rapidly than the time-honored method of ''independent groups.'' The difficulty of a planned program in such an instance is obvious: a considerable concentration on much detail in relatively few directions. The probability of hitting the correct solution would depend simply on having one of these few directions coincide with a particular, a right, method of approach. Looked at in this manner, the probability of hitting the correct solution is not very good.

While I am by no means a specialist on the cancer problem, I feel that it is justifiable to say that as yet we do not have a clear-cut line of approach to the solution. We are still irradiating with electromagnetic energy and with radioactive materials, we are still using surgery, etc.; in a word, we are doing much the same things that were being done years ago, in the factual sense of the word. To be even more specific, I would say that we are still completely at a loss, and that no one can predict which of the many branches of the physical science will eventually lead to the answer. While the promising lines should be pushed by sheer ''man-hours,'' there must be at least a corresponding support of the ''individual groups'' which, not being tied to a definite approach, would have, in my opinion, a greater chance of indicating the right direction to be followed by the mass-effort, which would not be too difficult to finance once the probability of success begins to approach unity.

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On the Theory of Acids and Bases

There is one theory in our biochemical and biological sciences that needs drastic revision, and that is the idea of acids and bases.

It seems to me that we should accept the theory that an acid is ''anything'' (ions, molecules, or particles) that yields hydrogen ions and that a base is ''anything'' that combines with hydrogen ions. This would get rid of the idea, for example, that a sodium ion is a base and brings forth the idea that such ions have other functions in the animal body, such as irritability and osmotic pressure regulations.

Many biochemists and biologists say that a food is basic in reaction because it contains sodium. This seems incorrect, because the negative ion should be considered the base. For example, if one takes sodium citrate into the body, the citrate ion is the base which, when oxidized, yields the bicarbonate ion, one of the most important bases of the blood. Vegetables are basic forming foods because they produce bicarbonate ions. The production of such a base takes place because there must be as many negative as there are positive ions, and when carbon compounds are oxidized in the body, they will yield bicarbonate ions if there is a positive ion with which to combine; otherwise, the $HHCO_3$ formed is eliminated as CO_2 and H_2O. When a chloride or sulfate ion, as in table salt, is already present in the food, the $HHCO_3$ is also eliminated as stated above.

The theory that the kidney functions in acid-base balance because it retains sodium when the acids are formed in the body is out of date. It seems more logical to say that ammonia is formed in the kidney which combines with the acid to be excreted, so that the body does not deprive itself of the sodium needed for osmotic pressure and nerve regulations and in order that the bicarbonate ion (alkali reserve) will not be used up. For example, we can show:

$$2\overset{+}{\text{Na}} + \underset{\text{base}}{2\overset{-}{\text{HCO}_3}} + \underset{\text{strong acid}}{\text{H}_2\text{SO}_4} \rightarrow 2\overset{+}{\text{Na}} + \underset{\text{very weak base}}{\overset{--}{\text{SO}_4}} + \underset{\text{weak acid}}{2\text{H}_2\text{CO}_3}$$

$$\text{H}_2\text{CO}_3 + \underset{\text{base}}{\overset{+}{\text{K}} + \overset{-}{\text{Hb}}} \rightleftarrows \underset{\text{weak acid}}{\text{HHb}} + \underset{\text{base}}{\overset{+}{\text{K}} + \overset{-}{\text{HCO}_3}}$$

$H_2CO_3 \rightleftarrows CO_2 + H_2O$ or to prevent loss of alkali reserve,

$$\underset{\text{base}}{2\text{NH}_3} + \underset{\text{strong acid}}{\text{H}_2\text{SO}_4} \rightarrow \underset{\text{weak acid}}{2\overset{+}{\text{NH}_4}} + \underset{\text{very weak base}}{\overset{--}{\text{SO}_4}}$$

Organic acid $\xrightarrow{(o)} CO_2 + H_2O$ is therefore not acid in reaction when metabolized in the body. Why say the potassium or sodium ion is a base when it does not enter into the reactions?

It should be made clear that meats act acidic in the body because when they are metabolized they form H_2SO_4 and H_3PO_4, which are strong acids and must be neutralized. Sodium chloride and sodium sulfate are not basic, because the chloride and sulfate ion are very weak bases, while monoacid phosphate and bicarbonate ions are rather strong bases. Why can't such ideas be used in the explanation of acid-base balance in the animal body? This would get rid of the ridiculous idea that a sodium ion is a base.

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Injection vs. Oral Administration of Folic Acid in the Chick

Previous experiments (D. V. Frost, F. P. Dann, and F. C. McIntire. *Proc. Soc. exp. Biol. Med.*, 1946, **61**, 65) indicated that 10 μg. daily of synthetic folic acid (*L. casei* factor, kindly supplied by Lederle Laboratories and identified as pteroyl glutamic acid) was sufficient to produce good growth, normal feathering, and near-normal pigmentation in chicks over an 8-week period when the material was given by intramuscular injection. When 10 μg. daily of folic acid was given orally under similar conditions, growth, feathering, and pigmentation were relatively poor. At levels of 2.5 and 5 μg. daily of folic acid there was an equally marked difference in the response between injection and oral administration. The following experiment was set up to resolve clearly the question whether synthetic folic acid was more active by injection than when given by mouth.

