his own body. The clinician may find the method useful where subjective answers may be relied upon.

Just why the corpuscles appear as bright somewhat elongated specks is questionable. I first observed the phenomenon on looking at a carbon arc focused to a parallel beam, passing through a combination Corning ultra-violet filter (G 586–A and G 584–J). I thought the effect was due to fluorescence of the white corpuscles but am now certain that is not the explanation.

If a small field is selected for observation the bright points, whose elongation I attribute to persistence of vision, are found to be not sufficiently numerous for red corpuscles. They move over the *same pathway* at infrequent intervals and must be white corpuscles. Nevertheless, there is a definite relation between the absorption spectrum of haemoglobin and the light in which one can see the moving corpuscles most plainly. Abelsdorff and Nagel showed that the moving corpuscles appear in light which haemoglobin absorbs. Thus they are visible in blue-violet but invisible in red light. One should expect that with a blue glass the continuous stream of red corpuscles would throw a shadow of the capillaries on the retinal elements. Yet we see no evidence of capillary loops or plexus in shadow form. No doubt this is because the capillaries are so near the retinal elements that their shadow is fixed. In the classic method of demonstrating the shadows of the *large* blood vessels over the *surface* of the retina by looking through a pinhole at a white surface, the pinhole must be moved so as to continually cast a bloodvessel shadow over new retinal elements. When the pinhole is fixed no shadows are visible, although shadows are continually cast upon the rods and cones. This corresponds to the condition where a continuous stream of red corpuscles moves through capillaries in blue light. Although each red corpuscle moves, the corpuscles overlap and the shadow is continuous. But when a white corpuscle comes along which does not absorb blue light, as the reds do, we have a rift in the shadow figure which corresponds to movement of a shadow across the rods and cones, analogous to the movement of the pinhole in the demonstration of the *large* retinal blood-vessels. Thus we see the white corpuscles by contrast with the reds and see them best in light which casts the best shadow. Red light passes both the red and white corpuscles and no contrast appears.

It so happens that the brightest lines of the mercury vapor lamp (the yellow, the green and the blue violet) lie in the position of oxyhaemoglobin absorption bands. One can therefore see the moving corpuscles of the retina very well by looking at a white matt surface illuminated by a mercury lamp; or by appropriate filters one can isolate each line and observe the moving corpuscles in yellow, green or blue violet light.

I recommend the above simple experiments to any one interested in the circulation of the blood or in subjective phenomena. They deserve to be more widely known than appears to be the case.

The literature on this subject is as follows:

Abelsdorff, G., "Arch. f. Anat. u. Physiol.," 1903, p. 366.

Abelsdorff, G., and Nagel, W. A., *Zeit. f. Psychol. u. Physiol. des Sinnesorgane, 34,* 291, 1904.

Fortin, E. P., *C. R. Soc. Biol., 62,* 355, 1907.

Helmholtz, H. von., "Physiologische Optik," 2nd Aufl., 1896, p. 198.

Reuben, L., *Amer. J. Sc., 31,* 325, 1861.

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E. NEWTON HARVEY

WOODS HOLE, MASS.

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MICROPROJECTION BY THE DAYLIGHT SCREEN

IN the teaching of histology, organology and neurology the chief difficulty lies, not in making the students see the details of an organ, but rather in orienting for them the plane of section and the relationship of the main parts. It is next to impossible to persuade the student that a low power objective is far more important in the study of most sections than a 4 mm objective, and as a result he fails to obtain a true conception of relationships. Then, too, in personal demonstration six times out of ten the average student does not see that which you try to show him under his microscope. Again, it is impossible to properly demonstrate three or four slides in five or six minutes, which is the average time a demonstrator has per student in order to handle 15 to 20 of them. These difficulties, I am sure, are encountered not only by anatomists but also by embryologists and botanists.

It has been my experience that a short time spent during each laboratory period in projecting the slides to be studied, with a 48 mm, 25 mm or 16 mm objective and pointing out the plane of section and the relationships of the main structures will create an interest and give a viewpoint conducive to effective laboratory study. The best results are obtained by a ten to fifteen minute demonstration to ten to fifteen students at a time. Personal demonstration for this number of students would require from one and one half hours and would permit greater misinterpretation.

For the projection method of demonstrating sections the day-light screen is of great value, since it permits demonstration at one end of the laboratory without interrupting the work of the rest of the

students. The daylight screen now on the market has several objectionable features: in the first place, its lines are too coarse, thus destroying the details and also producing a glaring streak of light across it; in the second place the greenish tint destroys the true color value in arc-light projection; and in the third place the screen is too expensive. A screen which presents none of these objectionable features can be had in a piece of paraffined tracing-paper, a piece of paraffined tracing-cloth or a ground-glass plate.

