Teaching of Automation and Rapid Methods in Food Microbiology

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ABSTRACT

Automation and rapid methods in food microbiology are timely topics for inclusion in a food microbiology course. The topics can be developed into a short course. Lectures in the classroom and at national and international meetings served as the basis for generating an outline suitable for speakers to use in developing a similar talk. This article presents a format for a presentation, a reference list of pertinent books and articles, sources of slides and teaching materials and strategy of presentation. The purpose is to provide a plan of action for those who wish to give a lecture or two, or to develop a short course on automation and rapid methods in food microbiology.

In developing the course, Food Microbiology, for undergraduate and graduate students at the university level, instructors should include not only "standard" topics such as numbers and kinds of microorganisms in foods, preservation, spoilage, processing of foods, foodborne pathogens, regulation, and standards for foods (1, 4, 12, 14, 18) but also topics too new to be reported in standard texts but important enough to warrant a lecture period or two. Such topics include automation and rapid methods in food microbiological analysis.

CURRENT STATUS OF AUTOMATION AND RAPID METHODS

Automation, widely used in industry, also is often used by scientists and technologists. The myriad of automated instruments used in human medicine is an example. These instruments are becoming increasingly important in microbiology and antibiotic testing. Concomitant with development of automated microbiology, many rapid methods of detecting, enumerating, and identifying microbes have been developed. The large number of kits on the market to identify microorganisms indicates the commercial potential of such products. Although many of the advances in automated instrumental methodology are in the fields of medical and clinical microbiology, many of the techniques and basic approaches can be adapted to food microbiology (7).

SYMPOSIA, BOOKS AND PUBLICATIONS ON AUTOMATION AND RAPID METHODS

The first international symposium to review automated and rapid methods in microbiology was held in Stockholm, Sweden, in 1973, with the proceedings published in two volumes: Automation in Microbiology and Immunology (10) and New Approaches to the Identification of Microorganisms (11). The second international symposium was in Cambridge, England, in 1976; proceedings from it were published in one volume, Rapid Methods and Automation in Microbiology (13). In 1974, a symposium dealing with similar topics but emphasizing rapid methods and automation in food microbiology, was held in Kiel, Germany. Proceedings from it were published as a series of papers in the January-February 1975 issue of Archiv für Lebensmittelhygiene. Proceedings of the 1975 International Conference on Mechanized Microbiology in Ottawa, Canada, emphasizing the automation of microbiological procedures, were published in one volume, Mechanizing Microbiology (16).

Another symposium on rapid methods and automation for food microbiological analysis was held in Dallas, Texas 1978 at the annual meeting of the Institute of Food Technologists. Papers from it (3, 7, 9, 15, 17) were published in the March issue of Food Technology in 1979.

PURPOSE OF THIS ARTICLE

I was invited to give papers at the three symposia in Europe and was asked to organize the 1978 symposium in Dallas, Texas, probably because I have included lectures on automation and rapid methods in Microbiology the past 8 years in the following courses at Pennsylvania State University and Kansas State University: Food Microbiology, Pathogenic Bacteriology, and Dairy Bacteriology. The results were encouraging because many students reported that during job interviews prospective employers were impressed by the students’ knowledge of automation and rapid methods in microbiology.

The purpose of this article is to present an outline for a lecture or two for teaching automated and rapid methods in microbiology. Also included are a list of books and articles as well as potential sources of materials for such a lecture.
I assume that readers most likely to use the information already are knowledgeable in bacteriology and food microbiology. Those who need more background information may find it in the books and articles listed in the REFERENCE section of this paper.

This article makes no attempt to discuss merits and limitations of individual instruments and test kits, nor does it describe physical and biochemical phenomena related to use of and interpretation of results from the test-kits and automated instruments. That is done, however, in review articles mentioned earlier in this paper.

PLANNING, SCHEDULING AND TEACHING AIDS

This topic can be covered in one or two lectures, depending on the interests of students and the instructor. It should be presented at the end of the course after students understand Food Microbiology so they can appreciate the value of automation and rapid methods. I find a slide presentation best because slides for demonstrating some general procedures in microbiology can be prepared or obtained from the Board of Education, American Society for Microbiology (ASM, 1913 I Street, NW, Washington, D.C. 20006), or from Dr. C. Pootjes of Pennsylvania State University (South Frear Building, University Park, PA 16802). Slides for specific instruments or test kits also may be requested directly from manufacturers (addresses listed later in this paper).