Synthetic folic acid, 200 μg./cc., was dissolved with a trace of ammonium hydroxide at pH 7.0. Benzyl alcohol, 1.5 per cent, was added, and the solution was sterilized by filtration and filled into vials. The potency of the solution was standardized by microbiological assay using *L. casei* and was checked twice during the assay period. Day-old Black Leghorn chicks were fed the basal diet previously described (*Proc. Soc. exp. Biol. Med.*, 1946, 61, 65). The chicks were divided into 6 groups of 8. Three of the groups were given dilution aliquots of the folic acid solution orally by pipette in amounts of 5, 10, and 20 μg./day. The remaining three groups were given similar dilutions by intramuscular injection at levels of 2.5, 5, and 10 μg./day. The data are shown in Table 1.

TABLE 1

Group	Folic acid per chick per day γ	No. of chicks: Started	No. of chicks: Surviving	4 weeks: Body wt. (grams)	4 weeks: Feathering	8 weeks: Body wt. (grams)	8 weeks: Feathering
Injected subcutaneously	2.5	10	9	204	Poor	362	Poor
	5.0	7	6	242	Subnormal	492	Subnormal
	10.0	8	8	243	Normal	517	Normal
Given orally by pipette	5	10	8	183	Poor	279	Poor
	10	8	7	244	Poor	405	Subnormal
	20	8	5	234	Poor	569	Subnormal

These data indicate that folic acid is approximately twice as effective by injection in chicks as when given orally. Campbell, Brown, and Emmett (*J. biol. Chem.*, 1944, 154, 721) concluded from a somewhat similar experiment of 4-week duration that the two forms of administration have the same biological effect. Analysis of their data shows that folic acid by subcutaneous injection actually evoked a slightly greater response both in the weight gain and hematopoiesis than did the same amounts given orally. As seen in the above table, the difference in growth response between the two forms of administration is accentuated to a clearly noticeable degree in the longer period of our study. There was also a higher survival among the animals receiving folic acid by injection in both sets of experiments.

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Book Reviews

An outline of organic nitrogen compounds. **Ed. F. Degering and collaborators. Ypsilanti, Mich.: University Lithoprinters, 1945. Pp. vi + 752. $7.50.**

This book, which is a revision and enlargement of the previous (1942) planographed edition, covers in outline form many of the more important types of open-chain organic nitrogen compounds and, to a lesser extent, heterocyclic nitrogen compounds. Its scope is indicated by the following list of topics treated in 45 chapters: a chronological survey, general concepts of structure, nitrogen fixation, the ammonia system of compounds, aliphatic nitro compounds (5 chapters), aromatic nitro compounds, nitroso compounds, oximes, aliphatic and aromatic amines, amino acids, polypeptides, proteins, aliphatic diazo compounds (diazenes) and azides (triazenes), aromatic diazo compounds, azoxy compounds, derivatives of hydrazine, urea, thiourea, guanidine, sulfamic acid and sulfamide, amides, imides, nitriles, carbylamines, isocyanates, cyanogen and related compounds, organic nitrogen dyes, alkaloids, medicinals and vitamins containing nitrogen, high polymers containing nitrogen, pyridine, quinoline and the synthesis of nitrogen ring compounds, explosives, some miscellaneous nitrogen compounds, and isomerism of organic nitrogen compounds.

The extent of treatment of these topics varies from fairly comprehensive in certain cases (for example, aliphatic and aromatic nitro compounds, amines, oximes) to very brief in others (proteins, polypeptides, alkaloids, polymers containing nitrogen). The material is presented in outline form, usually under the following main headings: (a) history, occurrence, structure, and uses; (b) nomenclature; (c) preparation; (d) physical properties of some examples; and (e) reactions. Although the outline form permits the presentation of a maximum amount of material in the allotted space, it also tends to obscure the relative importance of various methods of preparation and the degree of usefulness of the reactions. In some cases an evaluation by the author partially offsets this, but a wider inclusion of yields, where available, would have been helpful from this standpoint and would have enhanced the value of the work as a reference book.

For the most part the presentation of material is clear and concise, with the inclusion of equations and formulas. In places, however, the treatment is so condensed or cursory as to give the student little insight into the nature of the reactions. Thus, the treatment of the Arndt-Eistert reaction (p. 270) would leave the student at a loss to know how (or if) the first step could be controlled to give a diazoketone instead of a chloroketone, how the rearrangement step is carried out and the need for a catalyst, and gives no indication of the value of the reaction. The brief mention of the Bucherer reaction (p. 294) also is unenlightening. In neither case is reference given to the reviews in "Organic Reactions." Other examples might be cited.

Nevertheless, the book should be of value as an organ-