protein around which the remaining amino acids are united. This view, first advanced by Kossel, was recently substantiated by Block.[4]

Taking into consideration the importance of the terminal amino acids in the experiments of Landsteiner and Van der Scheer,[5] in which peptides were introduced as "determinant groups" it appears plausible that the immunological characters of proteins are determined by the arrangements of amino acids on the surface of the molecule.

If these views are accepted all keratins must possess a peculiarity in chemical structure that characterizes them as keratins, but among these chemically similar substances there must exist a special variant in each species to account for the specificity exhibited by each type of keratin. This may be due to the nature and spatial arrangement of the terminal amino acids, especially cystine and cysteine.

The differences observed between the reactions of oxidized and reduced keratins may possibly depend on the fact that either the—S–S—or—SH groups operate as "determinants," or that the reduction of the—S–S—linkage may produce an inter- or intramolecular rearrangement. An extensive report of these experiments and also on keratin derivatives will appear elsewhere.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MECHANISM FOR THE AUTOMATIC IRRIGATION OF SAND CULTURES[1]

A VERY satisfactory mechanism for the automatic irrigation of sand in culture experiments can be constructed from stock equipment or from parts that can be readily obtained. The containers for the sand must have an outlet at the bottom through which the culture solution is introduced and withdrawn, and the table on which the containers are placed must be of sufficient height to permit the placing, underneath, of the control mechanism and the carboys which supply the culture solution. With this mechanism any number of sand containers may be simultaneously irrigated and any container or group of containers may be supplied with any desired culture solution. The diagram shows the arrangement of the apparatus.

A vessel (a), made from an inverted one-liter wide-mouthed bottle with the bottom removed, is placed above the table and is adjustable for height. It is connected by a tube (b) to one of the carboys supplying culture solution and by the flexible tube (c) to the top of vessel (d). In vessel (a) tube (b) is brought nearly to the top, and tube (c) is formed into a siphon of 5 mm bore. Vessel (d) is an asphalted metal pan of 7½ inches diameter and of slightly more than 1 liter capacity, to the bottom of which is soldered an iron bar (e) which extends out approximately 18 inches. Through an outlet in the bottom, this vessel is connected by the flexible tube (f) to the top of the same carboy to which vessel (a) is connected. In the tube (f) is inserted a one-way glass valve, which permits flow of solution from the vessel but prevents escape of air from the carboy. The bar (e) is supported by a bearing 7 inches from the vessel (d) and its outer end is attached to the handle of a three-way valve (g). One arm of the valve is connected to the top of the carboy. One arm is attached to a compressed air main (h) carrying 5 pounds of pressure and the remaining arm is unattached. The valve is so arranged that when the vessel (d) is in the "down" position the carboy air line is connected to the unattached arm, and when the vessel (d) is in the "up" position the compressed air main is connected to the carboy air line. A small trip checks the downward

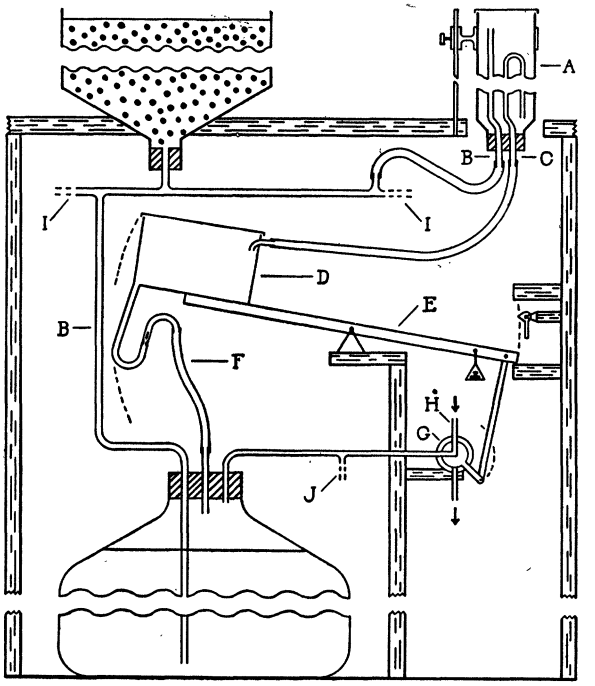

FIG. 1

[4] R. Block, *Jour. Biol. Chem.*, 103: 261, 1933; 105: 455, 1934; and *Proc. Soc. Exp. Biol. and Med.*, 32: 574, 1935.

[5] K. Landsteiner and J. van der Scheer, *Jour. Exp. Med.*, 55: 781, 1932; *ibid.*, 59: 769, 1934.

[1] Contribution No. 557, Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Canada.

movement of the end of the bar (e) and assures a quick and positive movement of the valve when the vessel (d) moves from the "down" to the "up" position. A suitable counter weight is suspended from the bar (e).

As indicated in the diagram, when the vessel (d) is in the "up" position air pressure from the compressed air main forces the culture solution up into the sand containers. As the solution rises in the sand it also rises in tube (b), the height of which is adjusted so that when the solution has almost reached the surface of the sand it overflows and fills vessel (a) until the siphon (c) is started. Vessel (a) then empties into vessel (d) where the weight of solution overcomes the balance weight, causing the rotation of the valve (g), shutting off the compressed air and releasing the air pressure in the carboy. The culture solution from the sand containers drains back into the carboy, while the one-way glass valve in the tube (f) allows the culture solution in the vessel (d) to drain back into the carboy. By constricting this tube the frequency of irrigation can be adjusted. When vessel (d) has emptied it returns to the "up" position and in so doing again turns on the compressed air at the valve (g).

Other sand containers irrigated from the same carboy are attached to the solution line (b) as indicated at (i). When additional culture solutions are to be used their carboys need only be connected to the air line, as shown at (j). Carboys need not be of the same size, but it is essential that the amount of solution in each carboy be so adjusted that when the compressed air is automatically shut off the level of the residual solution in all carboys is the same.

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A SIMPLIFIED TECHNIQUE FOR FORENSIC PRECIPITATION TESTS

FORENSIC precipitation tests for the identification of blood stains or other antigens can be carried out by merely placing small bits (1 sq. mm) of stained fabric, very thin wood shavings or a few particles of scrapings on a clean glass slide and adding one drop of the specific antiserum and control antisera to the test objects. In the presence of the specific antiserum, a macroscopic precipitate appears almost as soon as the object is thoroughly wetted. In normal rabbit sera or heterologous immune sera no precipitate forms. The addition of a small cover slip to each spot flattens the drop and makes it possible to observe the results with a hand lens or microscope. The cover slip is quickly sealed into position by drying of the serum at the margin so that the slides can be examined in any position.

The width of the zone of precipitation affords a rough indication of the relative potency of the extract and the antiserum. A strong antiserum in the presence of weak extract produces precipitate only around the object, while a potent source of extract causes a much wider zone of precipitate.

The method has several advantages other than the small amount of material required and the simplicity of the preparations. The preparation of extracts, and concern for their strength and clarity, is unnecessary. The extraction occurs by diffusion and the extracts are clear and undiluted. The outward diffusion of the antigen creates the different proportions of extract and antiserum which favor maximal precipitation. It has been shown that extracts or antisera which are too weak to give positive tests by the usual methods give positive results under these conditions. Since no extracting fluids are required, such controls can be omitted.

Photographic records of the results can be prepared more readily than in the case of tests prepared in tubes. Serological tests can be made under field conditions where only a lens, slides, cover slips and a few drops of antiserum can be carried with ease.

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