OBITUARY NOTICES.

HAROLD GOVETT COLMAN.

1866—1954.

Harold Colman was born at Peterborough on February 5th, 1866. He was educated at Bishop's Stortford College and under Sir Henry Roscoe at Manchester. He became a Fellow of the Society and took his B.Sc. in 1887, followed by D.Sc. in 1908.

He became associated with W. H. Perkin, jun., in work upon the formation of closed carbon chains and in particular upon the derivatives of *cyclo*butane and *cyclo*pentane (*Trans.*, 1887, 228; 1888, 185) and upon 4-oxopentan-1-ol and 5-oxohexan-1-ol (*Trans.*, 1889, 352).

Colman became an assistant to Sir Henry Roscoe and was part editor of Roscoe and Schorlemmer's " Treatise " but his work in this country was interrupted by visits to Strasbourg University in 1885–86 and to Würzburg where he took his Ph.D. At Würzburg he worked, at the suggestion of Emil Fischer, upon the derivatives of methylindole (*Trans.*, 1889, 1).

In 1891, Dr. Colman was appointed to the teaching staff at Birmingham but in the following year, under the influence of Joseph Chamberlain, he gave up academic work in order to enter the City of Birmingham Gas Department as Chief Chemist. This proved to be an important step not only for Colman but for the gas industry. Although he relinquished this post in 1903 in order to devote his energy to consulting work he retained close contact with the industry throughout the remainder of his long life. At Birmingham Colman created an appreciation of the importance of chemistry in gas manufacture which long continued to act as a stimulus to the rest of the industry and particularly to the larger units of it. The present status of chemistry in coal carbonisation dates in no small degree from his example and enthusiasm at the close of the last century.

Colman was elected a member of the Institution of Gas Engineers in 1894 and a member of their Council in 1902—an unusual distinction for a chemist at that time. Although he published relatively few formal papers he took an active part in many technical discussions. His services were recognised by election to honorary membership in 1942.

While at Birmingham he published with J. F. Smith a paper on the Estimation of Naphthalene in Coal Gas based upon the use of picric acid (*J. Soc. Chem. Ind.*, 1900, **19**, 128) and later gave the results of his long experience (*Gas J.*, 1918, **144**, 231). He also acquired a specialised knowledge of the occurrence and behaviour of cyanogen compounds in the products of coal carbonisation. During the First World War he made outstanding contributions to the control of toluene recovery in coal-carbonising and tar-distilling works. With E. W. Yeoman he published papers on the Determination of Benzene, Toluene, etc., in Coal Tar (*J. Soc. Chem. Ind.*, 1919, **38**, 57T) and the Determination of Aromatic Hydrocarbons in Petrol (*ibid.*, p. 82T).

He was on the Council of the Chemical Society from 1912 to 1915. He was also a member of Council, an Examiner and, later, Vice-President of the Institute of Chemistry.

In a busy life Harold Colman found relaxation in Continental travel and as a woodworker. He is remembered with affection by his former colleagues because of his readiness at all times to help his juniors in every way. In later years he was seriously handicapped by loss of hearing but still retained that cheerfulness combined with charming modesty which was so characteristic. He died at New Malden on February 20th, 1954, and is survived by his wife and daughter.

H. Hollings.

PIERRE JOLIBOIS.

1884—1954.

La chimie française a vu disparaître avec un infini regret l'un de ses plus distingués représentants dont la vie scientifique se déroula dans la plus parfaite harmonie. Il prit cependant une part très active aux manifestations collectives et fut même le créateur de certains rassemblements comme le Comité national de la Chimie, organisme de liaison entre la science et l'industrie, de représentation de notre pays à l'Union internationale de Chimie pure et appliquée.

Né dans une famille de magistrats le 23 Mai 1884, il fréquente le lycée Louis le Grand, puis il est élève à l'Ecole polytechnique de 1903 à 1905. Son service militaire effectué dans l'Artillerie Coloniale, il se consacre à la recherche de 1907 jusqu'à la première guerre mondiale sous la direction des Professeurs Lebeau et Le Chatelier, stage au cours duquel il soutint avec succès ses thèses de doctorat ès sciences (1910).

