to be largely responsible for the severity of leaf-spot infections are, in the order of their importance: (1) the incorporation of large quantities of organic nitrogen in the tobacco soils, a portion of which in some seasons may remain to be ammonified during the ripening period; (2) the use of too much nitrogen and insufficient potash in the fertilization treatment; (3) the use of excessive amounts of lime, which interferes with the normal potassium uptake of the plant; and (4) in some cases poor tilth, which also interferes with mineral uptake.

Practices tending to produce a normal resistant plant of high quality and good yield are as follows: (1) the use of another crop such as corn between clover and tobacco in the rotation to reduce the amount of organic nitrogen in the soil; (2) preliminary rotting of all manure used on tobacco in order to avoid the risk of adding large quantities of available energy to the soil; (3) the use of liberal applications of well-rotted manure to improve tilth and aid potassium uptake; (4) the use of suitable applications of a well-balanced fertilizer in which the amount of organic nitrogen is less than the amount of inorganic nitrogen; and (5) suitable cultivation to insure maximum uptake of potassium and other essential nutrient materials.

In the course of these investigations it was considered advisable to study physiologically and serologically several other members of the genus *Phytomonas*, associated with leaf-spots. The data obtained indicate that other members of this genus studied are merely temporary physiological adaptations of *Pseudomonas fluorescens*. A brief study of predisposing factors in these diseases further emphasizes the similarity of bacterial leaf-spot diseases and the relation of the pathological condition to the improper nitrogen-mineral nutrition of the host. The results of these investigations will be published in detail in a Bulletin of the Pennsylvania Agricultural Experiment Station.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SYSTEM OF INDEXING 2×2 INCH SLIDES

THE handling of microfilm (35 mm) used in research and teaching can be divided into three major phases: (1) the filing of negatives; (2) the filing and indexing of positive or negative film-strip reprints of library material; (3) the filing and indexing of 2×2 inch monochrome or natural color slides for use in teaching or in research where color must be recorded.

Considerable interest has been shown in the use of film-strip,[1, 2] particularly with reference to its bibliographic service. However, its value for teaching is distinctly limited by the inflexible sequence of the images on the film and the technical difficulties in using it for projection in natural colors.

The use of film-slides (2″×2″) has received less consideration in scientific journals, perhaps due to the fact that such slides do not serve a new purpose, but merely constitute a means of doing an old job better. Film mounted between cover glasses is little subject to injury, and the slides can be rearranged for various purposes by different individuals. They have therefore greater usefulness for longer periods of time than film-strip. As compared with larger sizes of lantern slides, the lower cost, the greater ease of carrying many slides and reduced breakage of the microfilm slides makes them a very valuable aid to teaching and research. Since the results of research can never be utilized to the maximum extent unless they are adequately exposed through effective teaching, it is apparent that the use of microfilm slides, particularly those in color, is well worth the consideration of those engaged in either teaching or research.

The cost of film-slides and their greater versatility of arrangement and use ordinarily requires that large departmental or institutional slide collections be used by several individuals. This necessitates a system of filing and indexing which will enable each user to find slides conveniently, not only in his own major field, but in those of his colleagues as well. Usually information concerning the subject illustrated on the slide and its source is required whenever a slide is used.

Several individuals have cooperated in devising a system for filing and indexing slides that effectively meets these requirements and has proven efficient and very useful in this department. The system is divided into three parts: a subject index, a slide file and a negative file. All may be housed in a filing cabinet designed for 3×5 inch cards.

The subject index is the central part of the system and is responsible for its usefulness. A picture of the slide subject (contact print) is attached with dry mounting tissue to the upper left-hand corner of a 3×5 inch card where it may be readily seen in thumbing through the index. The subject is placed in the remaining space at the top of the card. For brevity the major subjects of the index are abbreviated (G—genetics, E—embryology) and followed by a descriptive sub-title. On the rest of the card is recorded the number of the slide represented, the number of the negative from which it was made, bibliographic ref-

[1] Lee R. Dice, SCIENCE, 89: 39, 1939.
[2] Atherton Seidell, SCIENCE, 89: 32, 1939.

erence or other notation concerning the source of the material and descriptive information. The subject headings of the index are patterned after the bibliographic indices of those using the material. Colored cards are used for indexing colored slides, white cards for those in black and white.

Any one wishing a certain slide or one on a specific subject turns to that subject in the card index and chooses, on the basis of the picture and attached information, the slide he wants. He may then quickly draw the slide of that number from the slide file.

The slide file is a numerical arrangement of the slides in each major subject. The file of this department is divided into twelve such major fields. As in the card index the subjects are indicated by letters, the slides by numbers. To find slide G-253 one opens the "genetics" drawer and removes the slide bearing that number on the "thumb mark" placed on the upper right-hand corner of the slide as it goes into the projector.

