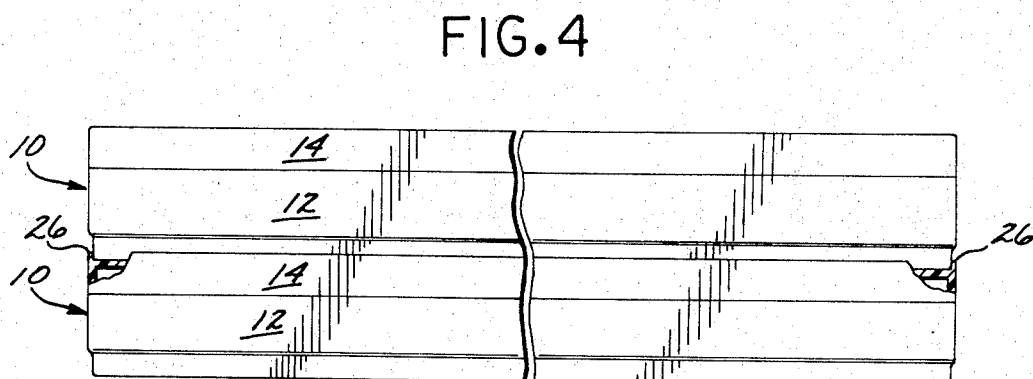
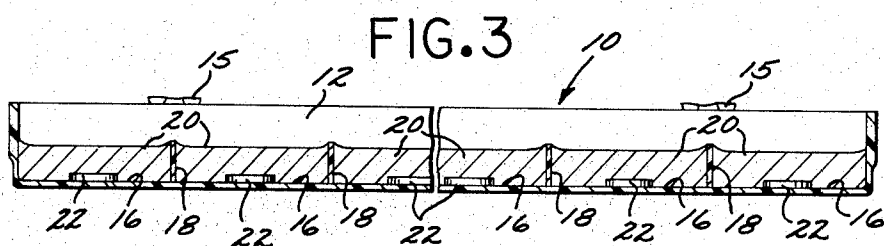
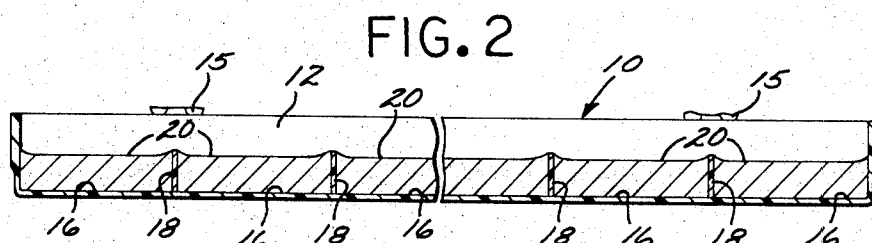
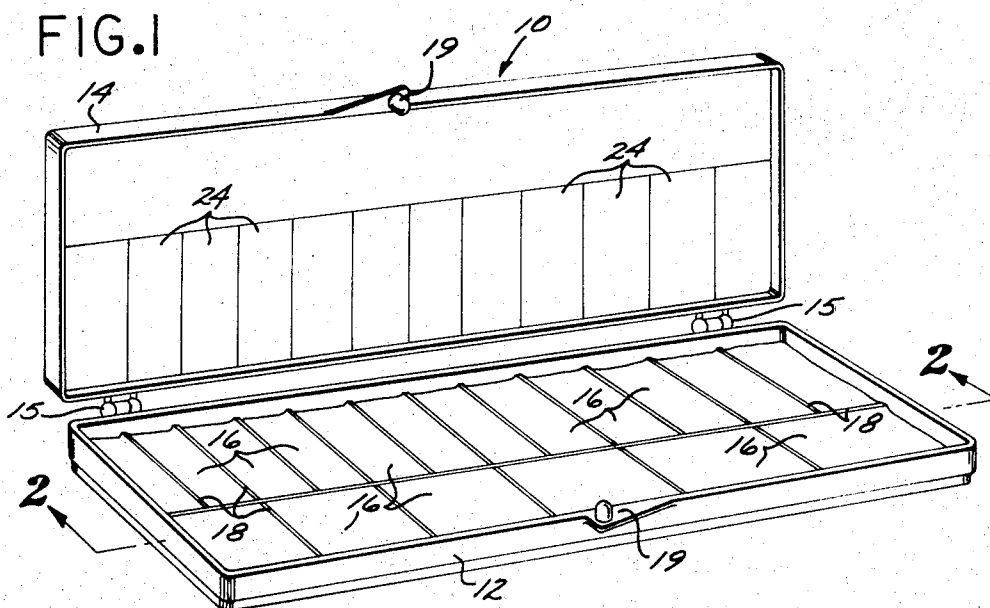


