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17. A. L. Lavoisier, "Sur un moyen d'augmenter considérablement l'action du feu et de la chaleur, dans les opérations chimiques", *Mem. Acad. Sci.*, **1782**, 457, published 1785. Also reprinted in *Oeuvres de Lavoisier*, Vol. 2, Imprimerie Imperiale, Paris, 1867, pp. 423-432. For an English summary, see reference 16, p. 458.

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19. J. D. Cassini, "Eloge de M. Le President de Saron", *Memoires Pour Servir A L'Histoire Des Sciences*, Colas, Paris, 1810.

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22. The building is located at 17 Rue de l'Université, Paris, France, 75007.

23. Personal communication from M. Lucien Boyer, Editorial Gallimard, Paris.

24. R. Hare, *Memoir of the Supply and Application of the Blowpipe*, Chemical Society of Philadelphia, Philadelphia, 1802. Reprinted in *Phil. Mag.*, **1802**, *14*, 238, 288 and *Ann. Chim.*, **1802**, *45*, 113.

25. See, for example, T. D. Mitchell, *Elements of Chemical Philosophy*, Correy and Fairbank, Cincinnati, OH, 1832, footnote on p. 69.

26. For a brief summary of the early history of the oxyhydrogen blowpipe, see J. R. Partington, *A History of Chemistry*, Vol. 3, Macmillan, London, 1962, pp. 724-725.

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KASIMIR FAJANS (1887-1975): THE MAN AND HIS WORK

Part I: Europe

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To some, the name of Kasimir Fajans calls to mind a man whose early achievements in radiochemistry secured for him a place in the history of chemistry. A very few may recall one of those blue volumes published under the aegis of the Baker Lectures at Cornell University and which evolved from lectures given by Fajans during his visit to the United States in 1930. Some may even have been contemporaneous with his teaching years at the University of Michigan, beginning in 1936. If so, his name may conjure up recollections of an outspoken critic of instruction in chemistry, particularly of the dominant qualitative approach to chemical bonding. To yet another group, those who were fortunate to have heard one or more lectures by him, the name recalls a person who left an indelible mark on his listeners.

None of these recollections, however, really gives much insight into what made this man "tick" or into the genesis of his major contributions to the progress of chemistry in our century. In this account I will try, among other things, to reduce this void by recounting some of the events said by him to have had a profound influence on the development and direction of his career (1).

Kasimir Fajans, the centennial of whose birth was celebrated in 1987 (2), was born in Warsaw, Poland, on 27 May 1887. He was the second child and the elder son of five children born to Herman and Wanda (Wolberg) Fajans. Both parents' families had members who had distinguished themselves at some period during the 18th, 19th, or 20th centuries: whether in science, medicine, music, photography, government, or in Polish patriotic movements. The Fajans family was part of the highly emancipated and "polonized" Jewish population. Polish, not Yiddish, was the daily language. Not surprisingly, as the elder son, Kasimir served as a role model for his younger siblings in what was reported to have been a loving and respectful family environment.

For the first years, private teachers taught Fajans at home. He later moved on to the Real-Gymnasium, a school where natural sciences, rather than Latin and Greek, were stressed. Nevertheless, the Russian dominance throughout the schools mandated that Russian be the official language. Polish was not allowed in the school building. The clash between Fajans' interests and that of the teacher's showed up in another way. In a Russian language class, Fajans was once given a poor grade for writing on "Climate" as an essay subject. Fortunately the director of the school was a scientist and responded favorably to Fajans' complaint about the grade. Beyond his early interest in science, Fajans was also a sports lover. He played tennis (something he kept up until retirement), rode a bicycle (a novelty then), and often hiked in the countryside and mountains.

The first event identifiably associated with the specific direction of his eventual career came when he was nine years old, vacationing with the family at a summer resort. His father, on a customary biweekly visit from the city, had brought a newly published book about the recently discovered Röntgen rays. This account, which included the first pictures of the bones within the human hand, aroused the boy's interest. In passing, it is also of interest to note that, many years earlier, Fajans' father had had the father of Marie Sklodowska Curie as his high school physics teacher.

