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Evaluation of the Improved Auxotab 1 System for Identifying *Enterobacteriaceae*

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The improved Auxotab Enteric 1 System is more accurate in identifying *Enterobacteriaceae* than is the original product, and results correlate better with those obtained with conventional tests.

Approximately two years ago, the Auxotab Enteric 1 System for the identification of *Enterobacteriaceae* (Wilson Diagnostics, Glenwood, Ill.) was marketed. The system has been thoroughly described and evaluated (3, 4). The manufacturer claims that recent changes in the product improve its sensitivity, make it easier to handle, and improve the procedure for performing the indole test. We have evaluated the improved system, limiting our study to *Enterobacteriaceae* only, in order to complement the previous report (3).

The source of the cultures, the procedures used in handling them as unknowns, the media used in the conventional tests, and the tests used in the Auxotab System have been described (3). In the present study, the only difference in technique was in the way the test for indole was performed. In the improved system, the capillary tube is under-filled at the time of inoculation, thus allowing the rim of the capillary tube to better retain the drop of Kovac reagent and permitting a stronger color reaction to develop. The remaining capillary tubes are filled as previously described. In describing the improved system, the manufacturer stresses the fact that the urea reaction is important only in the identification of *Proteus*.

Results of eight tests with the Auxotab System and the same eight tests performed conventionally are shown in Table 1. Viability control (resazurin reduction) and *o*-nitrophenyl-β-D-galactopyranoside tests which can be done with the Auxotab system were not performed by conventional means. In previous studies, problems were encountered with the lysine, ornithine, hydrogen sulfide, and malonate tests (3, 4), but in the improved Auxotab System these problems were greatly reduced. Test agreement was excellent. The test for sucrose was the least accurate; results disagreed 11 times with those from conventional tests. This disagreement affected the identification of only one of the unknown cultures.

The accuracy with which 200 *Enterobacteriaceae* were identified is shown in Table 2.

TABLE 1. *Comparison of improved Auxotab and conventional test results*

Test	No. in agreement/no. tested	Percentage of agreement
Phenylalanine	200/200	100.0%
Lysine	199/200	99.5%
Ornithine	199/200	99.5%
Urease	199/200	99.5%
Indole	198/200	99.0%
Hydrogen sulfide	197/200	98.5%
Malonate	196/200	98.0%
Sucrose	189/200	94.5%

TABLE 2. *Identification accuracy of improved Auxotab System with unknown enteric cultures*

Organism	No. correct/ no. tested	Percent correct
Salmonella sp.	13/13	100.0%
Shigella sp.	4/4	100.0%
Escherichia coli	13/13	100.0%
Enterobacter cloacae	14/14	100.0%
Providencia species	12/12	100.0%
Proteus mirabilis	14/14	100.0%
Proteus rettgeri	9/9	100.0%
Proteus morganii	7/7	100.0%
Proteus vulgaris	6/6	100.0%
Serratia marcescens, *Enterobacter aerogenes*, *Enterobacter liquefaciens*[a]	34/36	94.4%
Klebsiella pneumoniae	14/15	93.3%
Citrobacter freundii	12/13	92.3%
Enterobacter hafniae	12/13	92.3%
Edwardsiella tarda	9/10	90.0%
Shigella sonnei	6/7	85.7%
Arizona hinshawii	12/14	85.7%

[a] Auxotab does not differentiate these three species.

TABLE 3. *Erroneous identifications with improved Auxotab system*

Organism	Auxotab identification	Reason for misidentification
Arizona hinshawii	*Salmonella* (2 strains)	ONPG[a] negative
Shigella sonnei	*Enterobacter cloacae*	Sucrose positive
Klebsiella pneumoniae	*Escherichia coli*	Indole positive
Citrobacter freundii	*Klebsiella pneumoniae*	Hydrogen sulfide negative
Enterobacter hafniae	*Enterobacter cloacae*	Lysine negative
Edwardsiella tarda	*Salmonella*	Indole negative
Enterobacter liquefaciens	*Enterobacter cloacae*	Lysine negative
Enterobacter liquefaciens	*Salmonella* (H_2S negative)	ONPG negative

[a] *O*-nitrophenyl-β-D-galactopyranoside.

All cultures of *Salmonella*, *Shigella* (not including *S. sonnei*), *Escherichia*, *Enterobacter cloacae*, *Providencia*, and *Proteus* were identified correctly. One culture of *Proteus mirabilis* was urea negative but was identifiable with other tests. Only cultures from other genera or species were misindentified. These misidentifications and the reasons for them are shown in Table 3. Of the nine cultures missed, two were aberrant; one was a lysine-negative *Enterobacter hafniae*, the other an indole-negative *Edwardsiella tarda*. The latter occurs very rarely (1, 2). The remaining cultures, although not aberrant, are encountered in the clinical laboratory (lysine-negative *Enterobacter liquefaciens*, 17.6% at 37 C; indole-positive *Klebsiella pneumoniae*, 6% [1, 2]), and should be considered when this product is used. Overall, the Auxotab System correctly identified 96% of the 200 cultures tested.

Although the number of cultures tested was smaller than in previous studies, results suggest that some of the problems found when the system was first introduced have been solved. The greater sensitivity of reactions in the lysine, ornithine, malonate, and hydrogen sulfide tests is a major improvement. Introduction of individual plastic incubation trays apparently solves the contamination problem. One problem which still exists is the length of time required for initial incubation of broth cultures. If this incubation time could be reduced or eliminated, or an alternate method of obtaining the inoculum devised, the system would be further improved. A major point of concern is the simplified identification and flow charts supplied by the manufacturer. These charts fail to adequately indicate significant variations from the general biochemical results exhibited by *Enterobacteriaceae*. The manufacturer might remedy this by providing more information on atypical results.

Compared with the original system, this improved product gives greater accuracy in the identification of enteric unknowns and a higher correlation of results with conventional tests. In the improved form, this system, along with several other commercially available systems, now can be used in clinical laboratories.

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