whole length of the embryo; another is due to the fact that sagittal sections lack many of the structures which the student has come to regard as landmarks in his study of transverse sections. On the other hand, the preparation of sagittal sections presents difficulties for the technician.

The present writer has used for some years in his classes preparations which show the eight to fourteen somite (thirty to thirty-six hours incubation) chick in side view, in place of sagittal sections. Such preparations are scarcely more difficult to make than the usual whole mounts and help greatly the student in his attempt to visualize the structure of the embryo of this stage. The method has up to the present been used only on embryos before the beginning of torsion in the head region. It is possible, however, that it might be modified to apply to embryos of somewhat later stages.

The egg is opened in salt solution and the blastoderm cut from the yolk and floated into a watch glass in the usual way. It must then be turned over while still alive so that its dorsal surface is underneath (Figure 1, A). The lateral edge of the blastoderm directly opposite the middle of the embryo is then lifted with forceps and folded over so that the embryo appears along the folded edge and projects from it (Figure 1, B), while the half of the blastoderm which was lifted now lies over the other half which remained in position in the watch glass. The operation of folding the blastoderm can best be carried out under a binocular microscope. It is important to make the fold such that the entire length of the embryo lies along the crease. The salt solution is now withdrawn and the fixative added drop by drop directly onto the blastoderm. Such embryos can be washed, stained and mounted according to the usual method employed for "whole mounts." They show particularly well the general form of the embryo, including the head process, the foregut and the heart. Figure 1, C, shows a sketch of a chick embryo mounted as described.

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## COLOR DISCS USED IN SOIL COLOR ANALYSIS

IN the study of a series of podsolic soils developed upon the reddish-brown colored Early Wisconsin drift of east central Minnesota, considerable attention was recently (February, 1927) paid by the writer to the question of the best method of expressing the color of samples of soil from the various horizons of the soil profiles, in order that their color peculiarities might be brought out.

Munsell Rotating Color Discs were used, as one means amongst others, of analyzing and expressing the color of the disturbed soil samples. These discs are essentially Maxwell's discs, of stiff paper, colored "Red," "Yellow," "White" and Black." They are made to rotate upon a motor-driven shaft, and provide a means of matching a very great number of colors simply by altering the relative proportions of the different color discs exposed to the eye. Each one of the four almost new color discs was examined with a Keuffel and Esser Spectrophotometer, with the results given in Table I. Their spectral distribution curves are plotted in Figure 1. Each value for relative brightness represents the mean of five closely agreeing photometer readings. The standard white used in the machine was a freshly scraped surface of a block of magnesium carbonate.

TABLE I. ANALYSIS OF COLOR DISCS USED IN SOIL COLOR ANALYSIS

| Wave length | Relative brightness expressed as percentage | | | |
|---|---|---|---|---|
| | "Red" Disc | "Yellow" Disc | "White" Disc | "Black" Disc |
| | Per cent. | Per cent. | Per cent. | Per cent. |
| 7000 Å | 60.2 | 70.8 | 75.6 | 3.4 |
| 6500 | 55.6 | 66.2 | 73.8 | 2.5 |
| 6000 | 22.5 | 66.8 | 74.0 | 2.3 |
| 5500 | 5.8 | 63.0 | 74.0 | 2.3 |
| 5000 | 6.0 | 22.0 | 76.2 | 2.2 |
| 4500 | 10.2 | 22.2 | 80.5 | 3.0 |
| $\frac{I_{6500}}{I_{5000}}$ | 9.27 | 3.01 | ..... | ..... |
| $\frac{I_{6500}}{I_{6000}}$ | 2.47 | .99 | ..... | ..... |

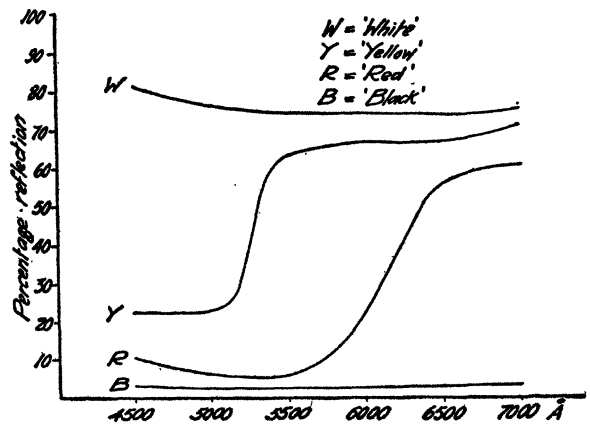


FIG. 1. SPECTRAL DISTRIBUTION CURVES PLOTTED FROM DATA OF TABLE I.

