these chiral reducing agents derived from α-pinene, encouraging further extension of this approach to asymmetric reduction.

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Registry No. α-Pinene, 80-56-8; borane, 13283-31-3.

Chemistry on Stamps (Chemophilately[1])

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The only science is physics. All the rest is stamp collecting.

E. Rutherford, Nobel laureate in chemistry (stamp 22)

Stamps and specific postal cancellations are issued to commemorate events and to inform and educate the public. Due to their universal circulation, stamps are rapid, powerful, and effective messengers which may raise curiosity in or enhance or degrade the image of our profession in the public eye.

Collecting chemistry-related philatelic material enables the collector to combine a hobby with professional interest, to study in a nonsystematic but a delightful way the history of chemistry, to learn about unknown chemists from remote countries who received fame both professionally and nonprofessionally, and to learn about family and student–teacher relationships in an arbitrary chosen group of professional brothers. It enables one to look with amazement, anger, or a feeling of superiority on the liberties taken by stamp designers and on the errors that they make in designing chemical formulas on stamps.[2]

Stamps can be educational tools, display the periodic table and minerals or activities of famous chemists, and even explain details in the oxygenation of hemoglobin.[3] Papers in the *Journal of Chemical Education* and occasionally in other journals cover some of these aspects, chemophilatelic exhibitions are shown in ACS meetings, and a modest journal, *Philatelia Chimica et Physica*, enters its 14th year.

Consequently, once in a quarter of a century there is a place for a paper on chemophilately in *Accounts of Chemical Research*, a journal whose first editor once wrote a paper in verse form.[4] The topic is so rich and diverse and the space so limited that any choice of material must be arbitrary. This paper reflects a personal outlook on a few subtopics that the author finds informative, interesting, and sometimes amusing.

Chemical Societies. Jubilees of large, old, and prestigious chemical societies are sometimes commemorated by stamps. The 75th and the 100th jubilees of the ACS were commemorated by stamps 1 and 2 (Figure 1), which differ not only in the 4.3-fold increase in postal rate. The brown stamp of 1951 displays a chemical distillation apparatus and the smoke-producing chimneys of a chemical plant, which today will be regarded as reflecting the negative side of chemistry. The 1976 stamp is much more lighthearted and colorfully displays simple laboratory tools. In contrast, the British Royal Society of Chemistry chose a different approach on its 100th jubilee stamps issued in 1977. They colorfully commemorate British achievements in chemistry as exemplified by activities of Nobel laureates related to chemicals known to the general public. The cholesterol structure honors D. H. R. Barton's conformational analysis (stamp 3); a vitamin C model honors its first synthesis by N. Haworth (stamp 4); starch chromatography honors A. J. P. Martin and R. L. M. Synge, who pioneered its use (stamp 5); and the NaCl crystal structure honors W. H. and W. L. Bragg, who determined it (stamp 6). Likewise, a 1990 stamp from Berlin (not shown) commemorates the 100th anniversary of the German Pharmaceutical Society by showing a model of aspirin.

Contribution of Small Countries. Although smaller chemical societies have usually to be satisfied only with special postal cancellations, small countries sometimes achieve great original chemophilatelic accomplishments, as shown by the following three examples. How much time does it take a trained scientist's eye to recognize the unusual philatelohydrocarbon produced in Monaco (stamp 7)? It is not a tetrahedral CH_4, as was presumably intended, but tetrahedral tetravalent hydrogen HC_4.[5]

Zvi Rappoport is Professor of Organic Chemistry at the Hebrew University of Jerusalem. He was born in Jerusalem in 1936, started to collect stamps at a young age, and received both M.Sc. and Ph.D. degrees at the Hebrew University, followed by two years of postdoctoral work in UCLA with the late Saul Winstein. His research interests include nucleophilic vinylic substitution, vinyl cations, and simple stable enols (the subjects of previous Accounts), solvent effects, and reactivity and selectivity. He is a collector of Holy Land and recently also of chemistry-related stamps.

