other nations, who may not be similarly affected, to our altered circumstances? Before the war we welcomed papers from distant contributors almost unreservedly; our attitude towards such contributors personally is in no way changed, but our purses are not so full or are more rapidly emptied. We would ask them kindly to think twice before sending to us a paper which could just as well be printed in their own country; but I should add that this suggestion has no official character whatever, and is made on purely personal responsibility.—From an Oxford Note-Book in *The Observatory*.

SPECIAL ARTICLES

ON THE STABILITY OF THE ACID-BASE EQUILIBRIUM OF THE BLOOD IN NORMAL AND IN NATURALLY NEPHROPATHIC ANIMALS[1]

IN a recent number of this journal[2] a note was published which had as its object a discussion of the influence of the age of an organism in maintaining its acid-base equilibrium. In this paper the observation was made that when animals of different ages were intoxicated by uranium nitrate, the factor of the age of the organism in the reaction was expressed by an inability of the senile animal to maintain with the same degree of perfection a normal acid-base equilibrium as was the case with the younger animal. More recently studies have been undertaken which have had as their object an investigation of the stability of the acid-base equilibrium of the blood in naturally nephropathic animals following the use of an anesthetic,[3] and of the ability of an alkali to protect the naturally nephropathic kidney against the toxic effect of an anesthetic.[4] As a result of these studies the observation has been recorded that following the use of an anesthetic a greater disturbance in the acid-base equilibrium of the blood was induced in a naturally nephropathic animal than occurred in a normal animal. Furthermore, a more adequate degree of protection could be obtained in a normal dog against an anesthetic by the use of a solution of sodium bicarbonate than could be obtained in a naturally nephropathic dog.

The following study is concerned with an investigation of the stability of the acid-base equilibrium of the blood in naturally nephropathic animals as contrasted with normal control animals when this equilibrium is upset by the intravenous injection of an acid or an alkali.

Twenty-six dogs have been used in this series of experiments. Ten of the animals were normal and were employed as controls for the sixteen naturally nephropathic animals. The animals were anesthetized by ether. A glass canula was inserted into the femoral vein and connected with a buret. Through this connection the acid or the alkali was introduced into the animal's circulation. At the end of half an hour of etherization the reserve alkali of the blood (R.p.H.) was determined by the method of Marriott.[5] Blood for this purpose was obtained by puncturing the saphenous or external jugular veins. After making the initial determination of the animal's alkali reserve, both the normal control animals and the naturally nephropathic animals received intravenously either 5 c.c. per kilogram of a $n/2$ solution of hydrochloric acid or 25 c.c. per kilogram of a three per cent. solution of sodium bicarbonate. Determinations of the alkali reserve of the blood were made in both groups of animals at fifteen minute intervals during the first hour

[1] Aided by a grant from the Rockefeller Institute for Medical Research.

[2] MacNider, William deB., "Concerning the Influence of the Age of an organism in maintaining its Acid-base Equilibrium," SCIENCE, N. S., Vol. XLIV., 643, 1917.

[3] MacNider, William deB., "I. A Study of the Acid-base Equilibrium of the Blood in Naturally Nephropathic Animals and of the Functional Capacity of the Kidney in Such Animals following an Anesthetic," *Jour. Exp. Med.*, Vol. XXVIII., 501, 1918.

[4] MacNider, William deB., "I. A Study of the Efficiency of an Alkali to Protect the Naturally Nephropathic Kidney against the Toxic Effect of an Anesthetic," *Jour. Exp. Med.*, Vol. XXVIII., 517, 1918.

[5] Marriott, W. McK., "A Method for the Determination of the Alkali Reserve of the Blood Plasma," *Arch. Int. Med.*, Vol. XVII., 840, 1916.

of the experiment and at half hour intervals during the final hour.

The normal alkali reserve of the blood for the control group of animals has varied from 8.0 to 8.1. When such animals are given intravenously 5 c.c. per kilogram of a $n/2$ solution of hydrochloric acid there occurs within fifteen minutes a reduction in the alkali reserve of the blood which, in the normal animal of Experiment 4 that is representative of the group, was 7.85. In these animals there occurs at once an attempt to restore the normal acid-base equilibrium. Within the second fifteen-minute period of Experiment 4 the alkali reserve had increased from 7.85 to 7.95, and at the end of one hour the reading was 8.0. At the termination of the experiment the alkali reserve was 8.05, as opposed to the normal of 8.1.

The remaining five normal animals received intravenously 25 c.c. per kilogram of a three per cent. solution of sodium bicarbonate. The response of these animals to the introduction of such a solution has been of the same type. The animal of Experiment 7 had a normal alkali reserve of the blood of 8.1. At the end of fifteen minutes following the introduction of the solution of sodium bicarbonate the alkali reserve was increased to 8.3. Within half an hour, as a result of the attempt on the part of the animal to reestablish a normal acid-base equilibrium, the reading was 8.2. At the end of the first hour the normal reading of 8.1 had been established and remained at this point during the second hour of the experiment.

Sixteen naturally nephropathic dogs are included in the second group of animals. Eight of these animals received intravenously 5 c.c. per kilogram of a $n/2$ solution of hydrochloric acid, while the remaining animals of the group received by the same method of administration 25 c.c. per kilogram of a three per cent. solution of sodium bicarbonate. Following a half-hour period of anesthesia by ether, the reserve alkali of the blood of these naturally nephropathic animals was found to vary between 8.0 to 8.1; a variation similar to that obtained for the normal control animals.

