streaming" was given by SCHWARZSCHILD who proposed to substitute to the Maxwellian distribution of the stars' velocities, adopted by EDDINGTON for the two hypothetical streams, a single law of distribution corresponding to a slightly altered Maxwellian law in which the spherical surfaces of equal frequency are replaced by spheroids. The rotation-axis of this spheroid, obtained by SCHWARZSCHILD and others from an analysis of proper motions and radial velocities, was found to be its longest axis, and its direction to coincide very closely with the vertices deduced by EDDINGTON from his "two-stream" theory. The next important step in the study of the structure of the Galactic System was achieved by SHAPLEY who applied his method of determining the distances of very distant star-clusters by the study of the Cepheid variables contained in them, to the system of the 96 globular clusters, forming in a sense the skeleton of our stellar system. SHAPLEY was able to show that the position of our sun in this extended Galactic System was by no means central as had hitherto generally been supposed, but completely excentric, the sun being separated from the "Galactic Centre", situated in the direction of the constellation of Sagittarius, by a distance of over 10,000 parsec (30,000 light-years). The existence of a very distant Galactic Centre was further confirmed by the systematic variation of the mean radial velocities and proper motions of the stars along the Galactic Equator, studied by OORT and explained by him as the result of a general rotation of the whole stellar system round an axis passing through the Galactic Centre, but with velocities decreasing with the distance of the stars from this rotation-axis. Two more peculiarities of the dynamical state of the Galaxy, discovered in the course of the present century, tend to confirm the "Galactic Rotation Theory" proposed and developed by OORT and LINDBLAD. These are: (1) the very great velocity of the sun with respect to the globular clusters whose radial velocities have been determined (about 300 km/sec in a direction roughly perpendicular to the direction of the Galactic Centre), and (2) the complete asymmetry in the distribution of the directions of motion of the stars whose space velocities with respect to the sun exceed 60 km/sec. All these stars of greatest observed speed move in the opposite direction to that of the sun's motion and are therefore evidently field-stars which do not participate in the rapid motion of the sun and the major part of the stars forming its immediate surrounding, but are left behind by this quickly moving group in the course of its rotational motion around the Galactic Axis. In trying to give a general picture of the structure of our Galaxy we see that the frame of this picture must necessarily be given by the spacial distribution of the globular star-clusters, but that vast regions within this general frame must as yet remain a blank. The distribution of the open or "galactic" clusters studied by R. J. TRÜMPLER permits us to a certain extent to bridge the gap separating the sun from the Galactic Centre, but all objects situated beyond this centre remain to the present day completely inaccessible to the optical means at our disposal. It is natural under these circumstances to turn to the numerous extragalactic nebulæ which have lately unquestionably been proved to be external star systems not unsimilar on the whole to our own, and among which the spiral form seems to play a very conspicuous part. There has accordingly been no lack of attempts to interpret the spacial distribution of the great star-clouds forming the Milky Way proper as the whorls of a spiral arm originating in the Galactic Centre, and the latest as yet only partly published results of W. BAADE, obtained with the 100-inch reflector of the Mount Wilson observatory seem to indicate, that our stellar system may very well be conceived as a spiral nebula of the particular type known as "barred" spirals, though we cannot as yet be quite sure of the validity of this conclusion. The question of the structure of our Galaxy is moreover complicated by the fact that it apparently is not a completely isolated formation as had till recently been supposed, but forms a part of a local cluster of at least ten galaxies, to which the two Magellanic Clouds and the great spiral nebulæ *M 31 Andromedae* and *M 33 Trianguli* likewise belong.

Brèves communications - Kurze Mitteilungen
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Synthesis of Symmetrically Labeled Acetic Acid from $BaCO_3$

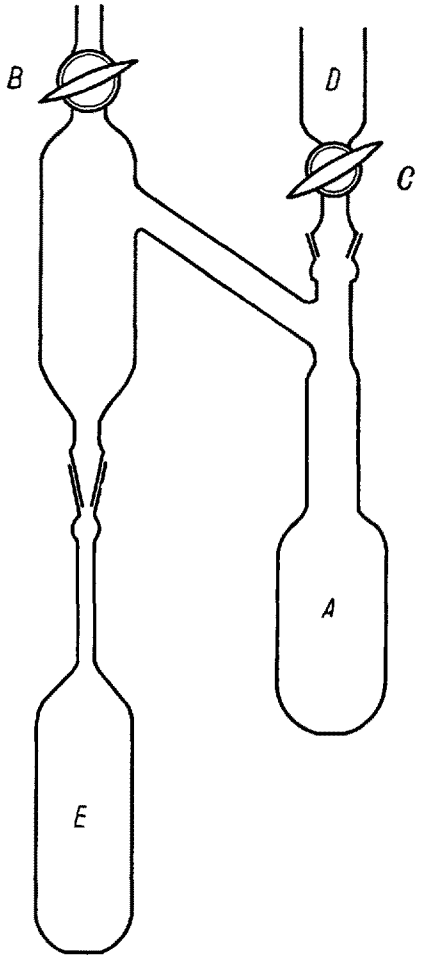
Acetic acid in which a labeling carbon isotope is distributed uniformly between the methyl and carboxyl groups is a useful compound as a tracer in metabolic experiments and in the synthesis of other metabolites. This report presents a simple method of synthesis on a small scale and in high yield. Since C^{13} and C^{14} are usually obtained as $BaCO_3$, the latter was taken as the starting material, and the synthesis consisted essentially of three steps: (1) reduction of $BaCO_3$ to BaC_2; (2) conversion of BaC_2 to acetylene; and (3) treatment of acetylene with KOH to form potassium acetate. Overall yields ranged from 60 to 80% when working on a 1-millimole scale.