Dès l'abord ses travaux sont marqués d'une telle originalité qu'il est classé par Henry Le Chatelier parmi les esprits inventifs, capables d'accroître la connaissance en chimie.

Trois sujets le préoccuperont durant son séjour à la Faculté des Sciences : l'allotropie du phosphore, les phosphures, les organomagnésiens mixtes. Malgré la diversité de ces questions, un souci constant le guidera dès cette époque et le poursuivra d'ailleurs tout au long de sa carrière : l'introduction des méthodes de la physique expérimentale à la résolution de problèmes chimiques. Il frappe ainsi d'une sorte de sceau indélébile les qualités de son œuvre au laboratoire : propreté et minutie, élégance et esthétique.

Ainsi par des mesures de propriétés physiques pertinemment choisies (densité, tension de vapeur, chaleurs de transformation en cours de chauffage) et susceptibles de montrer les variations les plus nettes lors du passage d'une variété à une autre, il ramène à trois le nombre des variétés allotropiques du phosphore : le phosphore blanc, le phosphore rouge et celui qu'il obtient en chauffant ce dernier à 280° avec de l'iode comme catalyseur et qu'il désigne sous le nom de phosphore pyromorphique. A cette occasion il s'occupe également de l'allotropie de l'arsenic et il fixe au voisinage de 850° le point de fusion de cet élément.

Il en est de même pour les différents alliages de la famille des phosphures et siliciures où il met en œuvre l'analyse thermique et la métallographie microscopique, techniques récemment apparues à l'époque. Avec son premier maître le Professeur P. Lebeau, il met en évidence $SiPd$, isolable, et $SiPd_2$. Il rénove ensuite la préparation du P_2Zn_3 et admet l'existence de P_2Zn. Il isole deux phosphures d'étain : P_3Sn_4 et P_3Sn, ce dernier très oxydable ayant des propriétés pyrogènes semblables à celle du ferrocérium. Il réussit à séparer P_2Ni_5 et à obtenir par une voie détournée les alliages riches en phosphore : P_2Ni et P_3Ni. Il démontre en outre l'existence des arséniures As_3Sn_4 et $AsSn$.

P. Jolibois rapporte que son incursion dans l'étude des organométalliques (1912) est une application de la technique du vide qui s'avérait fructueuse dans d'autres domaines. En fait il présente des arguments en faveur de la constitution X_2Mg,R_2Mg * des composés organomagnésiens mixtes de V. Grignard, il indique le principe de leur dosage par iodométrie et il découvre l'hydrure H_2Mg ainsi que le carbure CMg_2, celui-ci lié à une molécule de I_2Mg sous forme d'une combinaison jaune, insoluble dans l'oxyde d'éthyle.

Mobilisé en 1914 comme lieutenant de réserve d'Artillerie et nommé capitaine au début de 1915, il commande jusqu'en 1916 une batterie de 75 prenant part aux batailles du Grand Couronné, du Bois-le-Prêtre et de Verdun. Décoré de la Croix de Guerre, il dirige alors le laboratoire de la Poudrerie nationale de Bassens spécialisé dans la fabrication de l'acide picrique qu'il perfectionne rapidement; il trouve un nouvel explosif, un dinitrobromophénol, relevé des eaux résiduaires de cette fabrication et qui sera adopté pour les tirs de réglage, en raison de la visibilité remarquable du nuage formé par l'explosion. En 1918, il est Chef du Service des bombes d'avion à l'Aéronautique militaire : sa perspicacité a tôt fait de découvrir la cause des explosions prématurées survenant trop fréquemment dans la manipulation de tels engins et d'empêcher qu'elles se produisent. A ces titres militaires de la première guerre mondiale, ajoutons que dégagé de toute obligation militaire en 1939, il reprend cependant du service au Ministère de l'Armement.

A la fin des hostilités (1919), P. Jolibois est chargé de mission au contrôle de la Badische Anilin und Soda Fabrik. Il reviendra trente ans plus tard à Ludwigshafen pour présider de

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* En 1950, il publie une revue sur l'évolution des théories relatives à cette constitution : la question de structure simple ou double reste ouverte (*Bull. Soc. chim.*, 1950, 919).