When a naturally nephropathic animal is given 5 c.c. per kilogram of a $n/2$ solution of hydrochloric acid there occurs a rapid and marked reduction in the alkali reserve of the blood which is in excess of the reduction obtained in normal animals. In Experiment 14, which is representative of this group, there occurred within fifteen minutes after the introduction of the acid solution a depletion of the blood in its alkali reserve from the normal of 8.1 to 7.7. At the termination of the second fifteen minute period the reading remained unchanged, 7.7. No demonstrable attempt had been made on the part of the naturally nephropathic animal to reestablish a normal acid-base equilibrium. At the end of the first hour of the experiment the alkali reserve had increased to 7.85, and remained at this point during the final and second hour of the experiment.

The response of naturally nephropathic animals to a solution of hydrochloric acid differs quantitatively from the response of normal animals. The reduction in the alkali reserve of the blood is uniformly greater in a naturally nephropathic animal than it is in a normal animal. Furthermore, the normal animal is able to reestablish its acid-base equilibrium to a point within the range of the normal, while the naturally nephropathic animal is unable to effect such a return in the alkali reserve of the blood.

The eight naturally nephropathic animals that received intravenously a solution of sodium bicarbonate have shown the same type of reaction. The response of the animal of Experiment 21 is typical for this group. The animal had a normal alkali reserve of the blood of 8.0. Within the first fifteen minutes following the injection of the bicarbonate solution the reserve alkali of the blood rose to 8.4. At the end of the second fifteen minutes of the experiment the reading remained unchanged. At the end of the first hour the reserve alkali had been reduced to 8.2 and by the end of the second hour of the experiment to 8.15, a determination in excess of the normal reading of 8.0.

When the response of these naturally

nephropathic animals to a solution of sodium bicarbonate is compared with the response of the normal animals, the following differences are observed. The introduction of the solution into a naturally nephropathic animal effects a more marked disturbance of the acid-base equilibrium of the blood, as is shown by a greater increase in the alkali reserve, than occurs in a normal animal. When such a change is induced in the blood of a normal animal there occurs a rapid depletion of the reserve alkali of the blood with a return of the blood to its normal acid-base equilibrium. When, however, a similar type of change has been induced in the blood of a naturally nephropathic animal, the animal appears unable to effect with the same rapidity and degree of completeness a reduction in the reserve alkali of the blood with the reestablishment of a normal acid-base equilibrium. The reduction in the alkali reserve in such an animal takes place more gradually, and at the end of a two-hour period of observation the alkali reserve remains at a higher point than was obtained for the normal reading.

The experiments indicate that the reserve alkali of the blood in certain naturally nephropathic animals may be maintained by the animal within the range of normality. Such an observation is, however, no index of the ability of such an animal to maintain a normal acid-base equilibrium of the blood when the stability of the mechanism which regulates this equilibrium is subjected to the strain of handling either an acid or an alkali. When a normal animal receives intravenously an acid or an alkaline solution there occurs a disturbance in the acid-base equilibrium of the blood which is temporary, and which is rapidly followed by a reestablishment of the animal's normal acid-base equilibrium. When a naturally nephropathic animal is subjected to a similar disturbance in the acid-base equilibrium of its blood, the lack of stability on the part of the mechanism which maintains this equilibrium is shown by the facts that the acid or alkaline solution induces a greater degree of variation from the animal's normal equilibrium and that the animal is unable to reestablish within the time limit allowed the normal animal a return of the blood to a normal acid-base equilibrium.

WM. DEB. MACNIDER
UNIVERSITY OF NORTH CAROLINA

THE AMERICAN CHEMICAL SOCIETY

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

Wm. D. Harkins, *chairman*

H. N. Holmes, *secretary*

Preparation of zinc nitride: W. J. BENTLY and PAUL L. STERN. After the trial of several methods of making zinc nitride the following was found to be the best. Ammonia was passed over zinc dust for 30 minutes at 650° C. and the product cooled to at least 200° C. before exposure to the air. The ammonia was treated to remove oxygen and moisture. The zinc dust was washed with a solution of ammonia and ammonium chloride, alcohol and ether. It was then dried in vacuo. The chief difficulty was in excluding oxygen from the system. The highest yield was 36.8 per cent. nitride. Alloys of zinc-zinc nitride were prepared up to 3.9 per cent. nitride. It is thought a thorough investigation will disclose many valuable properties.

Hydrolysis of the calcium phosphates: H. V. TARTER.

On the hydrolysis of the silicates of sodium: ROBERT HERMAN BOGUE.[1] A series of seven silicates of sodium have been examined in which the ratio of Na_2O to SiO_2 in the molecule varied from 1:1 to 1:4. Solutions of each were made at five different molecular concentrations, and examined electrometrically for their hydroxyl-ion concentrations. From these values the degrees of hydrolytic dissociation have been calculated. Agreement with earlier investigations was not attained, and hypotheses are presented to account for this disparity. The values obtained for hydrolytic dissociation are much lower than have been previously reported. As the percentage of Na_2O in the molecule increases, the resulting product becomes less stable, and in dilute solutions ever increasingly hydrolyzed.

A revision of the atomic weight of antimony: H. H. WILLARD and R. K. MCALPINE. Final report on the analysis of the tribromide.

On the separation of crystalloids from one another by dialysis: LOUIS KAHLENBERG. Using pyridine

[1] Industrial Fellow Mellon Institute of Industrial Research, Pittsburgh, Penna.