Fajans' father, handsome, benevolent and well-liked, was a successful businessman representing Geiers, a large textile firm. This connection made the father aware of the contributions of chemistry to dye technology. Understandably, he very much wanted his son to go on to study dye chemistry and to take employment in the textile plant. Fajans, however, was more interested in pure science than in technology.

Furthermore, the political situation in Poland was bad. Even at the university level all subjects had to be taught in Russian and the admission of Jewish students was restricted. So, following the example of many who could afford it, Fajans opted to leave Poland. With his father's blessing, he chose to go to the University of Leipzig, intending to study biology. This objective changed during the first year, for he soon became interested in chemistry. The famed Wilhelm Ostwald was the Professor of Chemistry. Along with Arrhenius, Van't Hoff, and (later) Nernst, he had been one of the founding fathers of the new discipline of physical chemistry in the 1880's and 1890's.

The faculty at Leipzig seemed to be an ideal one. The scientific atmosphere proved to be very stimulating and Fajans attended as many seminars as possible. Even though he did not understand much of the subject matter, he valued the chance to hear and meet distinguished scientists. Unfortunately, Ostwald had decided to retire at the early age of 52 in order to pursue his many other interests, such as the development of an international language, color theory, and painting. A visiting professorship at Harvard took him away for most of the school year, and he returned only in time for Fajans to hear his last course lecture. Ostwald left in 1907 and his successor turned out to be incapable. This, in turn, led to the departure of the other notable faculty members, including M. Bodenstein, H. Freundlich (who was Laboratory Assistant for the course in Qualitative Analysis and had just completed his work on the adsorption isotherm), and R. Luther (Assistant Laboratory Director and co-author of the Ostwald-Luther laboratory text of physical chemistry).

This unforeseen and unfavorable development also caused young Fajans to leave for Heidelberg the same year. There he opted to study under Georg Bredig, who had recently left Leipzig as well, and who was still an "Associate Professor" at the time (German practice allowed only one full professor; Fritz Haber was *the* Professor of Chemistry). Bredig was interested in catalysis, a new field on the borderline between physical and organic chemistry. This appealed to Fajans' dual interests. Several chemists (A. Rothmann, for example) had observed that stereo-directed reactions could be catalyzed by naturally occurring enzymes, and Fajans' work with Bredig dealt with the use of an asymmetric base, such as nicotine, to preferentially catalyze the formation of one isomeric reaction product over another. His doctoral thesis was entitled *Partial Separation of Stereochemical Isomers by Asymmetrical Catalysis* (3). His discovery during this work of the directed decarboxylation of camphor carboxylic acid was the first use of a synthetic compound to mimic the stereospecific catalytic properties of enzymes. For this he earned the degree of *Dr. phil. nat.* and was awarded the Victor Meyer prize in October of 1909. It was during his last term at Heidelburg that Fajans also had the good fortune to meet Salomea Kaplan, a medical student and his future wife.

Kasimir Fajans, circa 1925.

Because of the prevailing undemocratic rules, the doctoral examination prior to the awarding of the degree was conducted without Bredig. Only full professors were allowed on the committee, which consisted of Philipp Lenard, Nobel Prize winner and Professor of Physics, Ludwig Königsberger, the Professor of Mathematics, and Theodor Curtius, who had succeeded Victor Meyer as Professor of Organic Chemistry ("Pure organic with a few inorganic byproducts," related Fajans). Curtius, not wishing to embarrass Fajans, asked a few simple questions about organic chemistry, but did not dare to challenge him on physical chemistry. Then, having finished his cursory examination, Curtius proceeded to spend the next hour talking about *his own work.*

As Fajans later told it, one of these stories dealt with Curtius' isolation of hydrazoic acid, HN_3. Having just discovered a hydrate of hydrazine, H_2N_2, he and his students were searching for a nitrogen compound having an even higher nitrogen content. When quite confident that they had succeeded, they did the analysis via decomposition, measuring the evolved nitrogen volumetrically over water. Curtius, with a perfectly straight face, recalled that after the volume was equivalent to two nitrogens "we counted the bubbles and we drank a bottle of champagne after each additional bubble!" Fajans remarked that, "Knowing Curtius, this was almost believable." (Fajans' moderation was in contrast to the drinking habits of some of his German contemporaries, who frequently accused him of "drinking beer through a straw.")

