solution (25.0% trichloracetic acid + 18% hydrochloric acid) is added to each tube. The resulting precipitate is filtered off through Whatman No. 42 paper (11 cm).

Five ml of the filtrate is pipetted into a small test tube, followed by the addition of 1 ml of 0.05% copper sulfate plus 2% Calgon solution, and 5 ml of 8% sodium carbonate solution. Then 2 drops of BQC solution (50 mg/10 ml absolute methyl alcohol) are added, and the colors allowed to develop for 15 min at 37° C. The developed colors are compared with suitable standards.

For ripened cheese, the color development procedure is the same, except that 1 ml of 10% Calgon solution is substituted for 1 ml of the copper sulfate-Calgon solution.

Tentatively, for the long incubation method any value over 5 γ phenol/0.5 ml milk or 0.25 g cheese indicates underpasteurization or raw milk products. A 1-hr test using the identical steps but with a different critical standard has also been developed.

The sensitivity and accuracy of this test are very high, and the value of blanks is low. Table 1 shows some data obtained with milk and aged Cheddar cheese.

References

1. KOSIKOWSKY, F. V. and DAHLBERG, A. C. *J. dairy Sci.*, 1948, **31**, 561.
2. *Ibid.*, 1949, **32**, 751.
3. SANDERS, G. P. and SAGER, O. S. *J. dairy Sci.*, 1947, **31**, 909.

Comments and Communications

Electronic Enhancement of X-Ray Film Contrast[1]

A viewing device for x-ray films, which makes use of some principles of television, promises to be of aid in certain long-standing problems of roentgenology. Many films contain questionable faint shadows whose existence and outlines ought to be ascertained definitely. If such a film is scanned by a densitometer, small but distinct differences in density can sometimes be found in homogeneous-looking regions of the film.

A television camera, using an orthicon tube or other scanning device, is employed as a continuously acting densitometer. The electrical output from the camera is amplified, "clipped" as described here, and fed into a kinescope, or viewing tube, as in conventional television practice.

The new feature of this method lies in the clipping. Unlike photographic film, which necessarily has black as the origin of its intensity-axis, a camera-amplifier-clipper combination can be arranged to ignore all light of less than a prescribed intensity. This is possible because a vacuum tube can be made insensitive to voltages more negative than a chosen threshold. The tube can also have an arbitrarily placed upper limit beyond which it fails to respond. Thus the voltages representing the darkest and the lightest portions of the film are clipped off, permitting those parts of the signal between the limits to be amplified as desired.

Thus a suitably high-gain video amplifier with adjustable cut-offs for both the black and the white ends of the signal can expand any portion of the gray to the full contrast of which the kinescope is capable. Everything darker than a certain gray is reproduced as black and everything brighter than another (lighter) gray comes through as white, but the outlines of those areas which have intermediate brilliance but small contrast are vividly portrayed by the picture tube.

[1] The authors wish to express their thanks to the Balaban and Katz Television Studios, Station WBKB, Chicago, for making available equipment for these experiments.

Successive parts of the black-gray-white scale can be examined by rotating a knob, analogous to the brilliance control of a television receiver. Let us imagine a solid, formed by erecting a line perpendicular to the film at each point of its surface, each line having a length proportional to the density of its foot. This solid is cut by two planes parallel to the film (one plane representing black on the kinescope and the other white), and the frustum can be examined in detail. The brilliance control regulates the distance of these planes from the base, and the contrast (sensitivity) control adjusts their distance from each other. The result can be metaphorically described as taking serial sections along the density axis of the film.

To date, a few x-ray films have been viewed by this method, and the improvement in contrast is striking, especially when one personally operates the controls and watches the shifts in emphasis. If the kinescope is photographed with the controls properly set, a more vivid picture results than can be taken from the film directly.

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The High School Biology Teacher

Victor A. Greulach (*Science* 1949, **109**, 385) in sharing Dr. Van Overbeek's concern over the inadequacy of high school biology teaching, (*Science* 1949, **109**, 210) exhorts "professional biologists through their societies to support a program designed to improve the quality and quantity of secondary school biology."

