# APPLICATION OF A SF-4SPECTROPHOTOMETER TO A STUDY OF THE PASSAGE OF ULTRAVIOLET RAYS THROUGH ANIMAL FUR

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Opinions concerning the penetration of animal fur by u.v. light are contradictory. Some authors using biological tests have concluded that the coat of the dog or cow as a whole blocks u.v. light [1-3]. Others using cardiography, gastrography, and remenography hold that the coats of these animals let through ultraviolet rays.

The use of a physical method (spectrographic photometry) to study the passage of u.v. rays have shown that the furry coats of laboratory animals let through u.v. rays of wavelength 297-365 mμ [4].

However, the method of spectrographic photometry is laborious and is not sufficiently accurate on account of the low sensitivity of the photographic plate or selenium photocell used as a receptor element. Of the modern methods used to study the passage of u.v. light through animal fur the most sensitive and objective is that of spectrophotometry.

We have used a SF-4 quartz spectrophotometer with recording head and a FÉU-18 photomultiplier whose maximum sensitivity is in the ultraviolet region.

The apparatus consists of three main sections (Fig. 1): a u.v. source of irradiation (1), a quartz monochromator (2), and a high sensitivity recording head with a FÉU-18 photomultiplier (3).

As a u.v. source we used a VSFU-3 hydrogen lamp which gave a continuous spectrum in the ultraviolet region. Because hydrogen lamps are of low power and therefore give a small ultraviolet flux, while the fur to be tested has a considerable optical density we could not use the SP-4 standard recording head because of the low sensitivity of its receiver, which was an antimony-cesium cathode. We therefore made a high sensitivity recording head for measurement of the very small light fluxes passing through the fur. Instead of the standard spectrophotometer head with an antimony-cesium cathode having a sensitivity of 500 μa per lumen we used a new recording head having a FÉU-18 photomultiplier and a sensitivity of 20 a per lumen. The current from the photomultiplier was measured by a M-95 microammeter having an external multiple shunt. The power supply to the photomultiplier was obtained from a high-voltage stabilized rectifier VSF [4].

The method of operation was as follows. Biopsy specimens of the fur measuring 25 × 25 mm were placed at the output slit of the spectrophotometer in front of the recording head. The sample was fixed in a special holder (see Fig. 1), which consisted of a vertical clamp and two protruding tubes. The internal diameter of the channel in the tubes was 0.3 mm.

They were fixed so as to lie accurately parallel so that the same flux of u.v. light passed through them. In the sample of fur to be tested the aperture was covered with a thickness equal to the thickness of the tube. The sample was placed on one of the tubes so that the outer end was at the level of the root of the hairs. Monochromatic ultraviolet radiation passing through the fur and through the channel within the tube fell on the photomultiplier and was recorded by the microammeter. A control measurement was then immediately made of the intensity of the radiation passing through the control tube which was not impeded by the presence of the sample. The percentage of monochromatic ultraviolet radiation passed by the fur was then calculated from the formula:

$$\tau = \frac{I_1}{I_2} \cdot 100 ,$$

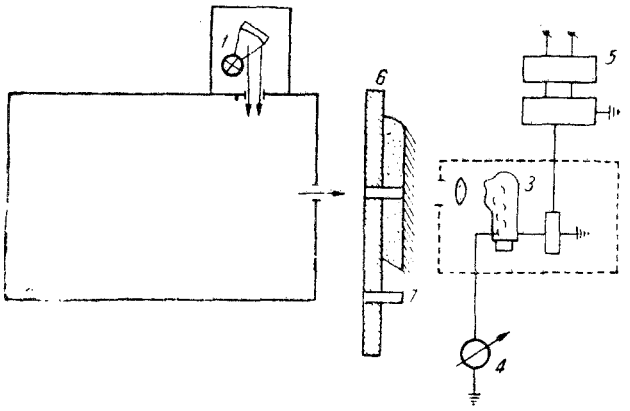


Fig. 1.

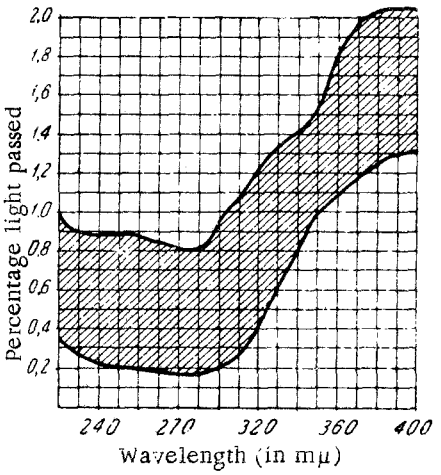


Fig. 2.

**Fig. 1.** Block diagram of the device for study of the amount of u.v. light passing through animals' fur. 1) Source of u.v. light; 2) SF-4 quartz spectrophotometer; 3) recording head with FÉU-18 photomultiplier; 4) M-95 microammeter; 5) VSF high-voltage stabilized rectifier; 6) holder for sample to be studied; 7) tubes for the passage of monochromatic ultraviolet light.

**Fig. 2.** Curves giving the percentage of ultraviolet light passed by the fur of white mice. Shaded portion indicates the range of variations.

where $\tau$ is the percentage of radiation passed by the fur of the animal under test; $I_1$ is the flux of monochromatic radiation passing through the fur of the sample; $I_2$ is the flux of monochromatic radiation passing through the control tube.

In each sample to be tested the proportion of ultraviolet light passed was measured at 3-5 points; measurements were made both from the side of the hairs and from the subcutaneous tissue.

Sample calculation. The current caused to flow by the monochromatic ultraviolet radiation of wavelength 290 mμ passing through the control tube, and which was measured by the microammeter, had a value of 120 μA; the light flux of radiation passing through the tube covered by the fur of a white mouse was 0.36 μA. Then the percentage of radiation passed by the fur was:

$$\tau = \frac{I_1}{I_2} \cdot 100;$$

$$\tau = \frac{0{,}36 \cdot 100}{120} = 0{,}3\%.$$

Figure 2 shows the threshold for the passage of u.v. light of wavelength 220-400 mμ through 25 samples of the fur of white mice.

The spectrophotometric studies showed that the fur of calves and pigs whether white or black constituted neutral light filters, i.e., the percentage of u.v. light in the range 220-400 mμ which was passed was the same and was independent of the wavelength of the u.v. light.

The passage of u.v. light by the fur depends upon how fresh the sample is, and therefore spectrophotometric work should be carried out within a few hours of removing the sample from the animal.

## SUMMARY

This paper describes a method and the results obtained in investigations on penetration of ultraviolet light in the range 220-400 m through the fur of animals; we used a special unit incorporating a SF-4 spectrophotometer which operated with a FÉU-18 type photoelectron multiplier. A spectrophotometric study was made of samples of fur taken as biopsy specimens of freshly killed animals.

## LITERATURE CITED


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