proach, but such names are invariably allocated, in the chronologic scheme, to dates of birth rather than to dates of achievement, with the fortunate exception of physicians of whom only the period in which they flourished is known. The very purpose of the chronology is defeated when we find Vesalius associated with 1514, the date of his birth, instead of 1543, the date of the *Fabrica,* or McDowell thrown into the eighteenth century (1771), when the whole interest of his life centers around his first ovariotomy (1809). We should not, however, quarrel with his arrangement were it possible to make it consistent throughout, but the orderly sequence of dates is frequently dislocated by such unaccountable entries as 1285 (top of page 62) or 1300 (near end of page 63). But it is in the actual spelling of names, notably inconsistencies in the rendering of names of men of similar nationality, that this attractive handbook stands mostly in need of revision. There is, as Victor Hugo said, a definite *"science des noms"* and the correct spelling of these, whether by poet, historian, bibliographer or chronologist, is coeval in importance with the effective use of significant names in verse or scientific prose. To misspell a well-known name renders the culprit liable to the challenge of Milton's Archangel to Satan: "Not to know *me* argues yourself unknown." In this regard the undersigned was once taken to task rather testily by a physiologist who excelled in another speciality, common to us all, namely, the proper spelling of one's own name.

In the chronology before us, such obvious slips as Ellil (p. 3), plague of Antonius (39), Guilelmo (64), Simon de Corco (64), Brunschweig (68), Mark Antonio (69), Heironymus Mercurialis (95), Merchettis (122), Leeuwenhoeck (126), le Blonde (153), Salvatore de Kenyia for S. De Renzi (202), Fiorravanti (263), and Gitolamo (263) may be mercifully charged up to printer's devil or proofreader. But we have in the same book such inconsistencies as Peter of Abano, Petrus ab Argelata and Pietro Andrea Mattioli, Nicholaus the Salernitan and Nicholas Prepositi (55). If it seems advisable to employ such Italianate forms as Salvino degli Armati or Luigi Rolando for Italians, then why such bizarre combinations as Alexander Benedetti (70), François Valleriola (83), Gabriele Falloppius (93), Constantine Varolio (100), Laurence Bellini (131), John Maria Lancisi (137), Andrew Verga (211) and Philip Pacini (212)? On p. 216, Karl Ludwig becomes Charles William Ludwig and the same carelessness is responsible for "Gasper Bauhine" (104), "Johann [Jean] Riolan" (109), "John Laurance Gasser" (157), "Mara Marat" (169) and "Peter Paul Broca" (222). The work terminates with useful chronologies of drugs and of foundations of universities. The list of drugs (245) culminates in two pyramidal absurdities, *viz.,* "d hyoscyaminé d' camphorsulphonate" and "d' hyoscyine hydrobromide."

It may be noted in passing that George Miller Sternberg was in no sense an epidemiologist, nor was Benjamin Franklin a physician, nor Alexander Kovalevsky a morphologist. On p. 30, it is not clear whether Poseidonius or Zopyrus "wrote on the bubonic or true plague." In a compact handbook, such loose statements as the following surely need reconsideration:

> He based his Methodism upon Epicureanism and so combated mysticism [p. 37].
>
> He was one of the fine flowers of the Eastern Empire when the Roman influence in the West was reverting to barbarism [p. 42].
>
> The teaching was considered to be subversive and led to a prolonged controversy [p. 73].

Excellent as are the portraits, it would be no sin of omission to drop out the caricatures of such great men as Pythagoras (14), Aretaeus (32) and Dioscorides (33), and no admirer of William Harvey can credit the atrabilious presentment on page 109. For practical reference purposes, the bothersome unscientific whim of printing pagination figures at the bottom of the page should be discarded in favor of the ordinary labor-saving practise. Nothing is scientific that leads to waste motion or dissipation of energy.

Apart from these defects, the handsome printing and format are what we have come to expect from the publisher (Hoeber), who will add to his reputation for artistic printing and business enterprise, if he will acquire a competent proofreader.

F. H. GARRISON

MANILA, P. I.

