dicted on the basis of the action of the individual ions, provided we take into consideration also the concentration of the various ions, the osmotic pressure, the temperature of the solutions, and the character of the tissue used. Various ions may mutually antagonize or intensify their separate actions according to the character of the combinations. This rule applies in cases in which a kation and an anion are united in the same salt, as well as in cases in which several salts are combined in the solution. Thus SO_4 counteracts the softening effect of low concentration of K more effectively than does Cl; while NO_3 under certain conditions intensifies softening and toxic effects. Therefore KNO_3 will neutralize the hardening effects of Na_2SO_4 more completely than KCl. A combination of NaCl and KCl can be as effective as a combination of Na_2SO_4 and KNO_3 The results also depend on the character of the tissue. A naturally soft tissue is comparable to a more resistant harder tissue to which a small amount of KCl or a still smaller amount of KNO_3 has been added. A harder, more resistant tissue resembles a softer tissue to which an adequate amount of acid has been added. If, on the basis of such and other similar considerations, the consistency of the cells can be predicted, we can therefrom also predict the action of the various ion combinations on amœboid movement, character of pseudopods, agglutination, extension of the cells, tissue formation, rapidity of outgrowth and secondary degeneration in the amœbocyte tissue.

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Decolorization by acids and alkalis of amoebocytes and of filter paper stained by neutral red.

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We have previously found[1] that amœbocytes of *Limulus* stained with neutral red are almost instantaneously decolorized

[1] Leo Loeb and Elizabeth Gilman, *Am. J. Physiol.*, 1924, lxii, 526; Leo Loeb and K. C. Blanchard, *Biol. Bulletin*, 1924, xlvii, 284.

by N/1000 HCl in isotonic NaCl solution. Addition of weak alkali (N/1000 NaOH) causes the granules to stain again, provided sufficient stain is available in the surrounding solution. At that time we had referred already to experiments in which we compared the action of acid and alkali on amœbocytes, and, on filter paper, both stained with neutral red. We now wish to report more definitely on the comparison between the extraction by acid and alkali of neutral red and eosin from filter paper and from amœbocytes stained with these substances.

In the case of both amœbocytes and filter paper stained by neutral red, acid is more active in extracting the stain than either alkali or water or a neutral salt solution. If we use a series of watery solutions of HCl in strengths varying between N/100 and N/5000 HCl, the neutral red is extracted the more readily the stronger the acid. If the corresponding solutions of HCl are made up in 3 per cent and 10 per cent NaCl instead of in H_2O, there is still some indication that the stronger solution of acid extracts more stain than the weaker solution; but on the whole the differences between the effect of the stronger and weaker solutions, if present at all, are much less marked than in the case where the pure watery solution of HCl are used. This diminution in the differences between different strengths of acid in NaCl solutions as compared to watery solutions is due (1) to a weakening of the extracting power of the stronger HCl solution through the admixture of NaCl to the acid; this weakening effect is much greater in 10 per cent NaCl than in 3 per cent NaCl. (2) This is due to the fact that the weaker NaCl solutions (1 per cent and 3 per cent NaCl) increase the extracting power of weak (N/5000) HCl solution as compared to the extracting power of a watery solution of the same strength of acid. This is in accordance with the fact that H_2O extracts practically no neutral red, while neutral 1 per cent to 10 per cent NaCl solutions extract a very small amount of neutral red from the filter paper. Stronger solutions of alkali (N/100 to N/500 NaOH) extract less neutral red than acid solutions of the same strength. Weaker alkali solutions (N/2000 to N/5000 NaOH) extract on the whole still less than the stronger solutions; but the difference between the various strengths of alkali is much less marked than that between corresponding extractions of acid solutions.

From filter paper stained with eosin, alkali extracts more stain

than acid. This holds good especially if we compare the stronger (N/100 to N/500) concentrations. Weaker solutions (N/2000 to N/5000) of acid extract more stain than the stronger solutions of acid; and the difference between acid and alkali almost disappears in the case of weaker concentrations. In watery solutions of acid and alkali the extraction is somewhat better than if the acid and alkali are used in the 3 per cent to 10 per cent NaCl solutions. In pure H_2O and in neutral 1 per cent to 10 per cent NaCl solutions only a trace of eosin is extracted.

Summary.—Acid and alkali behave oppositely as far as their extracting power towards an acid and an alkaline dye is concerned. Addition of NaCl inhibits the extracting power of stronger concentrations of acid and in certain cases also that of alkali towards neutral red. Neutral NaCl solutions on the other hand extract neutral red better than water. How far in these effects the dissociation depressing action of NaCl or other actions of NaCl are concerned is uncertain. These experiments demonstrate that there exists a certain similarity between the action of acid and alkali on amœbocytes on the one hand, and on filter paper on the other hand; but this simlarity is incomplete. It therefore appears probable that the conditions determining the staining of cell granules by neutral red differ in some essential respects from those determining the staining of filter paper.

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The effect of insulin upon the metabolism of certain bacteria.

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The striking pharmacological effect of administering insulin to a diabetic person suggests that a similar response might possibly be induced in cultures of bacteria that do not utilize glucose, provided, of course, that insulin alone, and no supplementary factor, is responsible for the phenomenon.

Four organisms that do not utilize glucose (or any other carbo-