small particles. The potency was further increased by the direct contact action of these small particles.

The apparatus used in this work consisted of a small nasal type atomizer mounted four inches above the center of an electric hotplate held at 375° C. A small electric compressor was used to maintain the air pressure that operated the atomizer.

To stabilize and increase the toxicity of these insecticidal aerosols, fatty acids (lauric or oleic) were added to the spray solution. It was shown with biological tests against the housefly that these materials increased the effectiveness of orthodichlorobenzene. The results of these tests are given in Table 1.

Although lauric and oleic acids are substantially inert when used alone, under the conditions of these tests they act as adjuvants when combined with orthodichlorobenzene and greatly increase the effectiveness of the aerosol. Certain fatty acid derivatives, such as salts, esters, and the like, also gave increased insecticidal action. The results were corroborated by room tests against the roach and the bedbug, where a 100 per cent. mortality was obtained by using 1.5 pounds of orthodichlorobenzene containing 5 per cent. of lauric acid per 1,000 cubic feet.

TABLE 1

RELATIVE EFFECTIVENESS AGAINST HOUSEFLIES OF ORTHODICHLOROBENZENE, ALONE AND IN COMBINATION WITH OLEIC AND LAURIC ACID, WHEN DISPERSED IN AEROSOL FORM; EXPOSURE PERIOD 30 MINUTES*

Material tested	Number of insects tested	Mortality after 2 days, per cent.
Orthodichlorobenzene	609	2
Orthodichlorobenzene plus oleic acid	440	55
Orthodichlorobenzene plus lauric acid	471	60
Lauric acid	216	1
Oleic acid	220	1

* Orthodichlorobenzene was used at the rate of 0.28 cc per cubic foot and the fatty acid at 0.071 gram per cubic foot.

This method of producing an aerocolloidal dispersion by spraying liquid toxins on a heated surface might be of use to bacteriologists, who have found bacteriocidal aerosols effective in decontaminating rooms.[2]

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A BUBBLER PUMP METHOD FOR QUANTITATIVE ESTIMATIONS OF BACTERIA IN THE AIR[1]

THE bacterial content of the air of a rheumatic fever hospital has been studied regularly throughout the past winter. For quantitative estimations, an air centrifuge of the type described by Wells[2] was used and occasional runs were made with apparatus similar to that of Hollaender and Dalla Valle.[3] Results were so variable even in successive runs in an apparently stable environment that more refined methods of estimating the number of bacteria in air were sought. The most satisfactory machine in respect to efficiency and ease of operation was a modification of that described by Robertson,[4] Bigg, Miller and Baker in SCIENCE, February 28, 1941. This operated on the principle of the slow bubbling of air through liquid media. Glass beads serve to break up bubbles and release bacteria to the broth which might otherwise escape within the bubbles.

The apparatus shown in Fig. 1 consists of a sterile 250 cc Erlenmeyer suction flask containing a measured quantity of glass beads and broth. Air is drawn through this flask at rates indicated by a U tube manometer at the inlet. At the completion of the ten-minute run, one and two cc amounts of the broth are pipetted to sterile petri dishes and blood agar is poured and mixed with the inoculum. A vacuum

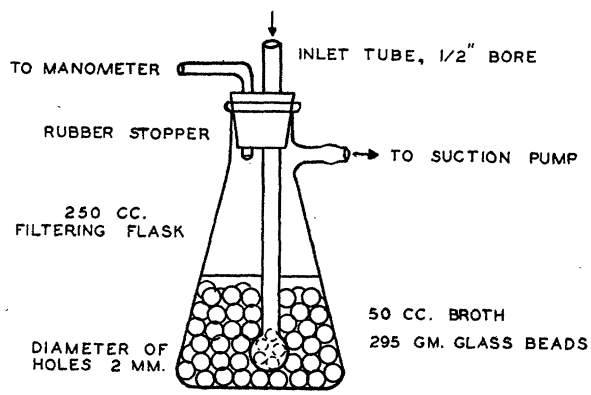

FIG. 1. Diagrammatic drawing of bubbler pump apparatus.

[1] From the Department of Preventive Medicine, Harvard Medical School, and House of the Good Samaritan, Boston, Massachusetts. This work was supported in part by a grant to the House of the Good Samaritan from the Commonwealth Fund.

[2] W. F. Wells, *Am. Jour. Pub. Health*, 23: 58, 1933.