Because he still felt deficient in the subject, Fajans initially decided to continue working in the field of organic chemistry, with the hope of eventually using his knowledge of physical chemistry to clarify some of its mysteries. In order to strengthen his organic background, he applied for a post-doctoral position with Emil Fischer. However, Fischer had no vacancies in his laboratory and Fajans ended up working with Richard Willstätter at Zürich instead. Fajans later characterized the experience at Zürich as frustrating. He quickly discovered that he did not feel comfortable with the high degree of empiricism prevalent in the presentation and practice of organic chemistry at that time and he had to admit that the laboratory skills necessary for a successful "organiker" were not his. This led Fajans to the conclusion that physics, rather than organic chemistry, should be his field of study. Though this decision was to lead to a highly successful research career, he continued to harbor a certain ambivalence towards organic chemistry and, some 50 years later, in 1959, he proudly confessed that "I began to understand organic chemistry only recently - only on the basis of the Quanticule Theory."

It so happened that during his earlier stay at Heidelberg, Fajans was asked to give a report at a physics colloquium supervised by Lenard. He was directed by Lenard to a 1908 paper by Rutherford and Geiger on counting alpha particles and determining their charge. In preparing his report, Fajans also read the 1907 German translation of Rutherford's Silliman Lectures, *Radioactive Transformations*, delivered at Yale University in 1905. Having decided to desert organic chemistry, Fajans now remembered his backround reading for the physics colloquium and decided to apply for a postgraduate position in Rutherford's laboratory at Manchester. About ten years later, Fajans was reminded of the events behind his decision to take up the study of radiochemistry. Having been invited to Heidelberg to give a lecture on radioactive displacement laws and isotopes, he was met after the lecture by his former physics professor, Lenard, who remarked that, "It was good that you gave in 1909 the report in the colloquium."

Before leaving for England, Fajans and Salomea Kaplan were married. This was fortunate, for more than the usual reasons, as Mrs. Fajans was fairly fluent in English. This skill enabled the couple to get along in everyday contacts outside the laboratory until Fajans' command of English had developed sufficiently. They frequently went to the theater in Manchester, in part, as a means of improving their knowledge of English and, in part, because of the excellent performances. They also enjoyed concerts. In the laboratory, Hans Geiger acted as an interpreter for Fajans and Rutherford during this learning period. Several years later Fajans sent Geiger a copy of his newly published book, *Radioactivity* (4). A short time later the two of them met at a meeting of the Berlin Physical Society, where Geiger remarked, "Fajans, your book is very well written ... I married recently and I read your book to my wife on our honeymoon!" Other contemporaries at Manchester included J. Chadwick, C. G. Darwin, G. von Hevesy, G. N. Antonoff, W. Makower, and H. G. Moseley.

Fajans' work at Manchester included the discovery of branching in radioelement transformations and the measurement of half-lives on the order of 10^{-1} and 10^{-3} seconds and resulted in collaborative publications with both Moseley and Makower (5-7).

Fajans greatly admired Rutherford and declared that he undoubtedly belonged with Faraday in the "Chemists' Hall of Fame". Rutherford had an ability to use very simple experiments to achieve important, far-reaching results. Fajans remarked that Lenard also possessed this trait to some degree. Without a doubt, Fajans' admiration for these outstanding scientists and their methods influenced his own future methodology in the study of atoms, molecules, liquids and solids.

It was intended that Fajans should return to Heidelberg when he was finished at Manchester. However, his doctoral mentor, Bredig, had followed Fritz Haber to Karlsruhe and in 1911 extended Fajans an invitation to join him there as Chief Assistant, with early promotion to Privatdozent (similar to our "Assistant Professor"). The invitation was accepted even though the situation was far from ideal. Karlsruhe had no medical school at which Salomea, who had begun work on an M.D. degree, could finish her training. She would have to take their baby son, Edgar, who had been born during the stay in Manchester, with her to Strassburg, the site of the nearest medical school, and for two years would have to be content with visits from Kasimir, who would live at Karlsruhe.