THEODORE H. BAST

UNIVERSITY OF WISCONSIN

SPECIAL ARTICLES

THE PHOTOACTIVITY OF SUBSTANCES CURATIVE OF RICKETS AND THE PHOTOLYSIS OF THE OXY-PRODUCTS BY ULTRAVIOLET RADIATION

THE demonstration by Huldschinsky[1] and others that radiation with the quartz mercury vapor lamp or sunlight prevented and cured rickets, was a great advance in the knowledge of that disease. It had been proved also that cod liver oil prevents and cures rickets[2] and therefore the dilemma presented itself that two therapeutic agents apparently unrelated cure the disease. The one, a physical force derived from the sun, is absorbed through the skin, the other, an oil taken from the liver of a fish, enters the body by way of the alimentary tract. Nevertheless, investigation soon showed that in their action in rickets and infantile tetany radiant energy and cod liver oil are indistinguishable. No matter which of these apparently dissimilar therapeutic agents is employed, favorable clinical and roentgenological evidences of healing in rachitic subjects are demonstrable. With both, there is a similar latent period; with both, the normal equilibrium of calcium and inorganic phosphorus of the blood is reestablished; and furthermore, with both, the histological changes in the skeleton are identical. The similarity of the action of radiant energy and cod liver oil is so striking as to cause Park, Powers and Guy[3] to conclude, "The similarity between the action of cod liver oil and that of radiant energy in rickets is so close that a connection must exist between them. So far as the calcium and phosphorous metabolism of the body are concerned, cod liver oil seems to be a substitute for radiant energy. It will be most interesting to see if, in the near future, a relation between cod liver oil and radiant energy will not be established of such nature that these effects will be explicable on a single basis."

Investigations were therefore undertaken to determine the possible common property of radiant energy and the various substances curative of rickets. The present data is representative of a series of preliminary experiments for qualitative orientation and serve as a basis for quantitative study.

A. *The Emission of Ultraviolet Radiation by Substances Curative of Rickets.*

Method. Substances curative and non-curative of rickets were tested for their emission of ultraviolet light. They were placed in beakers and covered with specially prepared photographic plate holders. The plates were exposed to each substance for twenty-four hours, developed with pictol,[4] fixed, washed and dried.

The plate holder consisted of a shallow lead box of a size just large enough to admit the four inch by five inch photographic plate and a closely fitting cover of the same material. In the floor of the lead plate holder a hole two centimeters square was cut to allow the formation of a sharp photographic image. A quartz plate, either fused or transparent, was sealed over this aperture in such a way as to prevent the permeation of volatile substances from the test materials. Similar holders were made with glass screens. Ultraviolet sensitive plates[5] coated with a very rapid emulsion (Seed Graflex 60) were placed with the film surface in apposition with the quartz or glass screen and then covered by the lid. Each beaker covered by this plate holder was placed within a light-proof container which in turn was placed within a second light-proof container.

Three series of experiments were carried out on each substance. In the first series the substances were made alkaline with ten per cent. potassium hydroxide and this mixture was oxidized by bubbling through it a current of pure oxygen. In the second series the substances were untreated. In the third

[1] Huldschinsky, K., Deutsche med. Woch., 1919, XLV, 712; Zeitschr. f. Orthop. Chir., 1920, XXXIX, 426.

[2] Schabad, J. A., Zeitschr. f. klin. Med., 1909, LXVIII, 94; Shipley, P. G., Park, E. A., *et al.*, *J. Biochem.*, 1921, XLV, 343. Park E. A., and Howland, J., Johns Hopkins Hosp. Bull., 1921, XXXII, 341.

[3] Park, E. A., Powers, G. F., and Guy, R. A., *Am. J. Diseases Children*, 1923, XXVI, p. 111.

[4] Dissolve 3 oz. of desiccated sodium sulfite in 16 oz. distilled water and add this to a solution of 150 grains of hydroquinone in 8 oz. of distilled water. This constitutes solution A. Dissolve 2 oz. of potassium carbonate and 60 grains of potassium bromide in 16 oz. of water. This constitutes solution B. For use mix three parts of A with two parts of B.

[5] These are being replaced by Schumann plates for photographing the extreme ultraviolet region since gelatin exercises a very powerful absorptive influence upon rays of short wave length.