The slides are filed on edge with the numbers toward the front of the drawer, in wooden troughs 2 inches wide by 1½ inches deep inside. A white card which projects slightly above the slides is placed at intervals of 25 slides and bears the number of the series at that point. The troughs are made in units of two, which fit into a 3×5 inch card compartment. Four rows of more than 100 slides each can thus be filed in each of the lower drawers of the cabinet holding the subject index. The bottoms of the troughs are raised above the bottom of the drawer sufficiently to raise the slides to the top of the 3×5 inch compartment. To facilitate removal and handling of slides the inside depth of the trough is one-half inch less than the height of a slide.

The negative file is a comparatively inactive file, since it is likely to be used only for duplication of slides or for making prints of the slide subject. Various methods of filing may be utilized.[1] A convenient one has been to cut the film into strips of three negatives each and place them in 3×4⅞ inch kraft paper coin envelopes ("bags") which are numbered serially. These envelopes are durable and can be filed in a drawer of the cabinet containing the subject index and slides. (Use of the short length of film has not appeared inconvenient in the enlarger or contact printer used, and when a certain negative is required, unnecessary handling of other negatives is avoided.)

The clerical labor and the printing of photographs necessary for the subject index is well repaid in a large collection by the later saving in time required for finding desired slides and by the fact that several individuals can use the same collection effectively and without confusion. Moreover, the experience in this department shows that slides thus catalogued are more extensively used because of the ease with which the desired material can be found.

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LANTERN SLIDES FROM TYPEWRITTEN MATERIAL

THE recent note of Carpenter,[1] under the present title, on typing or drawing through white carbon paper onto black paper, to eliminate one step in the photographic process of making white-background slides is useful for certain work, but we have found that another step—that of retyping text material and retracing diagrams through white carbon paper—can be avoided by photographing the material from which slides are to be made onto a contrast grade direct positive film of the type supplied by the Eastman Kodak Company in their "high contrast direct positive film." The result of using this is a positive film (without having to prepare a negative) which can be bound between two standard size slide glasses with a slide mask as usual, effecting a saving in time of preparation.

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BERKELEY, CALIF.

[1] SCIENCE, 89: 372, 1939.

BOOKS RECEIVED

American Philosophical Society: *Year Book, 1938.* Pp. 407. The Society, Philadelphia.

BERNAL, J. D. *The Social Function of Science.* Pp. xvi + 482. Macmillan. $3.50.

CHIBNALL, ALBERT C. *Protein Metabolism in the Plant.* Pp. xiii + 306. Yale University Press. $4.00.

FALES, HAROLD A. and FREDERIC KENNY. *Inorganic Quantitative Analysis.* Pp. xiii + 713. 132 figures. Appleton-Century. $4.00.

HEISKANEN, W. *Catalogue of the Isostatically Reduced Gravity Stations.* Pp. 140. Publication No. 5, Isostatic Institute of the International Institute of Geodesy.

HOLMES, HARRY N. *Introductory College Chemistry.* Third edition. Pp. viii + 619. 171 figures. Macmillan. $3.50.

MARSLAND, DOUGLAS and PAUL F. BRANDWEIN. *Manual of Biology; Part One, the Protozoa and the Plant.* Pp. ix + 176. 85 figures. *Part Two, the Metazoan Animals.* Pp. ix + 211. 83 figures. Holt. $1.20 each.

MELHUS, IRVING E. and GEORGE C. KENT. *Elements of Plant Pathology.* Pp. x + 493. 259 figures. Macmillan. $4.00.

MEYER, BERNARD S. and DONALD B. ANDERSON. *Plant Physiology; A Textbook for Colleges and Universities.* Pp. x + 696. 151 figures. Van Nostrand. $4.50.

Ruwenzori Expedition, 1934–5; Vol. I, No. 1, Introduction; No. 2–3, Simuliidae, by E. G. GIBBINS; *Mosquitoes,* by F. W. EDWARDS and E. G. GIBBINS; *Vol. I, No. 4, Psychodidae,* by A. A. TONNOIR; *Vol. I, No. 5, Ceratopogonidae,* by J. W. S. MACFIE; *Vol. III, No. 1, Trichoptera,* by M. E. MOSELY; *Vol. III, No. 2, Siphonaptera,* by K. JORDAN; *Vol. III, No. 3, Rhopalocera,* by A. G. GABRIEL; *Vol. III, No. 4, Lymantriidae,* by C. L. COLLENETTE; *Vol. III, No. 5, Ephemeroptera and Neuroptera,* by D. E. KIMMINS. British Museum (Natural History), London.

TAYLOR, F. SHERWOOD. *The March of Mind; a Short History of Science.* Pp. xiv + 320. 36 figures. 14 plates. Macmillan. $3.00.