responding to true primary accumulation of ions by the cell. It appears that as the accumulation of ions progresses, the concentration of these ions takes place in the granules of the cell. An objection to this technic may be that the whole protoplasm is centrifuged to the bottom of the cell under the conditions of the experiment. This, however, does not seem likely in view of the relatively strong turgor of the cells and the low centrifugal forces applied. A general discussion of ion permeability phenomena will be found in Mullins[2] so that only a brief explanation of the data will be given here.

Since a large concentration of ions distributed throughout the hyaline protoplasm might alter markedly the colloidal nature of the protoplasm by causing excessive solation of the colloid, it seems reasonable that there must be some stations in the cell where ions are accumulated and rendered ineffective. Apparently the vacuole of the *Nitella* cell functions in this manner, and the data here given would indicate that the granules also supplement the vacuole in this process.

11861

A Micro-Photoelectric Photometer.

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Photoelectric analytical procedures depend for accuracy upon a depth of color in solution sufficient to produce satisfactory deflection of a galvanometer or other recording device. Ideally the volumes of reagents and sample are adjusted to yield 20-80% absorption of the incident light. Since the necessary intensity of color varies with the length of the path of the light beam in the solution, the dimensions of the absorption cell are limiting factors in adapting procedures to microanalysis. Present instruments on the market do not permit an absorption path longer than 20 mm when the volume of solution is limited to 1 cc.

An instrument in use at the Babies Hospital during the past 2½ years demonstrates the feasibility of constructing apparatus in which the light beam traverses a path of 50 mm through a tube-cell of narrow bore and only 1 cc capacity. These specifications have made

[2] Mullins, L. J., *Ionic Equilibria in Protoplasm*, in press, 1940.

it possible to apply the photoelectric principle to measuring the low intensities of color in the cholesterol micromethod of Schoenheimer and Sperry[1] and have allowed the development of a technic for determining bilirubin in serum when the sample is only 0.1 cc. The sensitivity is great enough to make obligatory the use of color filters of narrow spectral transparency. Since no basically new features are involved in the electrical or optical systems, the instrument is adequately described by the details in Fig. 1. The light source is a 15-candle-power automobile bulb. The ratchets, not shown in the diagram, for centering the position of the lamp must be capable of fine lateral and horizontal adjustments in order that the beam shall traverse the absorption cell and fall on the dispersing lens, M. Energy for

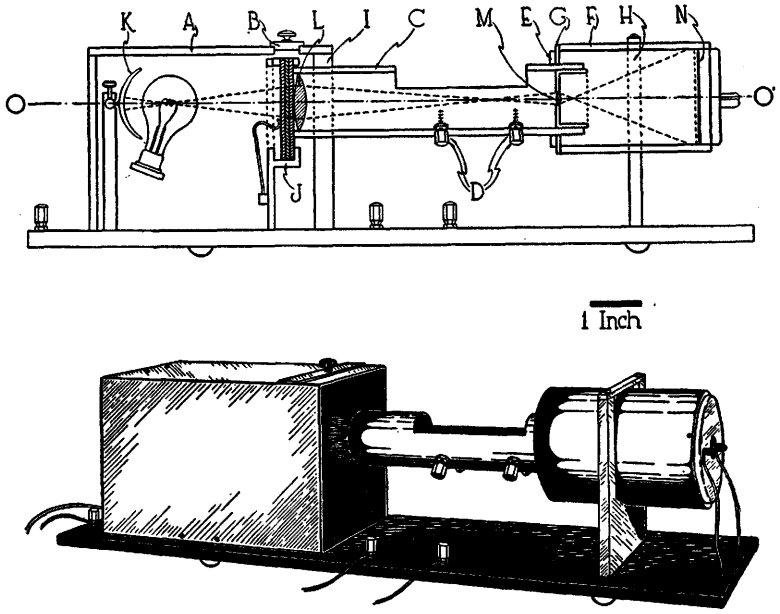

FIG. 1.

Diagrammatic section through the photoelectric photometer and three dimensional sketch of the instrument. The labeled parts of the diagram refer to: A, housing for the light compartment; B, lid over window giving access to the color filters; C, brass tube forming the cell compartment; D, bolts for supporting the absorption cell; E, lock-nut for fixing position of the cell compartment; F, compartment for the photoelement; G, end plate of the previous compartment; H, brass support; I, Bakelite support; J, compartment for the color filters; K, spherical mirror (diameter 1 1/16", radius of curvature 1¼"); L, converging lens (diameter 30 mm, focal length 37 mm); M, dispersing lens (diameter 6 mm, focal length 6.4 mm); N, photoelement (Lange, type S-50 or Weston photronic, type 2); OO', optical center of the instrument.