Along with his students at Karlsruhe, Fajans was to spawn some much needed advances in the development and understanding of radiochemistry. He had read in Soddy's book the reference to the Lucas-Lerch Rule about radioactive decay (8). This rule stated that all elements emitting radiation became more noble. Fajans recognized that this could not be right. One day in late 1912, feeling fatigued, he and a graduate student, Oswald Göhring, decided to take time off to go to a performance of the opera, "Tristan and Isolde". Although Fajans did not play a musical instrument, he was very fond of music and opera. While sitting there with eyes closed, enjoying the music, he suddenly opened them, took a paper from his pocket and wrote down an equation. The true decay route had suddenly dawned on him: *Only beta decay leads to a more noble element*. This led, in turn, to his enunciation of his famous displacement laws for radioactive decay (9-10). Frederick Soddy published similar rules (11), but not until after the appearance of Fajans' paper, leading some to doubt the originality of Soddy's conclusions (12-14).

Closely following the displacement laws was the discovery (with Göhring) of element 91 in the form of one of its short-lived isotopes, which they appropriately named Brevium (15). Regrettably, based on their study of its longest lived isotope, Hahn and Meitner are usually given the credit for having discovered element 91 (protactinium) five years later.

A comic opera by Lortzig entitled "The Czar and the Carpenter" provided the inspiration for another important rule. This was the relationship between the atomic weight and stability of radioactive isotopes (or the members of a *pleiad*, as Fajans originally named such groups). In summary, the rule states that, as the atomic weight decreases, the half-life decreases for isotopic alpha-radiators but increases for beta-radiators, and that, consequently, in a given pleiad, the beta-radiators have higher atomic weights than the alpha-radiators, and the longest lived is of shorter life than the longest lived isotopic alpha-radiator. Little was made of this rule at the time. However, with the rise of nuclear physics in the 1940's it became of increasing importance, though Swinne eventually found some exceptions (16).

Meanwhile, Fajans, along with some others, came to a growing conviction that the atomic weight of an element was not the fundamental constant which many others believed it to be. He also realized his lack of experience in atomic weight determination handicapped him in carrying out experimental work convincing to his peers. As a result, he wrote to T. W. Richards at Harvard requesting permission to send a graduate student, Max Lembert, to work there. The objective was to determine the atomic weight of lead obtained from radioactive minerals, for comparison with that of ordinary lead. The results obtained by Lembert and Richards were as Fajans had predicted - the lead from the new ore sample had a lower atomic weight, 206.5 vs. 207.2 for ordinary lead. Richards, who was skeptical about the existence of isotopes, had difficulty in shedding his original belief that impurities or errors were the cause of the differences in the determined atomic weights. However, the evidence obtained by Lembert was not easily dismissed and Richards and Lembert eventually published the results (17). Nevertheless, Richards continued to think of the subject as a "problem area" for several more years (18-19)! Otto Hönigschmid, working in Prague after earlier training at Harvard, also obtained similar, though less striking, experimental results at about the same time, as did Soddy and Maurice Curie (20). The term isotope, by the way, had been introduced by Soddy in 1913 and was suggested to him by an English physician, Margaret Todd, at a dinner party at the home of his father-in-law.

Atomic Weight	0 (VIII)	I a b	II a b	III a b	IV a b	V a b	VI a b	VII a b	Atomic Weight
197		Au							197
200			Hg						200
204				Tl					204
206					RaG				206
(207)				βAcC″ 4.7^m	(AcD)				(207)
207					Pb				207
208				βThC″ 3.2^m	ThD	Bi			208
210				βRaC″ 1.3^m	βRaD 16^y	βRaE 5^d	αRaF 136^d		210
(211)					βAcB 36^m	αβAcC 2.15^m	αAcC′ (0.005^s)		(211)
212					βThB 10.6^h	αβThC 61^m	αThC′ (10^{-11s})		212
214					βRaB 27^m	αβRaC 19.5^m	αRaC′ (10^{-6s})		214
(215)							αAcA 0.002^s		(215)
216							αThA 0.14^s	—	216
218							αRaA 3^m		218
(219)	αAn 3.9^s								(219)
220	αTn 54^s								220
222	αRn 3.82^d								222
(223)			αAcX 11.2^d						(223)
224		—	αThX 3.7^d						224
226			αRa 1600^y						226
(227)				βAc 20^y	αRdAc 19^d				(227)
228			(β)MsTh$_1$ 6.7^y	βMsTh$_2$ 6.2^h	αRdTh 1.9^y				228
230					αIo 10^{5y}				230
(231)					βUY 25^h	αPa 3×10^{4y}			(231)
232					αTh 1.5×10^{10y}				232
234					βUX$_1$ 24^d	{βUZ 6.7^h / βUX$_2$ 1.17^m}	αU$_{II}$ (2×10^{6y})		234
238							αU$_I$ 4.5×10^{9y}		238

Placement of the known radioelements in the periodic table, circa 1930 (16). Used by Fajans to illustrate his famous displacement laws for radioactive decay.