[3] A. Hollaender and J. M. Dalla Valle, *Pub. Health Rep.*, 54: 574, 1939.

[2] C. C. Twort, A. H. Baker, S. R. Finn and E. O. Powell, *Jour. Hygiene*, 40 (3): 253–344, illus. 1940.

[4] O. H. Robertson, E. Bigg, B. F. Miller and Z. Baker, SCIENCE, 93: 213 and 214, 1941.

cleaner motor provided sufficient suction for our purposes. Inlet tubes were specially constructed with one-half inch bore and with the submerged end a perforated bulb of the bubbler type to prevent clogging or unequal pressure from the glass beads.

Calibration of the air flow was determined by the displacement of air by water in a two-liter flask and checking these rates with differences in the manometer levels. Best results were obtained at relatively low rates indicated by the gentle bubbling of air through the broth and beads. Optimum speeds were between 3.6 and 9.0 liters per minute. Too strong suction tended to cause splashing and sucking of broth through the outlet of the flask. As in bacterial analysis of milk, the number of colonies found in plates poured with one and two cc samples of broth are multiplied to the number which should be present in the entire 50 cc. Immediate pour plates of the broth are not necessary since significant bacterial growth does not take place for an hour or more even at room temperature. However, if immediate pouring is not practical it is advisable to store the flasks in the refrigerator. Colony counts of samples ranging from 0.5 cc to 3 cc reveal a straight line relationship of size of sample to number of colonies.

Tests on the efficiency of this machine by attaching it in series to the Wells Air Centrifuge, and tests where two of the bubbler pumps are set up so that the exhaust of one is attached to the inlet of the other reveal that bacteria of air samples are more thoroughly absorbed by the bubbler pump than the air centrifuge. Table 1 shows the magnitude of this difference in

TABLE 1

RELATIVE EFFICIENCY OF THE BUBBLER PUMP AND AIR CENTRIFUGE AS SHOWN BY AIR SAMPLES FROM THE APPARATUS CONNECTED IN SERIES

Apparatus	Unit	Colony counts: 1 ml.	Colony counts: 2 ml.	Estimated colonies av. in 50 ml.	Count in 10 cu. ft.
(A) Two bubbler pump units in series.	Pump No. 1	5	8	225	990
	Pump No. 2	0	0	0	0
(B) Centrifuge in series to the outlet of the bubbler pump.	Pump	6	10	262	1,190
	Centrifuge	–	–	–	1

The above experiments were conducted in the same room on the same day.

colony counts when the machines are arranged in series. When separate runs are made in the same room by the two machines colony counts indicated by the bubbler pump are usually several times that found in an equivalent sample of air from the centrifuge. Table 2 shows sample protocols of such runs.

Preliminary experiments indicate that accurate evaluations of the bacterial content of air under the natural conditions of a hospital ward are possible with these bubbler pumps. Experiments are in progress involving the correlation of dust and bacteria counts and the effect of ultra-violet rays on the bacteria of irradiated rooms.

TABLE 2

COMPARISON OF BACTERIAL COLONY COUNTS IN AIR SAMPLES: PARALLEL RUNS IN AIR CENTRIFUGE AND BUBBLER PUMP

Room	Color counts: 1 ml.	Color counts: 2 ml.	Av. colony count for 50 ml. broth	Estimated colonies: 10 cu. ft. bubbler pump	Air centrifuge: Colonies counted in 10 cu. ft.
Ward F ...	3	7	162	710	86
Ward E ...	6	14	318	1400	108
Ward H ...	3	5	137	610	58
Room 63 ..	3	5	137	610	170

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COIN MATS FOR THE MICROSCOPIST

THE scarcity of supplies and the increase in cost of cover glasses suggest greater care in preserving those already on hand. It has been learned that much breakage can be avoided by the use of a rubber coin mat. Cover glasses and slides placed on these mats are easily grasped by the fingers without the necessity of pushing them to the edge of the table, where they frequently break from pressure in trying to pick them up, or fall to the floor. There is also a great saving on the finger nails and no risk of undernail splinters from rough tables. As a matter of fact, finger nails, long or short, cease to be a factor in handling the cover glasses. Ease in mounting specimens is sufficient reason for using the coin mat and the saving in breakage will soon amortize any expense involved.

The coin mats may be obtained from the Sun Rubber Company, Barberton, Ohio. Used whole, halved or quartered, they furnish a simple convenience to frustrate an ever-present source of impatience.

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