criminate use of phenolphthalein for all weak acids and of methyl orange for all weak bases cannot and does not give results of such accuracy as may easily be obtained if the right indicator is used."

McGill[2] determined the hydrogen ion concentration of certain alkaloidal salts by the potentiometer method. From the values obtained he chose the indicator which would give the most accurate results. He pointed out the greater accuracy of some of the phenolsulphonephthalein series of indicators.

The writers are also of the opinion that the new U. S. Pharmacopœa should include in Part II General Tests, the colorimetric method outlined by Clark[3] for the determination of hydrogen ion concentration. It should prove as useful for the pharmacists as it has for the biologists in the investigation of phenomena which is seriously influenced by the p_H of the solution.

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ON THE CALCIUM ION.

BY R. A. KUEVER.

It has long been known that calcium ion is of value in checking diarrhea. Taken in excessive quantities it produces constipation. Prepared chalk, which when taken into the stomach and converted into calcium chloride, is extensively used to control diarrhea and dysentery. Chalk is an effective antacid and valuable in the treatment of gastric hyperacidity. The objection to its continued use, however, in such cases, is the constipation that results. Magnesium carbonate, the antacid so commonly employed in gastiric hyperacidity, is distinctly laxative. And where this is objectionable, as it often is, the two carbonates may be administered mixed in equal proportion, thus producing neither a laxative nor constipating, but merely the antacid effect. No matter what calcium salt is employed, constipation follows—the more soluble salts being more efficacious than those which dissolve but sparingly. And while chalk, *per se*, is insoluble, it is converted to a very soluble form (calcium chloride) the moment it comes in contact with the hydrochloric acid of the gastric juice.

The value of calcium ion in the circulation, in order that blood may have a normal coagulating index, has also been known for some time. Thrombin causes blood to coagulate by converting dissolved fibrinogen into insoluble fibrin. Pope believes that the change takes place as follows: when the blood leaves the body, one of its constituents (probably the leucocytes) gives rise to a pro-enzyme, which is converted into the active enzyme under the influence of calcium ion. Gurber says that acid calcium phosphate is dissolved in the fluids of the body and that the calcium ion aids in the formation of fibrin ferment.

It is now a matter of common practice for surgeons to determine the coagulating index of the blood preceding operations. In case it is found to have a low coagulating index, the patient is given doses of calcium salt repeatedly until the coagulating index has become normal or at least materially increased. Serious hemorrhages are frequently avoided in this way. Of particular importance in this connection with mastoid, tonsil, or other operations in which there is danger of serious hemorrhages. In this respect the calcium ion is considered as a hemostatic and it is probably the only substance known which will increase the formation of fibrin ferment.

The proper coagulating index of blood is an important matter also, in so far that the blood clot, when normally and quickly formed, seals the wound and protects the granulation tissue. In this way it also prevents infection.

Another important function of the calcium ion in the human body, is that it increases phagocytosis. In fact, Fischer and Riethmuller have concluded that, besides calcium ion, no other substance is capable of increasing the phagocytic action of the leucocytes. Hamburger has found that while calcium has a stimulation function on the heart, sodium exerts marked toxic effects. And Sticker has demonstrated that the phagocytic action of the leucocytes is also impaired by the toxic action of sodium, but stimulated by calcium. Chiari and Januschke have found that the calcium salts have a remarkable action in reducing inflammation of tissues. Leo substantiates their findings and regardless of the bacteria selected his results were all positive. His conclusion was that the calcium ion does not exert an influence against the phlogogenic organisms, but serves to strengthen the resistance of the tissues against the influence of these bacteria.

Gurber, after experimenting for years with the action of calcium ion upon the blood, added to injected solutions, found that it is of prime importance in increasing the resistance of tissues to infections diseases. He found calcium chloride measurably increased phagocytosis in weak solutions (0.01 per cent.) in which solution it is completely ionized. The more concentrated solution he found less effective—in fact, excessive amounts decreased again the phagocytic action of the leucocytes.

