Survival of Bacteria on Swabs

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It has long been recognized that bacteria fail to survive for long periods on cotton swabs. Unsaturated fatty acids have been shown to inhibit a number of species (Pollock, Brit. J. Exptl. Pathol. **28**:295, 1947; Rowatt, J. Gen. Microbiol. **17**:279, 1957), and the presence of these substances in cotton has been demonstrated (Pollock, Nature **161**:853, 1948).

Various attempts have been made to overcome the inhibitory effect of the cotton by coating it with serum (Rubbo and Benjamin, Brit. Med. J. **1**:983, 1951) or by boiling it in phosphate buffer followed by treatment with charcoal (Stuart, Toshach, and Potsula, Can. J. Public Health **45**:73, 1954). Other materials have been substituted for cotton, including filter paper (Joe, Am. J. Trop. Med. Hyg. **5**:133, 1956), calcium alginate (Cain and Steele, Can. J. Public Health **44**:464, 1953), and Dacron (Hollinger and Rantz, Pediatrics **24**:1112, 1959). Success in prolonging bacterial survival was achieved by placing cotton swabs in a non-nutritive transport medium (Stuart, Glasgow Med. J. **27**:131, 1946) designed to minimize oxidative changes. Each of these studies has confirmed the poor survival of bacteria on cotton swabs.

The present study was undertaken to compare a number of materials known to prolong bacterial survival (Dacron and calcium alginate) with two previously untested swabs, namely, Fortrel (a polyester fiber) and cotton treated with polyvinyl alcohol (PVA cotton). Untreated cotton swabs used with and without transport medium were also tested. All swabs were supplied in sterile screw-cap tubes. Swabs were color-coded, and their identity was unknown to the investigators until the completion of the study. Stuart's Transport Medium (BBL) was prepared in screw-cap tubes (15 by 60 mm).

Cultures used were 18- to 24-hr cultures of a group A β -hemolytic streptococcus, *Corynebacterium diphtheriae*, and *Neisseria gonorrhoeae* on blood-agar, and *Haemophilus influenzae* on chocolate-agar. Cultures were suspended in sterile saline and adjusted to a turbidity corresponding to McFarland Turbidity Scale No. 5. Swabs were dipped into the bacterial suspensions,

drained, and returned to the screw-cap tubes. In addition, duplicate cotton swabs were placed in transport medium. All tubes were stored in the light at temperatures which ranged from 22 to 30 C. At 3, 6, 9, 12, 18, 21, 48, 72, 96, and 120 hr, swabs were removed from the tubes and streaked on blood-agar or chocolate-agar plates in duplicate. Similar cultures were made on duplicate swabs removed from tubes of transport medium at these times. Cultures were incubated for 48 hr before being recorded as negative. The experiment was arbitrarily discontinued at 120 hr.

The results (Table 1) substantiate the poor survival of bacteria on cotton swabs. It can also be seen that PVA cotton failed to enhance survival and, as suggested by the results obtained with *C. diphtheriae*, may be inhibitory. Under the conditions of this experiment, calcium alginate and Dacron were only slightly superior to cotton. Fortrel swabs retained more moisture than any of the other swabs and remained wet throughout the duration of the experiment. The improved survival of the streptococcus on Fortrel is paradoxical, since this organism has been shown to survive well on dry filter paper or dry Dacron swabs (Hollinger and Rantz, Pediatrics **24**:1112, 1959). The superiority of transport medium with ordinary cotton swabs is apparent.

The mechanisms responsible for death of

TABLE 1. Survival of bacteria on various swabs and in transport medium

Type of swab	Time (hr)			
	<i>Haemophilus influenzae</i>	<i>Streptococcus</i>	<i>Corynebacterium diphtheriae</i>	<i>Neisseria gonorrhoeae</i>
Untreated cotton..	3	3	12	3
PVA cotton.....	3	3	6	3
Calcium alginate...	6	3	18	3
Dacron.....	120	3	18	3
Fortrel.....	96	18	18	3
Untreated cotton in transport medium.....	120	120	120	21

bacteria on swabs are far from understood, although the present results suggest that factors other than fatty acid toxicity or moisture may be involved. It is recognized that the survival times recorded here are relative, since this experiment was performed with saline suspensions, rather than with clinical specimens in which the bacteria

may be protected by mucus, pus, serum, or other body fluids.

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