Formation of BaC_2. The reduction of $BaCO_3$ to BaC_2 by heating with Mg in an atmosphere of H_2 was first reported by MAQUENNE[1] in 1893, and has recently been used by CRAMER and KISTIAKOWSKY[2] for the synthesis

[1] L. MAQUENNE, Ann. Chim. phys. *28*, 261 (1893).

[2] R. D. CRAMER and G. B. KISTIAKOWSKY, J. biol. Chem. *137*, 549 (1941).

of lactic acid. This reaction goes well on a small scale only if one takes advantage of the heat of the reaction by compressing the mixture of $BaCO_3$ and Mg powders into a hard, dense mass. In practice, ·2 g of $BaCO_3$ was intimately mixed with ·5 g of Mg powder, and the mixture compressed in a steel pellet press to a small wafer. This was placed in an iron boat inside an iron pipe through which a stream of H_2 gas was flowing, and was then set in a furnace at 1,000°. When the temperature of the pipe reached 700–750° reaction occurred and the pellet exploded. The pipe was cooled rapidly with water



Glass apparatus for converting BaC_2 to acetate.

and the gray-black contents of the boat transfered to the apparatus shown in the Figure for conversion to acetylene. Acetylene titrations according to WILLSTÄTTER[1] indicated yields of 75–85% in this step.

Conversion of BaC_2 *to Acetate*: BaC_2 reacts rapidly and quantitatively with water to yield acetylene. The method then used for acetate formation was based upon an observation by FEUCHTER[2] that acetylene bubbled through molten NaOH—KOH was partially converted to acetate. This principle was adopted by STROSACKER *et al.*[3] who used solid NaOH in the commercial production of acetate. We found a practically quantitative conversion when acetylene was heated in a sealed tube with alkali-saturate asbestos.

The apparatus shown in the Figure proved convenient for carrying out the reaction. In practice, the BaC_2 was placed in *A*, 15 ml water in *D*, and ·3 g of asbestos upon which had been dried ·6 g KOH in *E*. The apparatus was evacuated through stopcock *B* and a liquid air flask placed around *E*. Water, admitted through stopcock *C*, reacted violently with the carbide (the mixture was warmed with a flame for 5–10 minutes to insure completeness) and the evolved acetylene plus some water condensed in *E*. Tube *E* was sealed off and placed in a furnace at 250° for 1 hour, after which the contents were suspended in 50 ml water, 6 ml of 20% H_2SO_4 were added, and the acetic acid was distilled out. The acid was identified by a Ducleaux titration. Yields of 80–90% were obtained in this conversion; overall yields from $BaCO_3$ being in the range of 60–80%.

R. ABRAMS
(Donner Foundation Fellow)

Karolinska Institute, Chemistry Department, Stockholm, September 12, 1947.

Zusammenfassung

Es wird eine Methode beschrieben, mit deren Hilfe sich aus $BaCO_3$ Essigsäure herstellen läßt, die C^{13} oder C^{14} symmetrisch als «tracer» enthält: $BaCO_3$ wird zunächst zu BaC_2 reduziert. Hierfür wird $BaCO_3$ in einer kleinen Kugel mit Magnesiumpulver gemischt und gepreßt und dann in reiner Wasserstoffatmosphäre auf 700–750° erhitzt. Das resultierende Karbid (BaC_2) wird langsam mit Wasser zersetzt und damit Azetylen gewonnen. Das Azetylen wird mit Hilfe von mit Kaliumhydroxyd durchtränktem Asbest auf 250° erhitzt, wobei sich Kaliumazetat bildet. Dieses Kaliumazetat in Asbest wird in Schwefelsäure suspendiert. Durch Destillation erhält man Essigsäure. Die Ausbeute beträgt etwa 60–80%.

On the Mechanism of Catalytic Hydrogenation and Dehydrogenation with Rhodium[1]

The successful use of synthetic high polymers in the preparation of highly active noble metal catalysts led to the extension of their application to rhodium. Following the earlier[2] procedure for palladium and platinum we have prepared a rhodium-polyvinyl alcohol catalyst (Rh-PVA).

The Rh-PVA catalyst was used in the hydrogenation of the C = C double bond and NO_2 group. In particular, nitrobenzene[3] was studied in greater detail. It is readily reduced to aniline at atmospheric pressure and room temperature by shaking its alcoholic solution with hydrogen in the presence of Rh-PVA. Addition of hydrogen to the carbon-carbon double bond is also easily achieved.

The behaviour of palladium and rhodium is remarkably different in that the activity of rhodium is greatly

[1] R. WILLSTÄTTER and E. MASCHMANN, Ber. dtsch. chem. Ges. *53*, 939 (1920).

[2] H. FEUCHTER, Chem.-Ztg. *38*, 273 (1914).

[3] C. J. STROSACKER, C. C. KENNEDY, and E. L. PELTON, U. S. Patent 1866430 (1932).

[1] Contribution No. 57.

[2] F. F. NORD et al., J. Am. chem. Soc. *63*, 2745, 3268 (1941); *64*, 2721 (1942); *65*, 429, 2121 (1943); *66*, 2126 (1944); Proc. Nat. Acad. Sci. U. S. *29*, 246 (1943). – H. S. TAYLOR and W. J. SHENK, J. Am. chem. Soc. *63*, 2756 (1941); T. H. JAMES, ib. *64*, 732 (1942).

[3] F. F. NORD, Ber. dtsch. chem. Ges. *52*, 1705 (1919).