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The effect of drying upon the viability of bacteria.By **C. E. A. WINSLOW** and **F. ABRAMSON**.[*College of the City of New York.*]

The curve of viability, measuring the rate of decrease among bacteria exposed to an unfavorable environment, has been determined for many conditions. Drying is known to cause a rapid elimination, but no exact quantitative determinations have been made. In the experiments here reported, colon bacilli were used. One cubic centimeter of a 48-hour broth culture was mixed with $2\frac{1}{2}$ grams of sea sand spread out in an ordinary Petri dish. Duplicate dishes prepared in this way were covered with porous earthenware tops and kept for various periods of time from four hours to ten days. At the end of each period nine cubic centimeters of sterile water were added to the sand in one of the dishes and well mixed by careful agitation. Portions of this water were then plated in duplicate on agar in the usual manner.

The results of eight series of tests are shown in the table below expressed in percentages of the original number of bacteria present. The original numbers in different series varied from 4,150,000 to 117,300,000 per gram of sand, and the final number remaining after ten days in Series II and III were 20,700 and 18,900 per gram, respectively. The average temperature and humidity of the room in which the plates were kept is shown for the last five series at the bottom of the table.

PERCENTAGE OF ORIGINAL NUMBER SURVIVING.

Period. Hours.	Series.							
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
4						76.45		
5½						57.18		
6				75.90			79.82	
7					57.56	37.46		57.76
8				67.23	59.30		69.03	
10					44.48			41.38
24	.85	.85	.85					
48	.16	.16	.15					
120	.08	.06	.06					
166	.04	.04	.04					
216		.02	.02					
240		.02	.02					
Average temperature				69°	69°	70°	69°	69°
Average relative humidity . . .				90%	72%	60%	90%	72%

The results are quite concordant when the dryness of the atmosphere is taken into consideration. Series VI showed a more rapid reduction than the others during the first 7 hours and the relative humidity was 60 per cent. Then came Series V and VIII with a relative humidity of 72 per cent., while in Series IV and VII with an atmospheric humidity of 90 per cent., nearly 70 per cent. of the bacteria were alive after 8 hours.

The general rate of reduction was directly proportional to the time, during the first 24 hours, and then fell off more and more gradually. As a rule, intestinal bacteria in any foreign medium, colon bacilli in water, for example, decrease rapidly at first and more and more slowly as time goes on, following almost a parabolic curve. Most die at first, but a few persist for a long time. In its general relations the curve for drying is similar. 99 per cent. of the bacteria are gone after 24 hours while 2 out of 10,000 persist after 10 days. The curve for the first 24 hours is however here practically a straight line. 50 per cent. perished after 10 hours, and 99 per cent. after 24 hours. This is to be explained by the fact that during this period the bacteria were not exposed to constant conditions, since the originally moist sand was becoming progressively dryer. Determinations made by weighing at intervals duplicate samples prepared just like those which were inoculated with the bacteria showed that nine tenths of the moisture in the sand was gone after 10 hours and practically all of it was gone after 24 hours (with an atmospheric humidity of 80 per cent.). With a constant unfavorable environment, the reduction of bacteria proceeds at a decreasing rate. With an environment growing more and more unfavorable we might expect an approximately even rate of reduction such as is indicated here.

So far as the absolute reduction is concerned, it appears that drying is highly inimical to the bacteria studied. A uniform reduction of 99 per cent. is indicated after 24 hours. It takes over a week to reach such a point when colon bacilli and similar intestinal forms are stored in water.