(1) We suggest the term "chemophilately" for the philatelic study of chemistry, in contrast to "philatelochemistry", which deals with topics such as the color, paper, print, or glue of stamps.

(2) Heilbronner, E.; Kettler, S.; Miller, F.; Rappoport, Z. Chomical errors on chemical stamps. *Philatelia Chim. Phys.* **1990**, *12*, 33.

(3) Stryer, L. *Biochemistry*, 2nd ed.; Freeman and Co.: San Francisco, 1981; p 77.

(4) Bunnett, J. F.; Kearley, F. J., Jr. *J. Org. Chem.* **1971**, *36*, 184.

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ETAT COMORIEN 200F
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The British Council education for development
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A. I. VIRTANEN
SUOMI·FINLAND
Kein ALKOHOL im Straßenverkehr
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Figure 1.

Grenada's list of elements is displayed together with Jöns (John in Grenada) Jacob Berzelius on stamp 8. The semialphabetical order (e.g., Cd, Ca, Cf, C, Ce, Cs, Cl, Cr) follows the complete spelling of the elements' names; the appearance of elements such as Cf, No, Es, and Md, whereas more important elements such as Al, Hg, As, Sb, and Ne are missing, is puzzling. Luckily, the elements discovered by Berzelius himself do appear in the list.

Comoro Island issued stamps displaying Nobel laureates in several disciplines. The chemistry stamp (stamp 9) displays Ramsay (chemistry prize, 1904), but also the nonchemists Banting and Hench (medicine prizes, 1923 and 1950) and Perrin (physics prize, 1926), as well as Mary Curie (with "1913" rather than "1911" chemistry prize). Amazingly, a half-filled horizontal beaker suspended in air without support is stirred by nobody without spilling a single drop.

Both Sides of Chemistry. Both positive and negative contributions of chemistry are represented on stamps. The positive role is exemplified by drug-related stamps, especially by a British stamp (stamp 10) showing an African nurse treating a baby on a background of 17 drugs used in Africa against various diseases. Vitamin C (stamp 4), penicillin, quinine, and insulin (stamps 85–87) (Figure 2) are other examples.

The uglier side of chemistry is demonstrated on two Dutch stamps. Stamp 11 displays a seal, an endangered species, emphasized by the black margin, on a background of biphenyl molecules, which symbolize the pollutant chlorobiphenyls. Stamp 12 from 1988 shows formulas of environmentally hazardous air pollutants related to gasoline [NO_x, CO, C_xH_y, and PAK (polyaromatic hydrocarbons)], the words "lead-free gasoline" in Dutch, and a "Pb" crossed out with red X.

Changing attitudes with the passing of time are demonstrated in Scandinavia. In 1945 the Finnish chemist Virtanen (Finnish stamp, stamp 13, 1980) received the chemistry Nobel prize for preservation of green fodder which involved acidification to pH < 4. However, the effect of acidity on vegetation was so alarming in 1986 that Sweden issued a stamp symbolizing trees on a first day cover pleading "stop acid rain" in many languages and showing HNO_3 and H_2SO_4 on the first day cancellation (I, Figure 3). Another example is EtOH, one of the first structures displayed philatelically. It appears on 1948 Japanese stamp (stamp 14) commemorating the government monopoly for its production. Forty years later the fight against drunken drivers is displayed in the command "Kein Al-kohol" on a German stamp (stamp 15).

Both sides of chemistry merge in the personality of Fritz Haber (stamp 27), whose ammonia-forming process increased food production via fertilizers but who also introduced chemical warfare in the first world war.

Chemistry Nobel Laureates. Many chemists appear on stamps. Sweden, France, the USSR, and Austria are philatelically generous to their scientists while other countries, including the USA, are misers in this respect.

The Nobel prize is a popular topic, and Alfred Nobel himself appears on stamps from many countries. A 1976 Antigua stamp (stamp 16) is representative, although the $N_2 + 2H_2O$ shown among other symbols on the stamp is somewhat puzzling.