1948 à 1953 le Conseil de Gérance de l'I.G. en dissolution, où son rôle à la fois ferme et conciliant est très apprécié. A l'expiration du mandat de ce Conseil, il reçoit les félicitations du Gouvernement. Aussi clairvoyant administrateur qu'habile expérimentateur, il nous lègue des liaisons et des accords dont étudiants, chercheurs ou industriels peuvent désormais bénéficier.

Rendu à la vie civile, la chaire de chimie générale de l'Ecole Nationale Supérieure des Mines lui est confiée en 1921. Avec l'appui d'une Direction compréhensive, il en fait un centre remarquable de recherches physico-chimiques, encore en pleine activité au moment de sa mort survenue à quelques mois de sa retraite.

Dans ce cadre progressivement amélioré se développent les études sur les phénomènes de précipitation, sur le plâtre, sur l'enregistrement photographique des réactions, ainsi que des contributions considérables dans les domaines de l'électrochimie et de la spectrochimie. Les exemples cités ci-après n'en donnent qu'un pâle aperçu.

Sa technique de précipitation est basée sur l'emploi d'un appareil réalisant en un temps très bref un mélange homogène de liquides. Grâce à ce dispositif aussi simple qu'ingénieux, lui-même et ses élèves distinguent aisément les composés définis des mélanges. Ainsi sont étudiées systématiquement les précipitations des phosphates de calcium, des sels mercuriques par l'hydrogène sulfuré, du nitrate d'uranyle par la soude. La méthode sert également à observer le fractionnement au cours de la précipitation, à déterminer les conditions de formation des sels basiques comme aussi l'état de précipités instables qui se transforment rapidement avec le temps, tel que l'iodure mercurique jaune (magnifique expérience de cours).

Les recherches sur le sulfate de calcium aboutissent à des conclusions pratiques, notamment à la construction d'un prisomètre à l'aide duquel on détermine une caractéristique de chaque sorte de plâtre : la variation de la température en fonction du temps d'un mélange en proportions connues d'eau et du plâtre considéré. D'autre part la connaissance exacte du rôle joué par chacun des composants du plâtre permet d'obtenir un matériau de qualités variables au gré du fabricant (vitesse de prise et dureté après durcissement) en associant des quantités convenables de gypse, de semi-hydrate et de surcuit.

En électrochimie, P. Jolibois étudie d'abord les actions engendrées par l'étincelle dans les gaz raréfiés. Il choisit la décomposition de l'anhydride carbonique bien connue du point de vue de la thermodynamique et il observe son évolution dans un tube à décharges en examinant tour à tour l'influence des électrodes, du voltage, de l'intensité, de la pression, des différentes régions de l'étincelle. Dans chaque cas il mesure le rendement énergétique et le degré d'avancement de la réaction; il fait alors d'intéressants rapprochements avec les dissociations strictement pyrogénées.

Il constate en outre que le voisinage d'une cathode subissant une pulvérisation électrique est le siège de phénomènes catalytiques intenses. D'où la décourverte d'une préparation d'ammoniac par synthèse directe à température ordinaire et avec une concentration qu'aucun procédé n'a encore réalisé à ces bases pressions.

Les recherches se poursuivent alors sur l'étincelle positive jaillissant à la surface d'une solution conductrice. Il en sépare plusieurs phénomènes lumineux distincts, examine les facteurs dont ils dépendent. Il réussit à mettre au point un procédé assez général d'analyse quantitative par spectrographie.

L'électrolyse à l'aide d'une étincelle négative lui ayant fourni un dépôt d'oxyde obéissant à la loi de Faraday, il étend ces résultats à l'électrolyse ordinaire en l'effectuant avec des électrodes formées d'eau distillée, et il en déduit des vues originales sur le phénomène élémentaire de l'électrolyse.

