Conclusions. Caffeine citrate increases the basal metabolic rate of guinea pigs. This increase is present 24 hours after feeding caffeine though not quite so marked. Lugol's solution or thyroidectomy tends to prevent this calorigenic action.

7525 C

Effect of Supersonic Waves on Bacteria.

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Destruction of living organisms by supersonic waves has recently been observed.[1] The mechanism of the destruction is, however, unknown. The present communication extends the observation to a number of pathogenic and nonpathogenic bacteria and the results seem to indicate that the destruction is due to the dissolution of the bacterial cells.

The oscillating circuit was similar to that described by Wu and Liu,[2] and the quartz was adjusted to vibrate at the rate of 1.5×10^6 times per second. Bacterial suspensions to be exposed were placed in a thin test tube, 15 mm. in diameter. Inside the test tube was placed a glass cooling coil through which cold water circulated. The temperature of the bacterial suspension was never over 20° C. The possibility of destruction by heat was therefore eliminated.

Saline suspensions of the following 10 strains of bacteria were used: *Bacillus subtilis, Bacillus anthracis, Bacillus proteus X* 19, *Bacillus coli communis, Bacillus typhosus, Bacillus dysenteriae Shiga, Staphylococcus aureus, Micrococcus catarrhalis, Bacillus influenzae,* and *Streptococcus hemolyticus.* The number of surviving bacteria per cc. before and after exposure was determined by counting the colonies in poured plates. In the case of *Bacillus influenzae* streak plating was used. Control experiments with bacterial suspension standing at room temperature without exposure showed no significant change in the number of surviving bacteria. Results are shown in Fig. 1.

[1] Wood, R. W., and Loomis, A. L., *Phil. Mag.*, 1927, **4**, 417. Harvey, S. N., and Loomis, A. L., *J. Bact.*, 1929, **17**, 373. Beckwith, T. D., and Olson, A. R., PROC. SOC. EXP. BIOL. AND MED., 1931, **29**, 362. Williams, O. B., and Gaines, N., *J. Inf. Dis.*, 1930, **47**, 485.

[2] Wu, H., and Liu, S. C., PROC. SOC. EXP. BIOL. AND MED., 1931, **28**, 782.

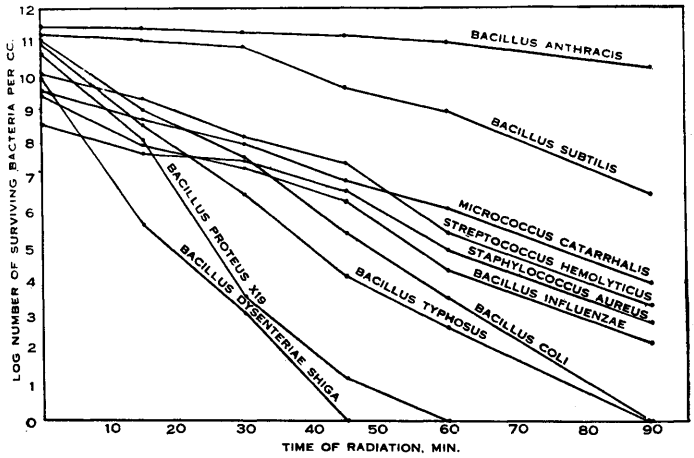

FIG. 1.

Effect of exposure on number of surviving bacteria. Volume of bacterial suspension used = 1 cc.

It will be noted that the organisms studied can be divided into 3 groups according to their susceptibility to the supersonic wave. The first group represented by *Bacillus anthracis,* is practically not affected by a 90-minute exposure. The second group which includes *Micrococcus catarrhalis, Bacillus subtilis, Streptococcus hemolyticus, Bacillus influenzae,* and *Staphylococcus aureus,* is partially destroyed but not completely sterilized by a similar exposure. The third group which includes *Bacillus proteus X* 19, *Bacillus coli communis, Bacillus typhosus* and *Bacillus dysenteriae Shiga,* is completely sterilized within 90 minutes. The organisms of this group are members of the Gram negative intestinal bacilli. The ability to form spores does not seem to explain the high resistance of *Bacillus anthracis* to supersonic waves, because the other spore-bearing organism studied, *Bacillus subtilis,* was definitely destroyed.

In order to throw some light on the mechanism we have compared the opacity, using Pulfrich photometer, with the number of surviving bacteria in a few of the suspensions before and after exposure. Results are shown in Fig. 2.

It will be noted that, in the case of *Staphylococcus aureus,* where little change of the number of surviving bacteria was observed, the opacity did not show appreciable change in the course of a 90-minute exposure. In the case of *Bacillus proteus* and *Bacillus dysenteriae Shiga,* destruction of bacilli was accompanied by a definite decrease of opacity in the first 30 minutes. This suggests that destruction of bacteria by supersonic wave was accompanied by lysis. In other words, destruction is due to the dissolution of the bacterial cells.

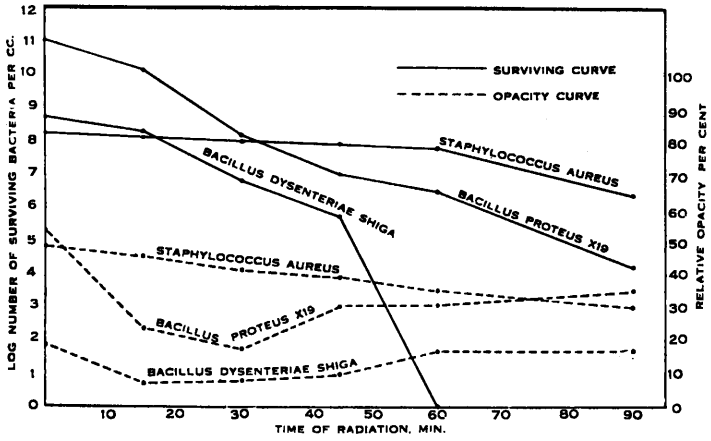

FIG. 2.

Relation between relative opacity and number of surviving bacteria. Volume of bacterial suspension used = 5 cc.

On longer exposure the number of surviving bacteria continued to decrease while the opacity increased to a definite level and then remained practically constant. This increase of opacity is probably due to the coagulation[2] of the cell proteins after lysis.

This study shows that exposure to supersonic waves brings about the killing and dissolution of various bacteria and that on prolonged treatment coagulation of the dissolved bacterial protein may be effected.

7526 C

Variation in Potency of Vaccinia Virus in Tissue Cultures.

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The possibility of employing vaccinia virus in pure culture for prophylactic vaccination against small-pox has been indicated by Rivers,[1] Herzberg[2] and Stevenson and Butter.[3] This leads to investigation of the behavior of such cultures, especially their immunizing and infective properties. Therefore a study was undertaken

1 Rivers, T. M., *J. Exp. Med.*, 1931, **54**, 453.

2 Herzberg, K., *Klin. Wochenschr.*, 1932, **11**, 2064.

3 Stevenson, W. D. H., and Butter, G. G., *Lancet*, 1933, **21**, 228.