The rules for co-precipitation of minute concentrations of radioelements were also enunciated by Fajans and P. Beer during this period. They were confirmed by Fritz Paneth, and extended by Fajans and co-workers and by Otto Hahn in the period between 1913 and 1926 (21-24).

A view of the difference in formalities observed by Fajans and his doctoral mentor, Bredig, has been given by one who knew both during the Karlsruhe days. Elizabeth Rona, in her delightful little book, *How It Came About*, tells how, in her early graduate school days, she changed her plan to work under Bredig, known as the "Shreckliche," and chose to work under Fajans "in a new and exciting field" (25). She adds that Fajans (apparently ahead of his time) did not discriminate against women at his frequently held laboratory parties. A dinner invitation to Bredig's home, in spite of the fine food and hospitality, meant that Rona would have to join the ladies in family talk rather than to talk shop with her laboratory associates, as she so longed to do.

A sidelight, possibly foreshadowed by Fajans' frustration with organic chemical research at Zürich, is also mentioned by

Rona. She remarks that, in contrast to his great ingenuity, foresight and courage, Fajans was not a skilled experimentalist. "We feared his handling our instruments." Yet Fajans insisted that "there are no experimental difficulties" too great to overcome. This assertion appeared as the caption on a caricature presented to him by his students on his 26th birthday and reproduced here. This shows him working away in apparent determination, despite one arm in a sling, blood from one hand dripping into a broken jar, and broken glass and equipment flying about!

With the start of World War I in 1914, things at Karlsruhe changed for the worse. Most of the students had to leave. Fajans, a Russian subject, was not allowed to teach, only to work in the laboratory. Each day he was required to identify himself at the police station. Of this duty, his little son, Edgar, would frequently remind him by asking, "Have you said Fajans already?"

Before the end of the war, Poland became an independent country and Fajans had some hope of getting a position at the University of Warsaw. This, however, fell through. Nernst, at Berlin, had indicated his interest in having Fajans join him, but another offer appeared before Nernst could make a definite proposal and, by a somewhat fortuitous route, Fajans was called to the University of Munich instead. Adolf von Baeyer, who looked with utter contempt upon physics and physical chemistry, had just retired. His former student, Richard Willstätter, who had arrived to replace him, recognized the need for physical chemistry but found there was no laboratory for it. He could not get Haber, who now was at the Kaiser Wilhelm Institute in Berlin and unavailable. It was then that Willstätter remembered Fajans and his work in Rutherford's laboratory. The result was that in 1917 Fajans was offered a position in physical chemistry, as he once wryly remarked, "in spite of my time at Zürich."

Life in this beautiful city was very pleasant. Vacations often were spent in the nearby Bavarian and Austrian Alps. Fajans and both sons (Stefan was born in 1918) came to enjoy skiing. There was an excellent opera, and the symphony orchestra, conducted by Bruno Walter, provided an added attraction. Among his colleagues at Munich were W. Röntgen, Professor of Experimental Physics; A. Sommerfeld, Professor of Theoretical Physics; P. Groth, Professor of Mineralogy and Crystallography; and O. Hönigschmid, Professor of Analytical Chemistry.

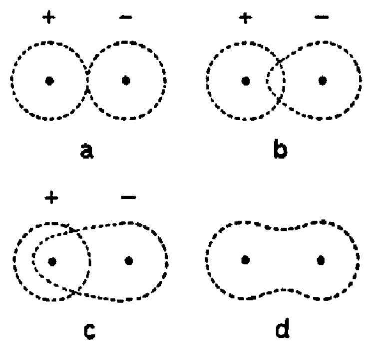
Upon arriving in Munich, Fajans dropped his work in radiochemistry and embarked instead upon the investigation of the factors governing chemical bonding and the properties of atoms and molecules in the solid, liquid and gaseous states. One could say that a new career began here. He was not to return to active work in radiochemistry until almost 20 years later, after leaving Germany.