En marge de cette œuvre si dense, Pierre Jolibois apporte un concours empressé et généreux aux groupements scientifiques ou professionnels (Société Chimique de France, Société de Chimie Physique, Maison de la Chimie, Palais de la Découverte, Centre National de la Recherche Scientifique, Union internationale de Chimie pure et appliquée etc. . . .) comme à certains organismes de sécurité de la Nation (Comités d'action scientifique : des Poudres, de la Défense nationale). Il préside bon nombre d'entre eux avec une aménité et une distinction naturelles, de juste renommée. Aussi ses élèves, ses collaborateurs et ses amis se réjouissent-ils particulièrement de le voir entrer à l'Institut en 1944 dans la Section de Chimie de l'Académie des Sciences et lorsqu'il reçoit en 1951 la cravate de Commandeur de la Légion d'Honneur.

Ils conservent le pieux souvenir d'un homme accueillant, spirituel et cultivé, ironisant parfois mais avec bienveillance. Ils évoquent avec émotion sa bonté, sa générosité, son inébranlable fidélité dans l'amitié. Ils s'inclinent encore devant le stoïcisme qu'il montra lors de la cruelle épreuve de sa vie : la mort tragique d'un fils de vingt ans qui embrassait la même carrière.

Pierre Jolibois avait tant d'attrait pour la Science expérimentale qu'il avait fait construire un laboratoire dans sa propriété des bords de la Sarthe. On songe avec mélancolie que ses murs ne verront plus jamais leur maître : il aurait laissé encore moins de pages blanches dans le livre fondamental de la Chimie.

R. DELABY.

NICHOLAS DIMITRIVICH ZELINSKY.

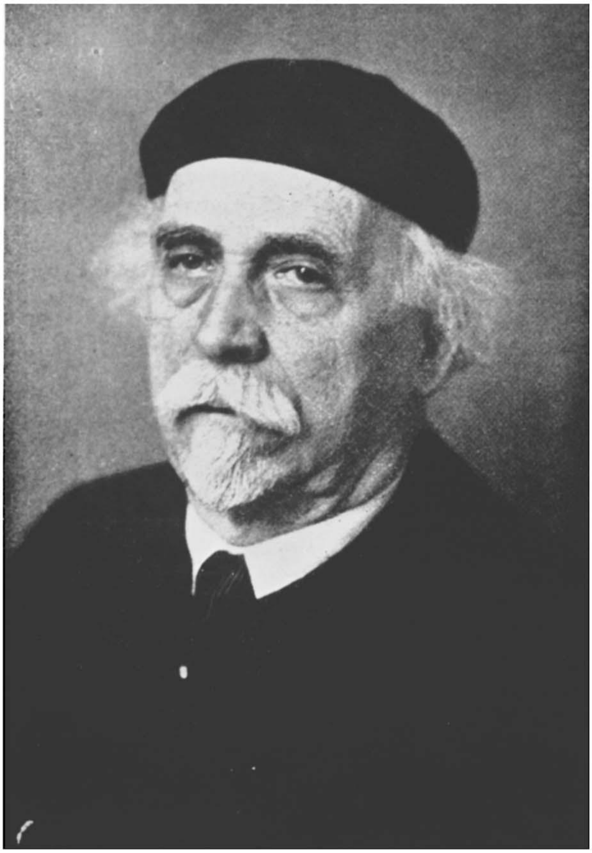
1861—1952.

NICHOLAS DIMITRIVICH ZELINSKY was born on February 6th, 1861, in Tiraspol in the Russian Province of Kherson. He received his school training in Tiraspol and in Odessa where he afterwards went to the University of Novorossisk. Later he studied in Leipzig and in Göttingen, working there in the laboratory of Victor Meyer. In 1888 Zelinsky obtained his master's degree and was appointed a lecturer at his old University of Novorossisk where in the next 3 years he presented two theses, one in 1889 dealing with " Isomerisation in the Thiophene Series " for his master's degree and the other in 1891 entitled " Research on the Phenomenon of Stereoisomerism in Saturated Carbon Compounds " for his doctorate. In 1893 he was appointed adjunct professor at the University of Moscow where, with the exception of the period 1911—17, he was to spend the remainder of his life. There Zelinsky took charge of the analytical chemistry laboratory and shared with Markovnikov, until the latter's death in 1904, the Department of Organic Chemistry. Zelinsky gave the lectures on organic chemistry, which were profusely illustrated by experiments and a very large collection of specimens and were outstanding because of their clarity and simplicity. The organic chemistry laboratory, built in 1885—87 by Markovnikov and situated in a low and damp cellar, was not large enough to hold all the students who wished to work with Zelinsky. In spite of such unfavourable surroundings the young Professor was able to impart his enthusiasm to those working with him, who gave little thought to Sundays and holidays. At times they indulged in choral singing in the laboratory for which Zelinsky received a reprimand from the Ministry of Education. In 1902, however, Zelinsky was provided with a new annexe which still to-day houses the teaching and research laboratories of the Department of Organic Chemistry. During this time Zelinsky spent a considerable time on social work and teaching outside the University. He organised a chair of Organic Chemistry in the Moscow Course of Higher Education for Women and also the Central Laboratory of the Ministry of Finance in Moscow which later became the Institute of Pure Chemical Reagents.