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 DEVICE FOR INDICATION OF BACTERIAL
 SENSITIVITY TO ANTIBIOTICS
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DEVICE FOR INDICATION OF BACTERIAL SENSITIVITY TO ANTIBIOTICS

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1 Claim

ABSTRACT OF THE DISCLOSURE

A device for indication of bacterial sensitivity to antibiotics and including a tray divided into a plurality of compartments which are each partially filled with a nutrient material for supporting bacterial growth. A different antibiotic agent is embodied in and diffused through the nutrient material in each compartment. A cover is pivoted to the tray to protect the tray interior from environmental contamination. In one embodiment the antibiotic agents are introduced in liquid form in the nutrient material, while in another embodiment the antibiotic agents are used to impregnate paper discs which are placed in the bottom of the compartments prior to filling with the nutrient material. The agents subsequently diffuse throughout the nutrient material and their capability for such diffusion is another measure of their effectiveness against microorganisms. The tray cover can be provided with appropriate indicia to identify the particular antibiotic agent in the various tray compartments. The tray, nutrient material, antibiotic agents and cover form an integral unit or package particularly adapted for use by non-laboratory personnel, such as in a physician's office.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a device for indication of bacterial sensitivity to antibiotics.

Description of the prior art

The determination of bacterial sensitivity to antibiotics is accomplished by several methods in the prior art, the present invention being directed to that prior art method which utilizes a plurality of antibiotic agents in combination with a nutrient material inoculated with the microorganisms under consideration. The sensitivity of the microorganisms to each of the antibiotics is determined by the presence or absence of growth of the organisms in the nutrient material.

More particularly, this prior art method involves the pouring of a previously prepared nutrient material into a petri dish. On cooling, a rigid or solid gel is formed which is inoculated or streaked with the microorganism under consideration. Paper discs, each impregnated with a different antibiotic agent, are placed on the surface of the gelled nutrient material and the petri dish is then incubated. If an organism is sensitive to one of the antibiotic agents, the organism will not grow about the particular disc impregnated with that agent. A so-called clear zone of inhibition is produced. If the antibiotic agent is ineffective upon the organism, the organism will flourish in usual discrete colonies about the associated discs. In a related manner, the nutrient material is utilized to identify certain forms of bacteria in addition to providing a sensitivity test. In such an instance, blood agar is often used. It includes defibrinogenated blood which is hemolyzed by the bacteria, converting it from an opaque to a transparent state.

The prior art method just described is relatively complex and generally impractical for office use by a physician's staff. It is used almost entirely in test laboratories

by skilled technicians. This presents a delay in utilizing such a system for the identification of an appropriate anti-microbial agent or antibiotic for use in an individual case. More immediate results are needed to quickly determine the identity of the antibiotic which will arrest the growth of the microorganisms, slow the spread of infection, and prevent the continuing tissue destruction associated with certain pathogenic organisms.

Various attempts have been made to develop improved testing techniques, but these have not been wholly satisfactory for a number of reasons. For example, where antibiotic impregnated paper discs are used they are dropped on agar nutrient material from sealed packages containing a number of identical discs. Each package can and generally does have a different shelf life compared to the other packages, as well as different periods of time of exposure to ambient conditions such as temperature and humidity. Consequently, the efficacy of the discs is impaired in varying, unpredictable degrees. Even placement of the discs upon the nutrient material is unstandardized and productive of errors in sensitivity determinations. That is, the discs are usually dropped upon the nutrient surface by some dispensing device associated with the antibiotic package. Some discs fall flat, while others are tilted or skewed on the surface, and it has been found that the degree of diffusion of the antibiotic agent through the nutrient material is greatly affected by the disc attitude.

Another difficulty with the use of antibiotic discs is that many persons erroneously conclude that the potency of the various antibiotics against a particular organism can be related to the size of the zones of inhibition around the discs. Various antibiotics have well known differences in solubility and diffusion, and selection of one antibiotic over another based upon the size of the zone of inhibition could result in the selection of an antibiotic of inferior capability. This problem could be avoided by using a qualitative test in which the technician simply checks to see if any bacterial growth has occurred for one antibiotic agent, rather than the amount of growth relative to another antibiotic agent.