One of the first fruits of this shift in interest was Fajans' experimental proof of what should properly be called the Born-

"Experimentelle Schwierigkeiten Gibt Es Nicht" Student commentary on Fajans' lab technique at Karlsruhe (25).

Fajans-Haber Themochemical Cycle (26). Each of the three parties involved in the development of this concept eventually agreed to simultaneously publish his own paper in the 5 December 1919 issue of the *Verhandlungen der Deutschen Physikalischen Gesellschaft*. Fajans' thermochemical investigations also extended to diamond, graphite, and to aliphatic and aromatic compounds (27-29).

As early as 1920, Fajans and H. Grimm, as a result of studying the halides of sodium and potassium, recognized the fallacy of assigning constant radii to ions (30-31). By 1923, based on further work with Georg Joos (in the first of some 50 publications by Fajans and co-workers dealing with refractometry), he proposed the dependence of anionic size on the polarizing (deforming) effect of the cation (32-33). It may be noted that Fajans was expounding and practicing a form of "crystal field theory" decades before it was applied to the problem of d-d spectroscopic transitions. Billiard-ball concepts in chemistry were ushered out - yet this reality was ignored by many in the following years. One can still find recent statements by physicists and chemists warning of the dangers of assuming spherical ions, written as though the concept of ion deformation were only recently developed! Already in 1925, Fajans predicted that NaF (not CsF, as Coulson later wrote) would be found to be the most polar of the



Fajans' picture of the transition from ideal ionic bonding (a), through polar covalent bonding (b and c) to ideal covalent bonding (d) via progressive anion polarization (16).

alkali metal halides, and 38 years later this was borne out experimentally by Canadian researchers (34-35).

At about this time, Willstätter resigned from the chairmanship of the department, and Heinrich Wieland, from the University of Freiburg, succeeded him. Wieland used his influence to get Freiburg to offer Fajans a Chair (full Professorship) in Physical Chemistry. However, the University of Munich and its Board did not want him to leave. They countered with a similar offer, with the proviso that all agreements had to be made with the approval of Wieland. Apparently Wieland had feared difficulties at Munich because of Fajans' influence and popularity in the department, which was why he had arranged for the offer from Freiburg. Long negotiations followed, Fajans stayed at Munich, and eventually the two developed a close rapport and a solid friendship.

It was also around this time, roughly halfway through the Munich period, that Fajans and Linus Pauling first met. It is no secret that their views on the nature of chemical bonding and its effect on structure developed along differing paths. In 1987 Dr. Pauling graciously took time out from busy preparations for an extended speaking tour to dictate and send to me some reminiscences of this period (36):

My wife and I arrived in Munich about the end of April 1926. I had received a Guggenheim Fellowship, and I worked with Professor Arnold Sommerfeld in his Institute for Theoretical Physics, University of Munich. Fajans' laboratory was some distance away, about one mile from the main university building, but I soon went to see him, to tell him that I was interested in working on some problems in which he also had interest. He had been working on the electric polarizability of atoms and ions. His students had carried out many experimental determinations of the index of refraction [using] light at different wavelengths, in order to obtain values of the electric polarizability. He was also interested in the structure of crystals, a field in which I had been working during the preceding four years.

Fajans and his wife immediately invited us to have lunch with them, in their home. I remember that on one occasion we came to lunch, continued talking, and finally also stayed for dinner. We met the Fajans children [Edgar and Stefan], who were amused by the rather odd German that we spoke. Later in the year we were planning to go skiing in the Bavarian Alps. My wife was small, just the right size to use a pair of skis belonging to one of the Fajans children, so that these skis were loaned to us.

Although we were interested in the same scientific topics, there did not arise any occasion when Fajans and I found it desirable to work together on a problem. One reason was that Fajans was very busy. He had a large Division of Physical Chemistry, with many students, and was kept busy with its administration and with his teaching duties, as well as his supervision of research programs. He told me at one time that the research results of many investigations had piled up on his desk, because he could not find time to write up the results for publication. He also regretted that he was so busy that he could not take the time to study the new theory of quantum mechanics. I think that this inability to get a good grasp of quantum mechanics was a problem that bothered him all the rest of his life.