In 1911 the entire administration of Moscow University was dismissed by order of the Ministry of Education and, in token of protest, the teaching staff, including Zelinsky, resigned. Zelinsky went to St. Petersburg where he directed the laboratory of the Ministry of Finances and taught at the Polytechnic Institute. Only in 1917, after the revolution, was he able to return to Moscow where he resumed his teaching with enthusiasm and energy, combining it after 1934 with the direction of the Institute of Organic Chemistry of the U.S.S.R. Academy of Sciences. At the time of his 90th birthday, Zelinsky held the chair of the chemistry of petroleum in the Faculty of Chemistry of the Moscow State University, was in charge of a section of the Organic Chemistry Institute of the Academy of Sciences, and was President of the Moscow Society of Naturalists. He died on July 31st, 1952, at the age of 91.

During his academic life, Zelinsky published over 500 papers with his many students who include some of the foremost organic chemists in Russia to-day.

Although Zelinsky's major contributions were in the field of hydrocarbon chemistry, from the beginning of his scientific career he was interested in biochemistry, particularly in the chemistry of amino-acids and proteins. His first publication entitled " On the Addition Products of Methylamine and β-Methylglycidic Acid " appeared in the Journal of the Russian Chemical Society in 1884 while he was still a student in Odessa working under Professor Melikov. His interest in this field continued throughout his life and the work was described in a number of papers published with his students. He prepared and studied a large number of amino-acids using the ketone cyanohydrin synthesis which he had developed (1906—1908) and obtained for the first time several important amino-hydroxy-acids. Following E. Fischer's work he investigated the hydrolysis of proteins with dilute hydrochloric acid in an autoclave at 180°, separating the product by means of organic solvents. An account of this work, published with V. S. Sadikov in 1923 and covering ten years' research, demonstrated the important part



N. Zelinsky

[*To face p.* 4062.

played by diketopiperazines in building up the complex protein molecule. For their research on protein chemistry, Zelinsky and Gavrilov were awarded a Stalin prize in 1948.

Zelinsky's chief interest was, however, in hydrocarbons and their reactions, and to this field he contributed much. He synthesised a large number of hydrocarbons, in particular *cyclo*paraffins, which brought him into contact with both terpene and petroleum chemistry. In 1895 he prepared the first synthetic naphthene, 1 : 3-dimethyl*cyclo*hexane, from αα′-dimethylpimelic acid by cyclisation and reduction of the resultant ketone to the hydrocarbon and showed its close similarity to the "octonaphthene" separated from Caucasian petroleum by Markovnikov. Employing a similar procedure he prepared a number of other *cyclo*hexanes and *cyclo*pentanes. In his synthesis of hydrocarbons, Zelinsky made considerable use of the organometallic compounds of magnesium and zinc and obtained many unusual compounds including *cyclo*propane, *cyclo*butane, *cyclo*heptane, *cyclo*octane, and *cyclo*nonane, being the first to synthesise the last. Besides saturated *cyclo*paraffins he prepared *cyclo*alkenes and *cyclo*alkadienes, often by unusual methods. *cyclo*Pentadiene, normally prepared by depolymerising the dimer, was synthesised by Zelinsky from *cyclo*pentene which he converted into 1 : 2-dibromo*cyclo*pentene and then dehydrobrominated. *cyclo*Hexadiene was obtained by a novel route involving treatment of *cyclo*hexane with selenious acid and acetic anhydride to give *cyclo*hexenyl acetate and converting this into the diene with potassium hydrogen sulphate. Zelinsky devoted considerable time to the synthesis of difficultly accessible ring systems including bicyclic and *spiro*-hydrocarbons. During this work he observed and investigated several intra-annular rearrangements similar to those which occur with terpene hydrocarbons.

