

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