Chemical purity and radiochemical purity, and the tests using isotope dilution, radio-autograph and gas–liquid chromatography are covered in chapter 6. The discussions of "isotope dilution" analysis and paper chromatography of labeled compounds are excellent. The review of counting methods and procedures covered in chapter 7 is complete and thorough and covers the standard procedures in common use. The author assumes a greater knowledge than is possessed by the average person reading this chapter. The theory of the flow counter is not explained nor is the "proportional region" defined. Under the discussion of "standards" the author neglects to warn that radioactive plastics do not always give the same count on both sides of the film.

A sensible explanation of the precautions and safeguards necessary when working with radioactive materials is given. The methods for disposal of wastes and allowable contamination differ little from American practice. The reasonable attitude of the author toward handling modest amounts of carbon-14 should do much toward allaying fears of the beginner in this field of chemistry.

The book is recommended to all contemplating entering this field of research.

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Metabolic Pathways in Microorganisms. E. R. Squibb Lectures on Chemistry of Microbial Products, Presented at the Institute of Microbiology, Rutgers, The State University of New Jersey. By VERNON H. CHELDELIN, Director, Science Research Institute, Oregon State University. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1961. ix + 91 pp. 13 × 19 cm. Price, $3.50.

In the first two lectures Cheldelin reviews the extensive work he and his associates have carried out on the different metabolic pathways of *Acetobacter suboxidans*. This aerobic organism is unique, even among closely related species of *Acetobacter*, in being unable to carry on oxidations by way of the citric acid cycle. Of the intermediates of the cycle, citric acid is the only one which is weakly oxidized. Oxalacetate yields pyruvate and acetate. This raises the question (as yet unanswered) of the origin of amino acids which normally arise from the cycle, especially glutamate and aspartate.

Quantitative data on $C^{14}O_2$ arising from the oxidation of glucose or gluconate labeled in the C-1, C-2, C-3, C-4 and C-6 position indicate that the pentose cycle is the terminal oxidation route in this organism and that virtually all the CO_2 formed from glucose arises in this manner. There is no indication that glycolysis is operative in the intact organism. When cell-free extracts are treated with Dowex-50 to remove magnesium ions and coenzymes, it becomes possible to demonstrate some of the glycolytic reactions with fructose diphosphate as substrate. In the presence of magnesium ions the pentose cycle is favored to the virtual exclusion of glycolysis.

Most of the enzymes of the pentose cycle and some ancillary enzymes were identified in cell-free extracts of the organism and several of these enzymes were purified. There are also a number of particle-bound dehydrogenases present which oxidize individual polyhydroxy compounds such as mannitol and sorbitol to the extent of one atom of oxygen per molecule of substrate. A soluble dehydrogenase oxidizes either end of the sorbitol molecule depending on which pyridine nucleotide (TPN or DPN) is present.

The biochemical literature is replete with discussions of the validity of "traffic counts" by means of specifically labeled compounds, an indication that there is dissatisfaction with many of the methods so far developed. When more than one pathway is operative in the same organism, as is usually the case, data based on specific activity of CO_2 or of intermediary products have limited quantitative significance. These problems are discussed and it is pointed out that certain advantages arise when the yields rather than the specific activity of $C^{14}O_2$ from various metabolites are measured. This radiorespirometric method, as developed in the author's laboratory, is illustrated by showing the time course of CO_2 yields from specifically labeled substrates by various organisms. In a summarizing Table estimates are given for various microörganisms of the extent of glucose catabolism by way of glycolysis–Krebs cycle, pentose cycle and Entner–Doudoroff pathways.

The third lecture is devoted to general considerations of metabolic pathways of carbohydrate. The role of the pentose cycle in supplying TPNH for synthetic reactions is stressed. Some stimulating ideas are to be found in this well-written booklet which is dedicated to Roger J. Williams.

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States of Matter. By E. A. MOELWYN-HUGHES, Lecturer in Physical Chemistry, University of Cambridge. Oliver and Boyd, Tweeddale Court, Edinburgh 1, Scotland. 1961. 100 pp. 14.5 × 22.5 cm. Price, 15 s.

The eight chapters correspond to eight lectures on general theory and the seven states of matter: crystalline, gaseous, metallic, liquid, dissolved, ionic and interfacial. In the preface the author says that he has applied the concept of intermolecular force "as directly and in as simple a form as possible." Simplicity is attained by ignoring complicated cases and sweeping most of them under the rug. The book is most successful in the first four chapters where this is done ruthlessly and the discussion is limited almost entirely to monatomic elements and ions.

The last four chapters are less simple because these restrictions are generally removed, because the material is inherently more complicated, and also, it seems to me, because the author thinks much less clearly about those things which he learned as an undergraduate than about those which he picked up later by himself. I can see no excuse for developing the laws of ideal solutions the way Raoult did.

Much use is made of the "Mie equation" for the mutual energy, ϕ, of two molecules at a distance a cm. apart

$$\phi = Aa^{-n} - Ba^{-m}$$

"where A and B are positive constants and n and m integers with $n > m$."

The low point in the book is the discussion of the van der Waals "statical pressure" term in the last chapter. Confusion between a, the instantaneous distance between two molecules, and the average distance leads to the conclusion that the van der Waals term denotes $m = 3$ in the "Mie equation." In chapter III, however, equation 70 from the author's approximate treatment of the second virial coefficient corresponds exactly to the van der Waals equation. It shows that m may have any value *greater than* 3 and less than n (and not necessarily integral), which is the same result as that obtained by the rigorous treatment.

The high point for this reviewer is Table I in Chapter I, where the equilibrium distance and the energy of interaction at that distance of the pairs $Na^+–F^-$, $Na^+–OH_2$, $OH_2–OH_2$ and Ne–Ne are calculated from the known charges of the ions and dipole moment of water with the assumption that all have the same repulsion potential as neon with $n = 9$. It's crude but very good fun.

Moelwyn-Hughes continues the awarding of unusual credits for scientific advances. One erroneous one is a good example of how stories grow. He calls the relation $\ln \gamma = A\sqrt{c}$ Mellanby's law and refers to Cohn and Edsall, where I say (p. 27), "It is worth noting that the dependence upon the square of the valence and upon the square root of the concentration were both first discovered empirically by Mellanby in his study of the solubilities of globulins in salt solution." I misunderstood a statement that Mellanby's results could be expressed as $\log S/S_0 = A\sqrt{c}$ as saying that Mellanby had so expressed them, and I failed to check the original reference. Mellanby discussed neither $\log S$ nor $\sqrt{c}$. Moreover, his globulin was a mixture, so his solubilities are not directly related to the activity coefficient. My statement about the square of the valence, however, is correct and is not affected by the fact that Mellanby studied a mixture.

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