Zelinsky's investigations of the conversion reactions of hydrocarbons in the presence of catalysts were outstanding and eventually led to establishment of a school of contact catalysis under his leadership. In 1911, while searching for a catalyst which would enable the dehydrogenation of *cyclo*hexane to be carried out at temperatures low enough to avoid pyrolysis, *i.e.*, not exceeding 300—310°, Zelinsky discovered that platinum and palladium black were both capable of converting *cyclo*hexane into benzene at 300° and, furthermore, were equally effective in hydrogenating benzene to *cyclo*hexane at 110°: in the presence of these catalysts the reaction was, in fact, reversible. He later showed that the metal could be deposited on asbestos or activated charcoal and that the supported catalysts so prepared were particularly active and stable. Under the conditions suitable for dehydrogenating *cyclo*hexane, *cyclo*pentane and *cyclo*heptane were unaffected and *cyclo*octane behaved abnormally to give methyl*cyclo*heptane and bi*cyclo*octane. Subsequently Zelinsky found that nickel supported on alumina was an equally effective catalyst in dehydrogenating hydrocarbons with a *cyclo*hexane ring, which was surprising since Sabatier had earlier found that pure nickel by itself brought about complete decomposition of *cyclo*hexane. An exhaustive study of the Zelinsky nickel–alumina catalyst was undertaken by his pupil A. M. Rubenstein who demonstrated that, with few exceptions, all hydrocarbons containing *cyclo*hexane rings readily underwent dehydrogenation to the corresponding benzene derivatives. A noteworthy exception was *cyclo*hexane itself which yielded under similar conditions a mixture containing toluene, xylene, and dimethyl*cyclo*hexane, the formation of which was regarded by Zelinsky and Shuikin as indicative of the participation of free radicals in the reaction. The few hydrocarbons containing the *cyclo*hexane ring which were not dehydrogenated included norbornylene (3 : 3 : 1-*bicyclo*heptane) and 1 : 1-dimethyl*cyclo*hexane. The former was completely unaffected and this was attributed to the presence of two fused *cyclo*pentane rings in its structure. Some aromatisation of 1 : 1-dimethyl*cyclo*hexane occurred, involving the elimination of methane as well as of hydrogen. The selective dehydrogenation of *cyclo*hexane derivatives over a platinum catalyst to-day forms the basis of a method widely used for the detection and determination of the *cyclo*hexane ring. The recently developed "Platforming" process, extensively employed in the petroleum industry for the large-scale production of aromatic hydrocarbons from petroleum fractions, which uses a platinum catalyst, can be considered an outcome of Zelinsky's discovery of the dehydrogenating properties of platinum and palladium.

In their investigation on the dehydrogenation of *cyclo*hexanes present in gasoline fractions, Zelinsky and Shuikin observed that the yield of aromatic hydrocarbons was often greater than would be expected from the amounts of *cyclo*hexanes present and concluded that other hydrocarbons were also undergoing aromatisation. Further investigation by Zelinsky and his colleagues and by Moldavsky and Kamushev led to the discovery that paraffins undergo cyclisation in the presence of chromia–alumina to give aromatic hydrocarbons.

This reaction received considerable prominence in the years immediately preceding the last war (1936—1939) since it appeared to offer an excellent method of producing aromatic hydrocarbons from petroleum. However, owing principally to loss of activity caused by decomposition of *cyclo*pentanes giving excessive carbon deposits, the process was eventually modified so that mainly *cyclo*hexane dehydrogenation was involved. Since this could be done at lower temperatures, pyrolysis of the *cyclo*pentanes was avoided.