From these interesting findings it will be seen how inportant it is to maintain an equilibrium between calcium assimilation and elimination. Moreover, it is easily seen how calcium malnutrition will produce such conditions as rickets, osteitis, osteomalacia, osteomyelitis, dental decay and many other diseases. The extreme prevalence of dental decay may, to some extent, be accounted for by the present-day diet from which calcium compounds are largely eliminated by modern methods of preparation. Investigations by Sherman, Bunge, Kellogg and others indicate that a very large percentage of the civilized race is suffering from calcium starvation because many people are eliminating each day more calcium compounds than they take into the system with their total daily food supply.

Again, from the above findings, it will readily be seen how valuable soluble calcium salts are in treating inflamed tissues. Particularly is this true in dentistry in treating irritated and inflamed gum tissue. Calcium ion increases the resistance of the gums to phlogogenic organisms. It increases the coagulating index of the blood and it causes the immediate formation of blood clots to seal the wounds, to protect granulation tissue and to prevent infection.

For this reason calcium chloride, in the proper dilution, is a very important

ingredient in tooth paste and mouth washes. It is a hemostatic and antiphlogistic. It reduces inflammation and overcomes bleeding gums. Moreover, it does not introduce into the mouth foreign ions, for both calcium and chloride ions are found in normal saliva.

Now that dental investigators are agreed that tooth pastes and mouth washes must be mildly acidic in reaction, calcium chloride may easily be incorporated with marked beneficial results. In fact, dentists should insist that their patients be supplied with dentifrices and mouth washes containing this important salt. Tooth pastes and mouth washes containing the proper amount of calcium chloride have been found noticeably efficacious in overcoming bleeding gums.

The fact that science has proven that mouth preparations must be mildly acidic is rather coincidental in this connection, for calcium chloride cannot be incorporated in alkaline preparations. Being an acid salt—a combination of a strong acid and a weak base—alkalies, particularly soaps, decompose it and destroy its action.

THE USE OF PRECIPITATED COPPER FOR STERILIZING PURPOSES.*

BY GRETCHEN SPRECHER.

It has been known for some time that copper and its salts acted as efficient agents in destroying bacteria, algae, and related minute organisms found in water. Copper sulphate in high dilution (1–500,000 to 1–4,000,000) has proven very efficient in ridding water supplies of annoying accumulations of filamentous algae. As applied in Stowe Lake, Golden Gate Park, San Francisco, enough copper sulphate to make 1–1,000,000, was placed in gunny sacs which were tied to boats and rowed about the Lake until all of the copper salt had gone into solution. As if by magic the filamentous algae disappeared, which until then required the constant labors of a number of men to rake out and dispose of the growth. According to a report by the Bureau of Chemistry this method has proven efficient in ridding city water supplies of algal growths.

In the experiments herein recorded, precipitated copper was used. This material is prepared by passing a current of hydrogen over finely powdered copper oxide, reducing the oxide to metallic copper which is nearly black in color and consists of very minute particles of irregular form. There are on an average 1,840,000 particles of copper per gram. The particles average 25 microns in diameter. Naturally, this reduction in size results in an enormous increase in surface exposure per unit mass of the metallic copper. Considering each particle as a sphere it was estimated that one gram of the copper represented a surface exposure of approximately 3.60 square meters.

Metallic copper when placed in water and in the presence of electrolytes, gives up colloidal copper particles to the water, and it is these colloidal particles of metallic copper which are effective as destroyers of the microörganisms which may occur in such waters. The rate of colloidal diffusion into a liquid as water, in the presence of a given quantity of electrolyte, is directly proportional in the surface exposure of the copper present. It therefore follows that precipitated copper with its enormous surface exposure will yield a maximum amount of colloidal

* Scientific Section, A. Ph. A., Cleveland meeting, 1922.