A practical and more immediately feasible suggestion might be for some university departments of biology to remove—or at least to open—the academic curtain that they keep tightly drawn between themselves and departments of education. I know of one large university in the East in which the zoology department schedules its courses at hours which seem deliberately designed to keep out high school biology teachers.

It is gratifying to learn of the preoccupation of at least some professional biologists with improvement of the biology literacy of the American public. National, state, and local associations of high school biology teachers are equally concerned and they would welcome the cooperation of their colleagues in colleges, universities, and research institutions.

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Correction

In my report on the Echo Lakes Symposium on Cosmic Rays (*Science*, September 2, 1949) the π- and μ-symbols were interchanged, in the line before last of the second column, p. 242, and in the first line of the third column in the same page. The portion of the text containing these two lines should read: ". . . the latest values for the masses of the μ- and the π-meson (215 and 285 electron masses respectively) and for the mean life of the π-meson (0.63×10^{-8} sec)." In a recent letter to the writer, Dr. Barkas states that this value for the mean life of the π-meson has been superseded by more accurate measurements. These measurements, made on positive π-mesons, give a mean life of 1.97×10^{-8} sec. Dr. Barkas also indicates that new mass measurements give 276 electron masses for positive or negative π-mesons and 210 electron masses for positive μ-mesons.

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Psilotum Gametophytes Matured under Greenhouse Conditions from Self-sown Spores

Recently, young sporophytic plants of *Psilotum nudum* (L.) Griseb. (Eames, A. J. *Morphology of vascular plants, lower groups.* New York: McGraw-Hill, 1936) were found growing in the pot of a ten-year old *Cibotium* plant and in the soil around a dead *Adiantum* plant taken from the former pot. Mature sporophytic plants of *Psilotum* have been growing for 10 to 12 years in the vicinity of the *Cibotium* plant in the Cornell University Conservatory.

Numerous whole or fragmentary pieces of gametophytes (Darnell-Smith, P. A. *Trans. Roy. Soc. Edinburgh*, 1917, **52**, 79; Holloway, J. E. *Ann. Bot.*, 1939, **3**, 313; Lawson, A. A. *Trans. Roy. Soc. Edinburgh*, 1917, **52**, 93) were found in the soil supporting the sporelings, but none were found in the larger pot where they probably first appeared. Gemmae were observed arising from both the gametophytes and the sporophytic rhizomes as described by Holloway. Antheridia were fairly abundant, and the characteristic four-rowed archegonial necks, both entire and decapitated, were observed on nearly all of the gametophytes. Structures which could unquestionably be called embryos were not seen. During the examination of the gametophytes in water under a dissecting microscope, the heat from the electric light bulb warmed the water sufficiently to cause the antheridia to open apically to discharge the sperms. Under the artificial conditions, the sperms were short-lived and died within an hour or less if they did not come in contact with archegonia. The striking, coiled, hyaline sperms were not seen to enter the archegonia, but apparently to lie down, as it were, and remain across the open end of the decapitated necks.

This brief description of a possible source of gametophytes of a plant so important to morphologists and systematists seems worthy of note, for, insofar as the authors are aware, the gametophytes of *Psilotum* have not before been cultured to maturity, either intentionally or, as here, unintentionally, and such culture is considered impossible by many. Lawson germinated spores under nearly natural conditions but it is not clear from his report whether he grew the gametophytes to maturity or not.

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Rainfall of Fish

With regard to the communication (*Science*, 1949, **109**, 402) concerning the rainfall of fish, another pertinent experience may be of interest.

While stationed on the island of Guam in September, 1936, I witnessed a brief rainfall of fish, one of the specimens of which was identified as the tench (*Tinca tinca*) which, to my knowledge, is common only to the fresh waters of Europe. The presence of this species at a locale so remote from its normal habitat is worthy of note.

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