While investigating the dehydrogenation of dimethyl tetrahydrophthalate, Zelinsky and Glinka found that in contact with platinum black at room temperatures it was converted into a mixture of the hexahydrophthalate and phthalate. This form of disproportionation was shown by Zelinsky and Pavlov to take place also with *cyclo*hexene, three molecules of *cyclo*hexene giving two molecules of *cyclo*hexane and one of benzene. Unlike the *cyclo*hexane–benzene dehydrogenation–hydrogenation this reaction was completely irreversible. A favourite lecture demonstration of Zelinsky's was to add *cyclo*hexadiene cooled to −20° to palladium black and show that the heat evolved in the reaction was sufficient to make the benzene and *cyclo*hexane formed boil vigorously.

Irreversible disproportionation of this type only occurs with *cyclo*hexene and *cyclo*hexadiene derivatives capable of producing an aromatic ring, 1 : 3 : 3-trimethyl*cyclo*hexene, for example, remaining unchanged. Molecules such as methylene*cyclo*hexane or vinyl*cyclo*hexane react, however many carbon atoms are interposed between the double bond and the ring. This behaviour was attributed to the migration of the double bond into the ring. That this explanation was correct was demonstrated by Zelinsky and (Miss) R. Ya Lavina by placing a quaternary carbon atom in the side chain as a barrier between the double bond and the *cyclo*hexane ring : no reaction then took place.

The isomerisation of *cyclo*paraffins involving change in ring size was first observed by Zelinsky in 1905, when, on treatment of ethyl*cyclo*pentane with aluminium bromide and bromine, pentabromotoluene was formed—a reaction which could have occurred only through the intermediate formation of methyl*cyclo*hexane. Other instances of the isomerisation of *cyclo*pentanes by aluminium halide catalysts were also investigated. In 1898 he devised an original method for estimating petroleum fractions based upon the treatment of the latter, freed from aromatic hydrocarbons by means of sulphuric acid, with a complex of acetyl chloride and aluminium chloride which converted the naphthenes into ketones while leaving the paraffins unattacked. This provided a useful method for separating the two types of hydrocarbons. At about the same time Zelinsky became actively concerned in the production of aromatic hydrocarbons from petroleum by pyrolysis and a plant was set up near Kineshma with his assistance to make benzene in this way. Some years later, during the 1914—1918 war, several such plants were erected and operated in the Caucasus to provide much needed toluene for explosives. The relatively low yield obtained by pyrolysis led Zelinsky to investigate alternative methods for producing aromatics. As early as 1913 by dehydrogenating the 100—104° petroleum fraction containing the methyl*cyclo*hexane he had obtained a product with a toluene content of 50%, thus forestalling the modern dehydrogenation processes. With Kasansky he investigated the conversion of acetylene into benzene by passage over activated charcoal at 600° and obtained a 74% yield of liquid product of which 35% was benzene.

Apart from his investigations into the composition of petroleum Zelinsky was particularly interested in its origin. He examined sapropelite found on the edge of Lake Balkhash as a possible source of natural petroleum, showing that on dry distillation, in addition to gas and coke, as much as 63% of tar could be obtained which in turn yielded gasoline, kerosene, and paraffins on redistillation. As far back as 1891 Zelinsky was a member of an expedition which investigated the waters of the Black Sea and proved the bacterial origin of the hydrogen sulphide formed in its depths, a mission which no doubt prompted his interest in problems related to the formation oil under similar conditions.

In recognition of Zelinsky's achievements in the field of organic chemistry he was in 1940, on the occasion of the 180th anniversary of Moscow University, awarded the highest honour of the U.S.S.R., the order of Lenin. On two later occasions he was again awarded this honour, in 1945 at the 220th anniversary of the Academy of Sciences and again in 1946, on his 85th birthday. On three occasions he was also awarded Stalin prizes, in 1942 for his work in organic chemistry, in 1946 with Shuikin and Novikov, and in 1948 with Gavrilov for research on the chemistry of proteins. Besides these he received a number of other honours and was in 1943 elected an honorary Fellow of the Chemical Society.

S. F. Birch.