Some companies will send as many as 10 test kits and promotional pamphlets for demonstration purposes. Such kits are ideal for use in the laboratory and for practical demonstrations during the lecture. It usually is not possible to borrow large automated instruments for demonstrations. But instrument companies usually will provide pamphlets for an instructor's use.

REFERENCE BOOKS AND PRINTED MATERIALS

Ideally a collection of the books listed in the REFERENCE section is available for student use in the library. At a minimum, the instructor should have a collection of the papers presented at the Dallas conference. Limited supplies of the following reprints are available from me: Fung and Wehr (7), Goldschmidt and Fung (8,9) and Cox et al. (2).

LECTURE OUTLINE AND SLIDE PRESENTATION OF AUTOMATION AND RAPID METHODS IN FOOD MICROBIOLOGY

I. Conventional methods of analysis of microorganisms in foods.
   Instructors can prepare the following slides in their own institutions or obtain them from ASM or Dr. Pootjes.
   A. Steps usually involved in the analysis of microorganisms in foods (2 to 3 slides).
   B. Use of many test tubes for conventional biochemical tests (2 to 3 slides).
   C. Use of many agar plates for cultivation and enumeration of microorganisms (2 to 3 slides).
   D. Use of time-consuming procedures in antibiotics testing (1 to 2 slides).

II. Improvement of conventional tests by miniaturized microbiological techniques (6). Slides may be requested from me.
   A. Multiple inoculation procedures (2 slides).
   B. Small tube tests (2 slides).
   C. Mass cultivation of bacteria on agar (2 slides).
   D. Mass cultivation of bacteria in Microtiter plates (2 slides).
   E. Miniaturized, viable cell-count procedures (2 to 3 slides).
   F. Efficiencies of miniaturized tests and of conventional tests compared (1 slide).

III. Improvement of conventional biochemical tests by multimedia test kits. Slides and promotional information can be requested from manufacturers.
   A. Multitest agar-based kit (2 to 3 slides per kit).
      1. R/B system--Corning Diagnostics, 25 Lumber Road, Rochester, Long Island, NY 11579.
   B. Dehydrated media kits (2 to 3 slides per kit).
      1. Auxotab (Inolex Enteric)--Inolex Corporation, 3 Science Rd, Glenwood, IL 60425.
      2. Minitake--BBL. Division of Beeton, Dickenson and Co., Cockeysville, MD 21030.
      3. API--Analytab Products, Inc., 200 Express Street, Plainview, NY 11803.

IV. Improvement of routine procedures by automation.
   This section and the next one may be combined as one lecture. Slides and promotional information may be requested from manufacturers.
   A. Sample preparation
      "Stomacher" (1 slide)--Dynatech Lab Inc. 200 Slater Lane, Alexandria, VA.
   B. Dilution and Harvesting (3 to 4 slides). Select from the following:
      2. Titer-Tek--Flow Laboratories, Rochville, MD.
      3. MediMix--Linbro Chemical Co., New Haven, CN.
      5. PRIAS System--Packard Instrument Co., Downers Grove, IL.
   C. Plating, Streaking, and inoculating (3 to 4 slides). Select from the following:
      4. Autostreaker--Tomtec Co., Orange, CN.
      5. Spiral Plate Maker--Spiral Systems Marketing, Rockville, MD.
   D. Colony counters (2 to 3 slides). Select from the following:
      1. Laser Bacteria Colony Counter--Spiral Systems Marketing, Rockville, MD.
      2. Petriscan--American Instruments Co., Silver Spring, MD.
      3. 3M Automated Colony Counter--Curtin Matheson Co., Houston, TX.
   E. Stainer machines (2 slides)
      1. Dynastainer--Dynatech Laboratory Inc., Alexandria, VA.
      2. GLS automated slide stainer--Honeywell, Inc., Minneapolis, MN.

V. Automation of biochemical and biophysical procedures.
   Procedures in this section may be new to students. It is advisable to have one slide describing the basic principles and another slide or two on the instrument.
   A. Particle counters (2 to 3 slides).
      Coulter Counter--Coulter Electronics, Inc., Hialeah, FL.
   B. Electrical Measurements (2 to 3 slides).
This article attempts to provide a framework for those who would like to lecture or teach a short course in automation and rapid methods. I have enjoyed such a lecture very much, so I think that anyone who spends some time in organizing a similar one will be rewarded by expanding his horizon in microbiology, by appreciative students, and with the idea of exposing students to new concepts. Try it, you'll like it.

REFERENCES