[1] Schoenheimer, R., and Sperry, W. M., *J. Biol. Chem.*, 1934, **106**, 745; Sperry, W. M., *Am. J. Clin. Path.*, 1938, **8**, 91.

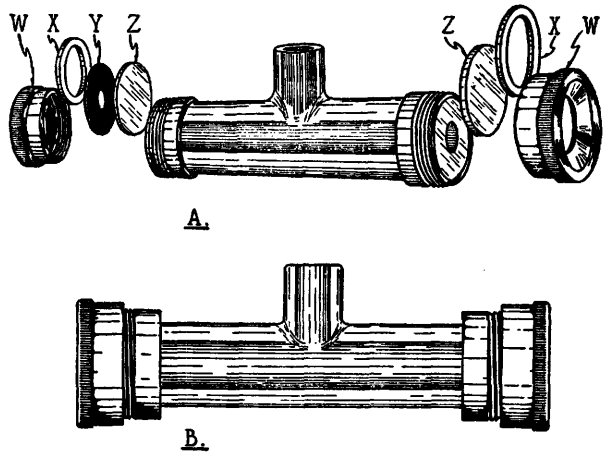

FIG. 2.

The absorption cell of 1 cc capacity; A indicates the constituent parts of the cell and B, the assembled cell. In addition to the main body of the cell, the parts include: two metal caps, W; two rubber washers, X; a single metal diaphragm, Y; two glass windows, Z.

the lamp is furnished by a 6-volt storage battery in series with a sliding-contact rheostat of 0.83 ohm resistance. The photocurrent is measured with a Lange multiflex galvanometer (maximum sensitivity, 4×10^{-9} amperes per mm of scale; maximum internal resistance, 1000 ohms).

The absorption cell, Fig. 2, can be purchased as part of the accessory equipment of the Zeiss Pulfrich photometer. For non-corrosive solutions we use a cell of similar dimensions constructed of German silver and encased in an insulating barrel of plastic. The fidelity of readings is somewhat greater with the metal than with the glass cell, apparently because equilibration of temperature is attained more rapidly. The analytical methods examined so far have utilized organic solvents for the development of color; with such solutions there has been no difficulty in rinsing and filling the narrow-bore cell. In operation the cell is filled with a blank solution of the reagents used in the method, placed in the instrument and rotated to a fixed and reproducible position. Galvanometer sensitivity is adjusted to yield full deflection of 100 scale divisions. Because the cell acts as a condensing lens, its removal brings about a fall in the galvanometer deflection. This "air-setting" is noted and maintained throughout subsequent readings by adjustment of the galvanometer rheostat. The percentage light transmission of the unknown solutions can then be read directly as units of deflection on the scale.

For the purpose of this report the reduplicability of measures of

color intensity was determined for the German silver cell by making a long series of readings over a number of days on two standard intensities of color. The colored solutions were composed of pure carotene dissolved in chloroform and diluted with alcohol; the readings were made with a blue filter. With the more dilute solution light transmission was about 70%; concentrations calculated at this level showed a standard error of ±0.65%. With the more concentrated solution light transmission was approximately 25%; concentrations computed from these data disclosed a standard error of ±0.24%.

The author expresses his indebtedness to Mr. Kern F. Larkin, who solved most of the constructional problems and to Mr. Fred Rosebury, who assisted in this work.

11862 P

Differentiation of Influenza A and Influenza B by the Complement-Fixation Reaction.*

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A recent report[1] has described the isolation of a new serological type (B) of virus from epidemic influenza. By means of the neutralization test with sera from convalescent animals and human individuals, it was shown that this virus was readily differentiated from virus of the type (A) previously identified. In the process of adaptation of the new virus to mice, attempts were made to ascertain whether serological differentiation could also be obtained with the complement-fixation reaction. While the earlier results were indefinite, these efforts have been renewed since the virus has increased in virulence for mice.

Antigens were prepared from lungs of mice infected with the PR8 strain of the virus of Influenza A[2] and also from mice infected with the Lee strain of Influenza B virus. Two percent suspensions of the infected lungs in physiological salt solution, after clarification by

* This study was conducted under a grant from the International Health Division of the Rockefeller Foundation.

1 Francis, T., Jr., *Science*, 1940, **92**, 405.

2 Horsfall, F. L., Jr., Lennette, E. H., Rickard, E. R., Andrewes, C. H., Smith, W., and Stuart-Harris, C. H., *Lancet*, 1940, **2**, 413.