I did not see very much of him in later years. However, my wife and I continued to feel grateful to him and his wife for their kindness to us, when we appeared in a foreign land as young people just beginning their careers.

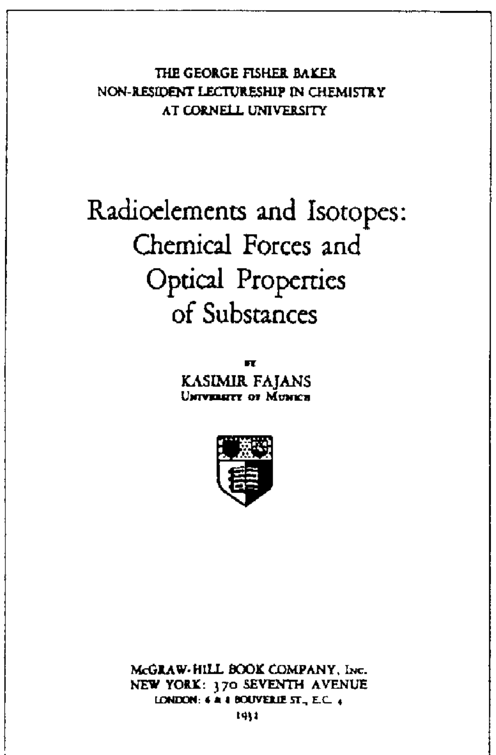
It was in 1928 that Fajans published his ideas on the importance of the mutual polarization of anions and cations (37-38). This became a continuing theme throughout his career. His frequently expressed disdain for the popular acceptance of the additivity of ionic radii may best be illustrated by his reply to a fellow attendee at the International Symposium in Trieste in June 1959. The man told Fajans how he used values from certain named sources, "for they are the best radii." Fajans replied, "There are no good ionic radii." Recounting this in October 1959, he added with a smile, "God did not make ionic radii."

Other activities during the Munich years dealt with photochemistry (39-41), dye absorption (which led to the development of adsorption indicators for argentometry) (42-44), extensive refractometric studies (carried out for all three states of matter and at temperatures as high as 1000° C) (45), a book of popular lectures on radioactivity (4), and the publication of a well-known laboratory manual for physical chemistry (46).

His Baker Non-Resident Lectureship at Cornell University in 1930, and the subsequent publication of these lectures, gave American audiences a firsthand exposure to his work and views (47). His popularity as a lecturer also resulted in invitations to lecture at, among others, Columbia, Harvard, Yale, Princeton, Michigan, Chicago, Northwestern, McGill, and Wisconsin. These obligations were squeezed between the weekly three days of lectures and seminars at Cornell. This busy schedule worried Professor L. M. Dennis, the Department Head at Cornell, since Fajans was supposed to deliver the manuscript of a book based on his lectures at the end of the term. While at Cornell the family also learned something of inherited school pride. A professor who had shown no previous interest in attending Fajans' lectures suddenly became friendly when he learned of Fajans' difficulties with Dennis. One day he confided to Mrs. Fajans, "I am a third generation graduate of Harvard. The first word my children are taught to speak is not 'mommy' or 'daddy' but 'Harvard'!" Fajans finally did complete the required manuscript, though it is interesting to note that the resulting volume is probably the thinnest of the entire Baker Lecture Series. Indeed, his preface suggests that he was not unaware of this possibility.

It was also during this visit that Fajans received the happy news that the Rockefeller Foundation had decided to finance a new Institute of Physical Chemistry in Munich with Fajans as the director. This was completed in 1932 and consisted of a wonderfully equipped three-story building, complete with a roof terrace for entertaining guests and holding afternoon laboratory teas.

Unfortunately, Fajans was not to enjoy his new Institute for very long. Gathering clouds on the political horizon and the ascendancy of Hitler left little doubt that he and his family would have to leave Munich. The Rockefeller Foundation optimistically thought that the Fascist Regime would soon fall and asked Fajans to wait patiently. No doubt, because of their influence, the Fascist government exercised some restraint in handling the affairs of both Fajans and the Institute. Yet, no new pupils came. His wife had to help in the laboratory. Acquaintances were being tagged and sent to concentration camps.


