It appears then that the toxic effect of $CaCl_2$ reported in our first experiments is an indirect one and is exerted only in an alkaline solution in which it interferes with the regulative action exerted by bacterial cells upon the reaction of a water or NaCl solution.

142 (1889)

Studies on salt action. V. The influence of various salts upon bacterial growth.

By C.-E. A. WINSLOW and MARGARET HOTCHKISS.

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Previous studies on salt action conducted in this laboratory have dealt with the effect of certain mineral salts upon the death rate of bacteria in water suspension.[1] The present investigation relates to the influence of various salts upon growth in a one per cent. pepton solution. The pepton used contained about 4 per cent. ash and the solution had a reaction of P_H 6.8–7.0. The salts studied were added in the form of chlorides in varying concentration. The solutions were inoculated with *Bact. communis* and incubated at 37° C., the rate of growth being determined by comparing the turbidity produced with standard suspensions of dead bacterial cells. Check determinations by the plate method indicated the substantial accuracy of this procedure.

Twenty-three salts in all were studied and the limiting toxicity determined as indicated below.

The results in general confirm those reported by Matthews[2] for *Fundulus*, and Eisenberg[3] for bacteria; and it is evident, as the former author pointed out, that there is a rough general relationship between toxicity and solution tension. We are making a further analysis of the relation between the toxic action of these salts and their other physico-chemical properties.

The new point brought out in our studies is the general occurrence of a definitely stimulating action, exerted by concentrations of salts below the inhibitive level. In the case of 15 out of the

[1] Winslow and Falk, PROC. SOC. EXP. BIOL., 1922, xix, 311.

[2] *Am. Jour. Physiol.*, 1904, x, 290.

[3] *Centr. f. Bakt.*, Abth. I, 1918, lxxxii, 69.

SALT CONCENTRATIONS WHICH LIMIT BACTERIAL GROWTH (INCUBATION PERIOD—THREE DAYS).

Salt.	Molar Conc. No Growth.	Growth.	Salt.	Molar Conc. No Growth.	Growth.
$HgCl_2$.....	.00001	.000005	TlCl.....	.005	.001
$CdCl_2$.....	.0001	.00005	$NiCl_2$.....		
$CeCl_2$.....	.0001	.00005	$SnCl_4$.....		
$AlCl_3$.....	.0005	.0001	$TiCl_3$.....	.01	.005
$PbCl_2$.....					
$CoCl_2$.....			$MnCl_2$.....	.05	.025
			$BaCl_2$.....	.25	.1
$FeCl_3$.....	.001	.0005	$CaCl_2$.....	.5	.25
$FeCl_2$.....			$MgCl_2$.....	.5	.25
$CuCl_2$.....			$SrCl_2$.....	1.0	.25
$ZnCl_2$.....					
			LiCl.....	1.0	.5
			NH_4Cl.....	1.0	.75
			NaCl.....	2.0	1.0
			KCl.....	2.0	1.0

23 salts studied we found a concentration which caused more rapid growth than occurred in the plain pepton solution, the stimulating salts including not only K, Na, NH_3, Li, Sr, Mg, Ca and Ba, but such toxic salts as those of Ti, Sn, Ni, Pb, Ce and Hg. The stimulating concentrations with the latter salts were of course exceedingly low (.00005 molar in the case of Pb, .00001 molar in the case of Ce, .000005 molar in the case of Hg) while with K and Na .25 molar concentrations were stimulating. It is very possible that stimulating concentrations of the other eight salts could have been established by more exhaustive study.

143 (1890)

A ten-year-old strain of fibroblasts.

By ALBERT H. EBELING (by invitation).

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A strain of fibroblasts, obtained from the heart of a chick embryo on January 17, 1912, has completed the tenth year of its life *in vitro*. On April 19, 1922, our incubators contained about 60 cultures which represented the 1906th generation of the connective tissue cells. Their growth is as rapid as during the past