SUMMARY OF THE INVENTION

According to the present invention, apparatus is provided for indication of bacterial sensitivity to antibiotics. The apparatus includes a tray divided into a plurality of compartments in each of which is disposed a nutrient material for supporting bacterial growth. A different antibiotic agent is embodied in the nutrient material in each of the compartments. In one embodiment the antibiotic agent is diffused throughout the nutrient material at the time of introduction of the nutrient material into the compartments, and in another embodiment the antibiotic agents are incorporated in paper or fibrous discs which are disposed on the bottom of the compartments and upon which the nutrient material is poured. Where the nutrient material is opaque, the tray cover is preferably provided with indicia to enable a determination of the character of the antibiotic agent in the particular compartment. The indicia on the tray cover can be eliminated where the nutrient material is transparent and the paper discs used are imprinted with an identification of the antibiotic agents involved.

In all embodiments the nutrient material is prepared, and disposed within the compartments in a standardized manner. The antibiotic agents in the compartments are also standardized, being, for example, of the same concentration, and shelf life, and time for exposure to ambient conditions. The nature of the device lends itself to almost complete standardization so that little is left for the individual physician or his staff to do but swab or streak the upper surfaces of the nutrient material with the

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organisms to be analyzed. This can be facilitated by filling the compartments to a level or at just below the upper edges of the walls defining the compartments. Alternatively, the tray can be filled with the nutrient material and a grid then dropped in to define the compartment walls. This assures uniform material level in all the compartments.

The efficacy of the antibiotic agents is evident by observation of the growth or lack of growth of the organisms on the nutrient material surfaces. The capacity or capability of the antibiotic agents for diffusion throughout the nutrient medium in the compartments also is made evident.

The present device is not intended to provide a determination of the quantitative effect of the antibiotic agents, since the absence of the zones of inhibition of the prior art system makes this impossible. Instead, a qualitative result is provided in that the particular compartments are characterized by growth or no growth, depending upon the sensitivity to the organisms under consideration.

The present device is an integrated, relatively inexpensive package uniquely adapted for standardization so that it can be used in a doctor's office. Thus, neither the patient nor the test specimen need be sent to a test laboratory.

Other objects and features of the invention will become apparent from consideration of the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an apparatus according to the present invention;

FIG. 2 is a view taken along the line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 2, but including a plurality of antibiotic discs in the nutrient media; and

FIG. 4 is a showing of the manner in which a plurality of the trays may be stacked for easy storage, portions of the trays being omitted and cut away for brevity and clarity.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIGS. 1 and 2 there is illustrated an apparatus or device 10 comprising, generally, a rectangular tray 12 and a complementary overlying cover 14 which is pivotally mounted to the tray by hinges 15 located at the back of the tray. The cover and tray are each formed of a suitable plastic material, preferably transparent and unaffected by the materials to be placed in the tray.

The sides and bottom of the tray 12 define a rectangular central cavity which is divided into a plurality of compartments 16 by intersecting walls 18. The walls 18 may be molded or otherwise integrally formed as part of the tray 12, but preferably the walls 18 are part of a separate, one-piece grid element which is dropped into the tray 12 to define the compartments 16. The sides and bottom edges of the walls 18 fit relatively closely against the sides and bottom of the tray 12, preferably but not necessarily in fluid tight relation.

The front of the tray 12 and cover 14 includes complementary snap fittings 19 which enable the cover and tray to be snap fitted or clamped together in tight fitting relation to reduce evaporation of the tray contents.

A nutrient broth, liquid, or like material 20 is poured into the tray 12, and the material is isolated into the separate compartments 16 when the grid element forming the walls 18 is dropped into place. The nutrient material 20 may be any of the standard materials available in a bacteriology laboratory, including heart-infusion agar, tryptose blood agar base, or blood agar. A gelling agent renders the material solid after a period of time. Typically, a Mueller-Hinton blood agar with 5% defibrinogenated blood can be used. This agar solution or nutrient mate-

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rial is opaque and provides an identity function in that it becomes transparent in the presence of certain bacteria which hemolyzes the blood. If desired, the wall forming grid could first be dropped into the tray, and thereafter certain compartments filled with nutrient materials solely for sensitivity testing and other compartments for identification testing. Such latter compartments would thus be filled with materials such as eosin methylene blue, Simmons citrate, or the like, which change color in the presence of certain types of bacterial.

The nutrient material 20, of whatever type and however modified, preferably is approximately 4 millimeters in depth, with the walls 18 being higher only by the height of the meniscus of the material 20 adjacent the walls. Of course, the walls 18 may be made somewhat higher, if desired.