LABORATORY APPARATUS AND METHODS

AN APPARATUS FOR THE STUDY OF MICROORGANISMS IN CULTURE SOLUTIONS UNDER CONSTANT HYDROGEN ION CONCENTRATIONS

STUDIES in the changes produced by microorganisms in the hydrogen ion concentration of their culture medium have been made by a number of investigators in many different ways. The general method which has been followed, so far, consists in growing the microorganisms in some culture medium for different lengths of time and observing the changes produced therein. In the majority of cases, such cultures after being examined once were discarded, because of the danger of contamination; although in a few cases they may have been ex-

amined two or more times. The above method serves only in a relatively limited way, because it does not provide sterile conditions for a frequent determination of the changes produced by the microorganisms in their medium, nor for the introduction of adjusting reagents for the maintenance of a constant hydrogen ion concentration. A somewhat different method was employed by Wolf[1] in the study of the changes produced by bacteria in the hydrogen ion concentration of their culture solution. This consists in introducing some indicator, such as are described by Clark and Lubs,[2] and observing the changes produced in the color of the indicator due to the changes in the reaction caused by the organism. This method is not entirely satisfactory, because of the influence of the indicator on the normal development of the microorganisms and the probable decomposition of the indicator, particularly methyl-red, as a result of their reactions.

The writer,[3] while studying the influence of the hydrogen ion concentration on the growth of Fusaria, devised an apparatus by means of which examinations of the changes produced by microorganisms in their culture solutions and introductions of adjusting reagents can be made at frequent intervals and under relatively sterile conditions. This apparatus provides for the removal of any desired portion of the culture solution for examination and the introduction of any volume of adjusting reagent.

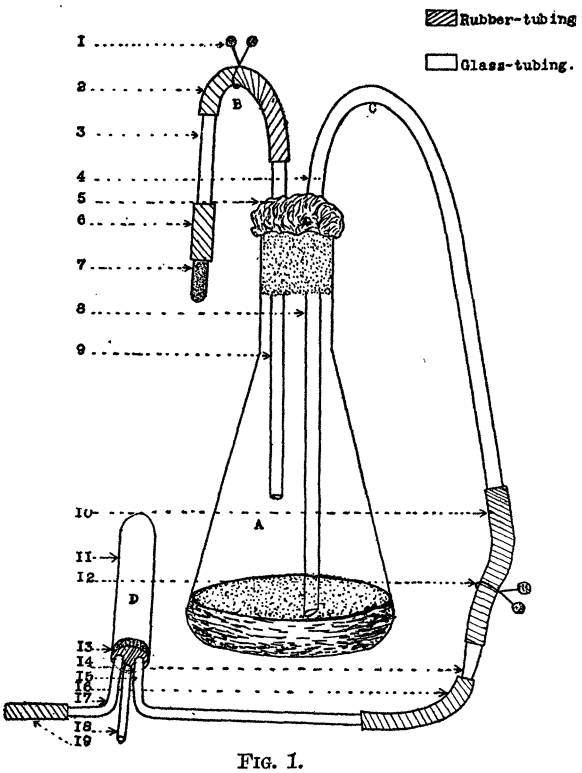

FIG. 1.

The apparatus is very simple in construction and fully illustrated in Fig. I. It consists of an Erlenmeyer's flask (A), carefully plugged with cotton through which are passed two glass-tubes 5 mm in diameter. One of the glass-tubes (B) provides for the introduction of the adjusting reagents and the other (C) for the removal of portions of the culture solution. If desired, two tubes may be provided for the introduction of the adjusting reagents—one for the acids and the other for the alkalies. The other part of the apparatus, which is detachable, is the receiver (D) made out of a test tube (11), plugged with a rubber stopper (13) through which three glass tubes (15), (17) and (18) are passed.

Any desired portion of the solution may be withdrawn from the flask by attaching the one end (16) of the receiver (D) to the nipple (14) of the apparatus and the other end (19) to the suction. Then open pinch cock (12) and close tube (18) by applying the thumb to the opening. When the desired quantity of the solution has been withdrawn tube (C) is raised above the surface of the medium. After all the solution has been drawn into the receiver (D) the pinch cock (12) is closed and the receiver (D) and its attachments are disconnected from the nipple (14).

The adjusting reagents used are placed in flasks which can be made to empty into burettes by means of air pressure generated by a rubber bulb. The opening of the burette through which the discharging glass-tube enters is plugged with cotton in order to prevent contamination from the air. The adjusting reagent to be used must be of such a concentration as to possess disinfectant properties; solutions of 0.2 normal or stronger of either HCl or NaOH may be used with safety. The nipple of the burette in order to be kept sterile is kept immersed constantly in a test tube containing a much stronger solution (about one normal) of the reagent.

Additions of the adjusting reagent may be made to the culture solution by removing the glass rod plug (7) from the rubber tubing (6) and inserting in its place the nipple of the burette which contains the reagent, releasing at the same time the pinch cock (1) to permit the passage of the reagent. The opening of the introduction tube (B) is sealed again

[1] Wolf, F. A., "Studies on the physiology of some plant pathogenic bacteria. VII. Pectic fermentation in culture media containing pectin." *Phytopath.*, Vol. 13, No. 9, Sept., 1923.

