actually be seen; its streaming is, however, made evident by the movement of included particles. A rapidly moving particle may, where there is an irregularity in the arrangement of the striae, strike against the side of a strip of phaneroplasm; its forward movement is thus retarded, but only for a few moments while it is slowly pushed through the phaneroplasm, first thinning it, and then breaking through. This and other similar events indicate that *the cryptoplasm is the actively streaming component of protoplasm.*

The strands of phaneroplasm are from 0.3 to 0.4 μ in thickness and 0.2 to 0.3 μ apart.

Except for the optical properties already referred to, there is little to be said concerning the physical, chemical and vital nature of the two substances which make up the living hyaline diphasic system. The phaneroplasm is brightly illuminated but the cryptoplasm is not. Where the protoplasm, at rest, assumes a mottled appearance, the phaneroplasm becomes the dispersed phase and the cryptoplasm the dispersion medium of an emulsion; where the protoplasm is striated but the striae broken, the structure is still that of a (distorted) emulsion; but where continuous striae exist, there is no distinction between a discontinuous and a continuous phase, that is to say, there is no emulsion as ordinarily defined.

New terms are convenient if merely as temporary handles to be discarded as knowledge of the subject increases, but they add confusion if satisfactory old terms exist. Strasberger[3] distinguished between kinoplasm (active substance) and trophoplasm (nutritive substance), two terms which have been brought into use again by Lloyd and Scarth;[4] but these terms are not applicable to the cryptoplasm and phaneroplasm described here if Strasberger's original description is to be adhered to. He says that kinoplasm possesses a fibrous structure and trophoplasm the structure of a honey-comb, and that the two substances may be in quite distinct regions of the cell. No such differences are evident in the dark-field structure of protoplasm as seen by the Spierer lens. This lens differentiates not kinoplasm from trophoplasm, but two substances which make up the kinoplasm alone.

There does not appear to be any satisfactory correlation between the structure of actively flowing hyaline protoplasm as revealed by the Spierer lens, and structures seen and described before. The mottled emulsion structure of the resting protoplasm is, in a broad way, comparable to alveolar protoplasm as described by Bütschli, and to numerous other pseudo-alveolar, vacuolate and emulsion structures. The striated structure of protoplasm when under tension, has apparently no counterpart in the older literature.

The nearer we approach the ultimate structure of protoplasm the less easy it is to differentiate between the relative importance of its constituents, but the idea that some substances in living matter are more important than others is often entertained. If we attempt to draw a distinction between the relative "vital" significance of phaneroplasm and cryptoplasm, then, frequent discontinuity in the former and active streaming of the latter suggest that cryptoplasm is the more fundamental of the two.

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[3] "Ueber Cytoplasmastructuren," *Jour. wiss. Bot.* 30: 375, 1897.

[4] "The Rôle of Kinoplasm in the Genesis of Vacuoles," SCIENCE, 65: 599, 1927.

ON A POSSIBLE EFFECT OF FUNGICIDES UPON THE COMPOSITION OF APPLES

THERE is prevalent among the practical fruit-growers of the Annapolis Valley district of Nova Scotia the opinion that apples sprayed with sulphur fungicides do not keep as well in common storage as those sprayed with copper fungicides. Actual storage comparisons have not, however, indicated any marked difference in the rate of senescence of fruit treated with these respective fungicides as evidenced by the rate of fall of the pressure test, by the appearance of the fruit, or by its rate of spoilage. One of the workers, at present actively engaged in making storage tests of this nature, has, nevertheless, found differences in flavor sufficiently marked to enable him to differentiate (by blindfold test) unsprayed fruit from that which has been treated during the growing season with sulphur or with copper fungicides. This fact indicates that there may actually be a difference in composition induced by the repeated use of these respective fungicides during the growth period of the fruit.

In an attempt to obtain evidence of such differences the authors have recently made analyses of apples of the Northern Spy and Ribston Pippin varieties which had received various fungicidal treatments. Samples of five apples each of the former variety and of ten apples each in the case of the latter were selected from quantities of fruit gathered in connection with a study (in progress) of the amounts of sulphur and copper remaining upon the fruit at harvest under Nova Scotian conditions. This fruit had received uniform storage treatment of the common storage type since date of picking, and all samples were gathered at practically the same stage of maturity. The apples were quartered, the stems and cores removed, and the remaining tissues finely ground in a common food chopper. Samples of 25 grams each were weighed out as soon as possible after thorough mixing of the