The antimicrobial agents or antibiotics utilized in the various compartments 16 typically may include penicillin, terramycin, erythromycin, aureomycin, etc.

The antibiotics may be diffused throughout the nutrient material 20 in the various compartments in at least two different ways. In the embodiment of FIG. 2 the antibiotics are in liquid form and are introduced into the compartments after the nutrient material is poured in. Standard concentrations are used so that the potency of the agents is predictable. In this regard, it is an important feature of the invention that the manufacture of the device 10 takes place under closely controlled laboratory conditions so that the character of the nutrient material 20 and the antibiotics can be closely standardized, controlled, and protected.

Alternatively, commercially available paper discs 22 may be used to incorporate the antibiotic into the nutrient material in the compartments 16, as best illustrated in FIG. 3. In this embodiment, each disc 22, which is usually formed of a porous paper or other suitable fibrous material, contains a different dehydrated antibiotic of known concentration. These discs 22 are placed upon the bottom of the tray 12 for location of the disc or discs of a particular antibiotic in one of the compartments 16. The nutrient material 20 is then poured over them and the antibiotic in each disc 22 then diffuses throughout the nutrient material 20 in its compartment. With this arrangement the orientation of each disc 22 within the nutrient material 20 does not affect its capability for diffusion of the associated antibiotic. Moreover, the introduction of all of the discs 22 into the tray 12 during manufacture enables the use of discs 22 of the same potency, shelf life, exposure to ambient conditions, etc., and otherwise standardizes the test procedures.

Identification slips 24 or other comparable indicia are applied to the interior face of the cover 14 adjacent the various compartments to identify the nature of the antibiotic in that compartment. The smaller compartments shown in FIG. 1 are usually utilized for sensitivity testing, while the larger compartments are used with solutions which yield an identification of the bacteria. The arrangement is a matter of choice since the character of the particular nutrient media and antibiotic or other agent does not form a part of the present invention.

A plurality of the devices 10 can be stacked for compact storage by making the dimensions of the base of the tray 12 such that it will fit or nest within the area defined in the cover 14 by a peripheral upward projection or lip 26, as illustrated in FIG. 4.

In use, the device 10 constitutes an integrated package which can readily be used by a physician or his staff in his office. A number of devices 10 can be stacked and stored under refrigeration. When needed, the cover 14 of a device 10 is pivoted open so that the nutrient material 20 in the various compartments 16 can be inoculated with a colony of the pathogen. This can be done by preparing a broth culture of the organism, which is then streaked evenly over the material 20 with a sterile cotton swab or, if time does not permit preparation of such a cul-

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ture, a clinical specimen of the causative organism can be smeared or streaked directly upon the nutrient material 20. Since the upper surfaces of the nutrient material 20 in the various compartments 16 are near the upper edges of the walls 18, the material in all of the compartments 16 can be streaked easily and quickly. 5

Next, the device 10 is incubated at approximately 37° C. overnight. Subsequent examination of the surfaces of the nutrient material in the various compartments will indicate the sensitivity or lack of sensitivity of the organisms to the various antibiotics. Other compartments, as previously indicated, can be examined to obtain an identification of such organisms. 10

The device 10 is sufficiently inexpensive that it can simply be discarded or destroyed upon completion of the test. 15

The device 10 thus affords a rapid and practical means for determining the susceptibility of microorganisms to particular antibiotics. The nutrient materials and antibiotic concentrations and placement are standardized and an integral part of the device. All the user need do is smear a broth culture or clinical specimen directly onto the nutrient material 20 and examine the bacterial growth characteristics after the usual period of incubation. 20

Various modifications and changes may be made with regard to the foregoing detailed description without departing from the spirit of the invention. 25

I claim:

1. A device for indication of bacterial sensitivity to antibiotics, said device comprising: 30
a tray having a plurality of compartments;

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a composition in said plurality of compartments, said composition consisting essentially of nutrient material for supporting bacterial growth; and
an element at the bottom of each said compartment below the upper surface of said composition and in contact with said composition, said element consisting essentially an inert nontoxic substance impregnated with an antibiotic whereby said antibiotic tends to become diffused through said composition to said surface thereof to produce a detectable indication of the sensitivity to said antibiotic of a colony of pathogen applied to said surface, the capacity of said antibiotic to diffuse through the intervening space between said element and said surface being a measure of the capability of said antibiotic for diffusion through said composition.

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