Colour of Red Blood Corpuscles

I HAVE read with great interest recent communications on this subject which have appeared in *NATURE*¹. I agree entirely with them, but another factor is, I think, involved, for when single red blood cells are looked at under a microscope they appear to be chrome yellow, lemon (barium) yellow or yellowish-green (crude auriolin) according to circumstances, whereas very dilute solutions of hæmoglobin look pale orange, beige or straw-coloured (yellow ochre) according to circumstances. In other words, there seems to be a greenish tinge visible in the cells which is absent from the dilute solution. Now, it is very easy for the eye to be misled in judging shades of colour when they are seen separately. Judgment is much more exact when the colours to be compared are seen side by side. This can be achieved in the following way.

Remove the eyepiece from an ordinary microscope. Unscrew the lenses and place them together so that they form a Ramsden eyepiece. Prick the finger and dilute the blood about 1 in 100 with normal saline. Place a drop of the mixture on a slide, cover with a cover slip and examine with a $\frac{1}{4}$ -inch objective.

Prick the finger again, dilute the blood about 1 in 100 with distilled water. Place tiny drops of the mixture on a glass slide by means of a very fine paint brush. Place on a drop of xylol. Place this slide on top of the draw tube of the microscope. Examine the droplets with the Ramsden eyepiece, constructed as above, and focus the magnified images of the red cells at the same time. Shift the slides until a red cell and a droplet of solution are seen side by side in the eyepiece. The cells look greenish, whereas the solution looks orange; the difference in colour is usually quite striking. Droplets of different depths of tint may be tried, but none of them will be found to match the colour of the red blood cell.

The explanation is as follows. As is well known to the computers of optical objectives, the secondary spectrum due to uncorrected chromatic aberration tends to colour the edges of the images of all objects. The precise colours of the secondary spectrum depend on the two wave-lengths chosen for exact coincidence in the focal plane of the objective. In photographic objectives the colours of the secondary spectrum are often blue and yellow. In achromatic microscope objectives they are often blue-green and pink. In semi-apochromatic objectives they are often green and purple. These colours are well seen if an emulsion of two colourless fluids is observed with the microscope, such as xylol vigorously shaken with water. The droplets should be colourless, but when seen under the microscope appear to be tinted green, blue-green or blue according to the objective in use, and to have surrounding them narrow rings which are purple, pink or yellow respectively. The precise colour of this surrounding ring is often obscured by other aberrations which are present.

Consequently, when objects such as cells are observed under a microscope the colour presented to the eye will be that which results from combining the absorption of the dye in the object with the secondary spectrum of the objective. In the case of red blood cells, the faint orange or straw yellow of the hæmoglobin is modified by the green, blue-green or blue contributed by the objective, as the case may be, causing the cells to appear yellow or even yellowish-green. In confirmation of this, experiment shows that when red cells are observed through a fully corrected apochromatic lens, their colour is no longer

yellow or yellowish-green, but the unmodified pale orange or straw yellow of the hæmoglobin alone.

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¹ *NATURE*, 152, 331, 476 (1943).

Intracutaneous Injection of Cattle

DURING the course of investigations on the production of immunity to foot-and-mouth disease the intracutaneous route of vaccination has been considered. It has generally been recognized that one disadvantage of this route in large animals is that, owing to the pressure required, only a small volume of inoculum can be injected at one site. Various attempts have been made in the past to overcome this difficulty, and by means of compressed air Curasson, Dischamps and Andriesky¹ found it practicable to inject 10 c.c. of their rinderpest vaccine into the skin of the bovine scrotum and vulva.

With an ordinary hypodermic syringe it is possible to inject up to 5 c.c. of a watery liquid into the skin of cattle, but the pressure required is too great to make the injection of a number of animals a very practical procedure; it is only with very great difficulty that a more viscous liquid such as serum or defibrinated blood can be injected in such a large dose. There is also a tendency with a hypodermic syringe for some of the inoculum to leak past the piston.

With the help of Dr. E. Schuster of the National Institute for Medical Research, Hampstead, a special syringe has been designed for this work. The principal difficulty of providing sufficient pressure has been

overcome by making use of the mechanical power of the screw.

The salient features of this syringe are shown in the accompanying diagram. It is of metal construction. The capacity of the syringe is 10 c.c. and it is filled and emptied by turning the knurled wheel on the end of the piston rod, the pitch of the thread on the piston rod being so designed in relation to the bore of the barrel that one turn delivers 1 c.c. The syringe can be dismantled by loosening the grub screws on the collar, unscrewing the collar and withdrawing the piston from the barrel. It is essential that the piston fits the barrel very closely, and in order to prevent these two metal surfaces seizing, the sides of the piston are formed by an 'oilite' bearing bush. Such a bush consists of sintered bronze impregnated