mass of pulped tissue, and killed by dropping into sufficient boiling 95 per cent. alcohol to make the final alcohol concentration about 80 per cent. The sucrose equivalent of the total reducing power of the alcoholic extract, and of the extract obtained by hydrolyzing the alcohol-insoluble residue for one and one-half hours with a 3.6 per cent. solution of hydrochloric acid, were determined by the cuprous chloride-iodine method.[1] Aliquots of the alcoholic extract were also titrated for acidity. The variations in acidity were, however, small and showed no definite trend. In the case of the reducing power of the alcoholic extract, and also that of the alcohol-insoluble residue after hydrolysis, there was an indication that the fruit which had been treated with sulphur fungicides during the growing season possessed, at the time of the analysis (December 19, 1930, and January 3, 1931), a slightly lower reducing power than unsprayed fruit or fruit which had been sprayed with Bordeaux mixture. Particularly was this true when the sulphur treatments were considered as a group and compared with the check and copper treatments as a second group. The actual results are given in the accompanying table, where the values marked with an asterisk indicate the average result obtained for three samples, the others the average for duplicate samples.

Variety	Treatment	Sucrose equivalent		
		Alcoholic extract	Alcohol-insoluble-acid-hydrolyzable	Total
Northern Spy	Lime-sulphur	10.61*	1.11*	11.72*
" "	Lime-sulphur with ferrous sulphate	10.84	1.13	11.97
" "	Unsprayed	11.06*	1.16*	12.22*
" "	Bordeaux	11.24*	1.17*	12.41*
Ribston Pippin	Sulphur dust	10.90	1.25	12.15
" "	Lime-sulphur with aluminium sulphate	10.98	1.31	12.29
" "	Bordeaux	11.40	1.41	12.81
" "	Unsprayed	11.60	1.43	13.03
" "	Lime-sulphur	11.76	1.37	13.13
Average of all sulphur treatments		11.02	1.23	12.25
" " "	other treatments	11.33	1.29	12.62

These results can not be considered as demonstrative of an actual difference in the composition of apples resulting from varying fungicidal treatment, the number of determinations being too few and the differences too small. They may perhaps be taken as indicating that further investigation of the problem is justified, and it is the intention of the authors to make a more detailed study as soon as time and opportunity permit.

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[1] F. M. Scales, "The Cuprous Chloride-Iodine Method for Sugars Simplified," *Jour. Ind. Eng. Chem.*, 11: 747, 1919.

DIFFERENTIATION OF VIRUSES CAUSING GREEN AND YELLOW MOSAICS OF WHEAT

IN previous papers[1,4] dealing with the wheat mosaic occurring in Illinois and Indiana, attention was called to severe yellow mottling, streaking or striping phases associated with dark green and light green mottled phases. Similar associations have been observed in natural field infections in Virginia and in North Carolina. It has been pointed out[1,4] that the Currell variety, selections of several other wheat varieties and Red Winter spelt develop yellow mosaic to some extent in the spring when the seed is planted out of doors in virus-infested soil in the autumn, whereas certain other varieties of wheat (Harvest Queen) when grown simultaneously in the same soil and in adjacent rows develop green mosaic, become dwarfed, producing a condition which has been termed rosette, and show only occasional traces of yellow mottling, striping or streaking.

Although these several expressions of the disease are influenced by the species and variety of the host plant, it has been considered[4] that a mixture of virus might be present in the soils under study and that the several types of hosts may differ in their susceptibility to distinct viruses.

To obtain information on this phase five successive series of inoculations were made. Except for slight modifications the procedure was that used in building up severe yellow mosaics on tobacco, tomato and *Nicotiana glauca*[2,3] (pp. 562–563). In the case of solanaceous species it is possible to cut the small yellow mosaic areas from the green mosaic regions and obtain sufficient virus for the inoculation of a large number of plants. Owing to the small size of wheat leaves and the difficulty of obtaining sufficient virus from the narrow yellow spots or streaks initial virus

[1] H. H. McKinney, "A Mosaic Disease of Winter Wheat and Winter Rye," U. S. Dept. Agr. *Bul.*, 1361, 1925.

[2] H. H. McKinney, "Virus Mixtures that May not be Detected in Young Tobacco Plants," *Phytopathology*, 16: 893, 1926.

[3] H. H. McKinney, "Mosaic Diseases in the Canary Islands, West Africa, and Gibraltar," *Jour. Agr. Res.*, 39: 557–578, 1929.

[4] H. H. McKinney, "A Mosaic of Wheat Transmissible to All Cereal Species in the Tribe Hordeae," *Jour. Agr. Res.*, 40: 547–556, 1930.