[2] Clark, W. M., "The determination of hydrogen ions." Baltimore, 1920, pp. 317.

[3] Sideris, C. P., "The influence of the hydrogen ion concentration on the development of the pink root disease of onions" (in press). Thesis for the Ph.D. degree, Univ. of Calif.

with the glass rod (7), which is dipped in one normal solution of the reagent before insertion.

CHRISTOS PLOUTARCHOS SIDERIS
UNIVERSITY OF CALIFORNIA

A NEW METHOD OF OBTAINING MOSAIC "VIRUS"[1]

IN connection with certain studies on the nature of the causal agent of the mosaic disease it became desirable to secure "virus" with less mixture of foreign substances than could be obtained by filtration of plant extracts through Pasteur or similar filters. It is quite evident that the causal agent of mosaic is carried in the sap of the vascular system of infected plants. By submitting the root system (or the end of a cut stem) to a pressure[2] of about one hundred pounds, it was found that the contents of the vascular bundles could be forced out of the plants and collected with capillary pipettes or medicine droppers. This was accomplished by placing the washed-out roots of the plants in a metal container attached to the city water supply, the stem of the plant extending through a split rubber stopper inserted in a "packing box," similar to that used around valve stems. With a little experience no difficulty was found in making this connection water tight around the plant stem. A succulent mosaic plant with hydathodes readily yields considerable quantities of the liquid water containing the infectious principle, though apparently the "virus" was not as concentrated as when secured from crushed tissue. By cutting the leaf or petioles so as to expose the ends of the bundles the liquid may be secured in a more concentrated form from plants with or without hydathodes. Modifications of the above apparatus and method will be evident to the experimenter to suit the particular needs in hand. It is important to use rapidly growing succulent plants for the best results.

A comparative microscope study of the liquid exuded from healthy and mosaiced plants did not lead to any conclusive results as to the presence of an organism. On slides stained with carbol-fuchsin bodies closely resembling very small bacteria were abundant, but apparently similar bodies occurred in the exudate from healthy plants.

Virus obtained in this way probably closely approximates the virus transmitted by sucking insects, and the method may, therefore, be useful for cross-inoculation studies. This material is also useful in other ways, as, for instance, in attempts at culturing the mosaic agent. The sap as it comes out of the vascular system is usually sterile. It may also prove interesting in studies with other plant diseases, particularly where vascular parasites are concerned.

JAMES JOHNSON,
MAURICE MULVANIA
COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN AND UNITED STATES DEPARTMENT OF AGRICULTURE

[1] Published with the permission of the director of the Wisconsin Agricultural Experiment Station.

[2] This principle was first described by De Bary in studying exudation of liquid water from plants.

SPECIAL ARTICLES

CHROMOSOMAL CHIMERAS IN THE JIMSON WEED

THE production of so-called bud sports is not a rare phenomenon in plants. In general, they may be classified either as sectorial chimeras in which a branch or other portion of the plant shows morphological differences from the rest of the individual, or as periclinal chimeras in which an internal tissue of one type is surrounded by tissue of a different type. The cause of these chimeras has been carefully studied in relatively few cases. Their origin has generally been assumed to be due to somatic mutations in the genes effecting the visible changes. Evidence has been accumulating during the last few years' study of the Jimson Weed (*Datura Stramonium*) that in this species chimeras are brought about by changes in the somatic number of chromosomes, and at least three types of sectorial chromosomal chimeras have been established: (a) those in which one of the sets shows a deficiency of a single chromosome and hence can be represented by the formula $(2n-1)$; (b) those in which the aberrant branch has an extra chromosome, the formula of which would be $(2n+1)$; and (c) those in which one branch has 4n chromosomes or double the number of the normal 2n branch.

(a) *Chimeras with chromosome deficiencies.* In the summer of 1922, two plants from different lines were found each with a branch which showed certain slight deviations from normal. The pollen from both these abnormal branches had considerably more than 50% of abortive grains. Counts of chromosomes in their dividing pollen mother-cells demonstrated a deficiency of one of the largest chromosomes which has been shown to be the extra chromosome present in our $(2n+1)$ mutant known as Rolled. Offspring from these $(2n-1)$ branches failed to show individuals of the parental type, a fact which indicates that gametes deficient for the Rolled chromosome are rarely if ever capable of functioning. In the summer of 1923, a single individual was found with a branch similar in appearance and in the degree of pollen abortion to the two chimeras already mentioned, but the failure of grafts to set prevented a count of its chromosomes. Counts of chromosomes in pollen mother-cells reveal the cytological condition in the subepidermal tissue only and it is possible that these sectorial chimeras were at the same time periclinal chimeras with an epidermal tissue having