The purpose of this notation upon the subject is to point out the relative impurity of the color discs. This lack of purity of hue means that the percentages assigned

to the various colors used on the disc are far from representing percentages of pure spectral hues. The actual percentage transmission of spectral red, for example, from the "Red" disc is lower than that from the "Yellow" disc. To the eye, of course, the differences in reflection of light of these wave lengths appears extreme in the opposite direction. By means of the ratio $\frac{I_{6500}}{I_{5000}}$ the different appearances to the eye of these two discs is more satisfactorily represented. Similarly the ratio $\frac{\text{"Red"}}{\text{"Yellow"}}$ as determined by color disc analysis is found to bring out better the apparent striking color differences of two soils.

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## SPECIAL ARTICLES

### LIVING CELLS TWO AND A HALF CENTURIES OLD

RESEARCHES dealing with the growth and hydrostatics of trees and other massive plants have led to a consideration of the activities of living cells in the interior of large stems. Rigidity and other mechanical features of tree-trunks are such that living cells in layers a year old can not grow or divide and hence the existence of a living cell in layers 50 or 100 years old may be taken as an example of a protoplast which has carried on an individual existence for that length of time. In many trees all living cells perish when the splint or sap wood of which they form a part is converted into heartwood. A notable case was recently described in SCIENCE in which medullary cells of the redwood remained alive in the heartwood attaining an age of over a century.[1]

Professor Faul has recently called attention to the work of J. H. White in which tyloses were seen in heartwood of beech, maple, oak and other trees in regions invaded by *Fomes applantus*. It is implied that these formations take place only in living cells and that their development was induced by the penetrating fungus. The case seems to call for a more detailed examination. Now that the existence of living cells in heartwood and in old wood has been rescued from the negations of widely used text-books it is highly probable that numerous additional examples will be found.[2]

Our quest for other examples of long-lived cells has had for its chief purpose the determination of the progressive changes in protoplasts which attain great age and to appraise the conditions endured. A desert tree *Parkinsonia microphylla*, which has been used for tests in conduction and growth has yielded results of interest in this matter.

This bean tree is a prominent member of the desert flora of the southwest and because of its smooth green bark is known as "Palo verde." Despite the fact that its growth in thickness is at an extremely low rate, 0.2 to 0.6 mm annually, the trunk is soft and brittle, losing 45 per cent. of its dry weight in two days in the drying oven at 100° C. Bark and wood are heavily loaded with crystals, mostly calcium carbonate. The ash constitutes as much as 3.4 per cent. of the dry weight.

Sections of stems 10 cm in diameter and over 75 years old, first examined, showed occasional living ray-cells near the center and also a number of tracheids in which the nucleus and cytoplasm were plainly in a normal and active condition.

An older excentric trunk which stood in a leaning position showed sound moist wood in the flank which was 9 cm in thickness. Several counts of layers by Dr. Forrest Shreve gave a basis for the estimate that the age of the trunk might be safely taken as between 275 to 300 years old. Living ray cells and tracheids could be seen in sections near the center without staining and with a dry objective. We have no hesitancy in announcing that these elements may be safely considered as having an age of over 250 years.

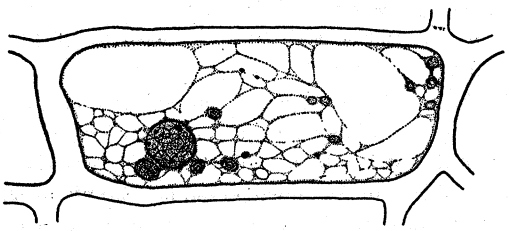

FIG. 1. Ray cell of Parkinsonia over 250 years old. Reticulum of nucleus and cytoplasm well defined.

Macroscopically the stele of *Parkinsonia microphylla* presented a nearly uniform light straw color sometimes with a small central core of heartwood (duramen). In other words, sapwood (alburnum) made up almost the entire mass of wood. Elements of the xylem consisted of tracheids typical in shape; coarsely pitted vessels; elongated thick-walled cells with blunt ends, and short prosenchymatous cells in vertical rows near the medullary rays.

The tracheids composed by far the greatest part of the xylem. They measured approximately 20 microns in length. Those laid down at the end of the growing season in the oldest wood near the central pith had walls averaging 4 microns when measured between lumina of two tracheids, while those formed in spring and summer and measured in the same way averaged 3 microns in thickness. Comparative measurements of tracheids in xylem formed in recent years was 3.2

[1] MacDougal, D. T., and G. M. Smith, SCIENCE 66, 456–457. 1927.

[2] Faul, J. H. "Living Cells in Heartwood," SCIENCE 67, 296. 1928.