THE GEORGE FISHER BAKER
NON-RESIDENT LECTURESHIP IN CHEMISTRY
AT CORNELL UNIVERSITY

Radioelements and Isotopes:
Chemical Forces and
Optical Properties
of Substances

BY
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It was in 1934, in the *Zeitschrift für physikalische Chemie*, that Fajans published one of his last papers to be written in Germany, a long discussion of refraction and dispersion, with references to papers in the same volume by his co-workers at the Institute (48). Also included were critical comments on the work of other investigators, which foreshadowed the increasingly divergent nature of his own views on the subject.

The next year Fajans was finally forced to leave Germany and his Institute. Because Edgar, the oldest son, had been born in Manchester, he could claim English citizenship. He had just acquired his Ph.D. at Frankfurt, and fortunately was able to go to London to work with F. G. Donnan. Young Stefan, born in Munich, was sent to a private boarding school in Cambridge. The remaining task was to find congenial employment for Fajans. Tendered professorships in Poland and in Turkey and a possibility of industrial research in Poland presented problems only too obvious. A one-year fellowship appointment at Cambridge opened an opportunity not only to finish some work which he had planned, but also to prepare for a more permanent move. Indeed, before leaving Munich, he had been offered, through messages sent by way of his son in London, a professorship at the University of Michigan. The arrangements were completed during the stay at Cambridge, and in 1936 Fajans, along with his wife and younger son, arrived in Ann Arbor.

Part II of this article, dealing with Fajans' career in the United States, will appear in the Spring 1990 issue of the Bulletin.

References and Notes

1. An earlier version of this account was presented as part of the *Symposium in Commemoration of the Centennial of Kasimir Fajans' Birth*, held at the Fall National ACS Meeting in New Orleans, LA, on 1 September 1987. Parts derive from my past conversations and correspondence with Kasimir Fajans, also from seminars which he presented, particularly the historical lectures at 3M Company on 27 June 1956 and on 13 October 1959 (the latter during a week of seminars and discussions about his views of chemical bonding). I am particularly indebted to his son, Dr. Stefan Fajans, M.D., for providing a copy of his mother's excellent biographical notes about his father. (She also earlier gave me a copy of the book (25) by E. Rona.) I also wish to thank my former employer, the 3M Company, for its support and encouragement, and for the willing assistance by members of its Technical Libraries Staff. The much needed help of Dr. Mary V. Orna and Dr. Seymour Z. Lewin in setting up the original Symposium is deeply appreciated.

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Dr. Reynold E. Holmen, 2225 Lilac Lane, White Bear Lake, MN 55110, is retired from the 3M Company, where he was employed as an organic chemist. He received his Ph.D. degree from the University of Michigan, where he had the stimulating experience of taking several courses from Fajans.

THE HISTORY OF THE DEXTER AWARD

Part IV: The Third Decade

Aaron J. Ihde, University of Wisconsin

The winner of the 1977 award, Modesto Bargalló (1894-1981), was born in Spain and played an important role in science education in Spanish universities. At the close of the Spanish Civil War, he fled Spain and started a new career in Mexico, where he was a faculty member of the National Polytechnic Institute in Mexico City. Although he had been interested in history of chemistry while still in Spain, that interest flowered in Mexico, where he made extensive studies of the history of metallurgy in Colonial Latin America. He published numerous papers on history of chemistry and of metallurgy and was the author of several works on Latin-American metallurgy.

Modesto Bargalló

George Kauffman (b. 1930), recipient of the 1978 award, was born in Philadelphia and educated at the Universities of Pennsylvania and Florida. He developed a deep interest in coordination compounds, aroused at Penn by a professor who had worked with Alfred Werner at Zürich. Kauffman became a member of the chemistry faculty at California State University in Fresno in 1956 and has taught courses in general and inorganic chemistry, as well as history of chemistry. His interest in the latter subject developed early in his career and came to fruition during a research leave in Zürich where he studied the papers of Werner. He has edited three collections of classical papers in coordination theory and has chaired two symposia on teaching history of chemistry, one of which was published in book form. He has also published a biography of Werner and a symposium volume on the Werner Centennial