Nobel laureates are mainly presented here by using several of the corresponding Swedish issues. From 1961 to 1981 Sweden annually issued a series displaying the laureates of 60 years earlier. Of the 18 stamps, we show only 11 (stamps 17–27), as well as two from 1988 (stamps 28 and 29), which enable one to look at the development of a philatelic concept and the history of chemistry at the beginning of the century.

Stamp 17 displays the slightly shifted profiles of all four recipients in the various fields, but Van't Hoff's profile appears farthest left and back and his name is the last in the accompanying list. In stamp 18 Emil Fischer's profile is still the farthest left and back, but his name now appears first. The number of laureates on a stamp in later years is reduced to two and then to one, and in 1909 and 1910 the laureates appear en face together with symbols associated with their chemistry, e.g., the camphor formula with Wallach (stamp 24). From 1974 the laureates appear mostly on the background of their institutes (stamps 26 and 27). The format was changed in 1982 to a strip of a few stamps devoted to a single discipline with symbolic pictorial representation, but regardless of consecutiveness. Examples are stamps 28 and 29, describing in a colorful and delightful way the work of laureates Libby (^{14}C dating, stamp 28) and Ziegler and Natta (a polymer, stamp 29).

The chemical and personal data which can be extracted from stamps 17–27 and from those not shown from intervening years are interesting. For example, the old and new chemistry subdisciplines are nearly equally represented. The three founders of physical chemistry, Van't Hoff (stamp 17), Arrhenius, and Ostwald (stamp 23), are joined by Haber (stamp 27) and Nernst of the next generation. Four inorganic chemists—Ramsay, Moissan, Werner, and Richard (e.g., stamp 20)—are accompanied by the three representatives of the new branch of radiochemistry—Rutherford (stamp 22), Curie (stamp 25), and Soddy—while six organic chemists received five prizes: Fischer, Baeyer, Wallach (stamps 18, 19, and 24), Grignard, Sabatier, and Willstätter (stamp 26). Interestingly, the prize was given always to a single chemist, except in 1912, and only one biochemist (Buchner, stamp 21) and one American (Richard) are among the 1901–1921 recipients. The dominance of Germany, especially Berlin and Munich, is shown by the eight German laureates in addition to Van't Hoff, who worked in Berlin.

From the pictures taken when the prize was given, we learn that beards predominated in the first decade of the century and that mustaches dominated in the second decade. Was this change in fashion due partially to the need to wear gas masks in the first world war?

Each laureate left his name in our chemical vocabulary: Van't Hoff and Arrhenius equations, Fischer projection, Baeyer's strain theory, Buchner funnel, Ostwald dilution law, and Grignard reagent are just a few examples. Anecdotes connected with them enliven history of chemistry books: Baeyer's girl friend Barbara, who (so we were told) gave her name to barbituric acid; Rutherford's remark at the opening of this Account, which reflects his relation to chemistry, for

(5) HC_4 is known and is probably linear.[2] It was detected in star IRC+10216 (Cernicharo, J.; Guélin, M.; Menten, K. M.; Walmsley, C. M. *Astron. Astrophys.* **1987**, *181*, L1).


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Figure 2.

Figure 3.

which, ironically, he received his prize; and Marie Curie, who received her Nobel prize in 1903, but assistantship in the Sorbonne only a year later.

An inspiring teacher greatly helps. Fischer, Buchner, and Willstätter (stamps 18, 21, and 26) were Baeyer's (stamp 19) students, Moissan (stamp 20) was Marie Curie's (stamp 25) Ph.D. thesis examiner, and Soddy collaborated with Rutherford. What Baeyer and Moissan thought when their students Fischer and Curie recieved the prize before they themselves won it would be interesting to know. An insight into several of these complex personalities, including tributes to a teacher (Baeyer) and a friend (Haber), are given in Willstätter's beautiful autobiography.[6]

We note, however, that Moissan's prize given for preparation of fluorine should be immediately returned. The French stamp (stamp 30) commemorating the centenary of the preparation of fluorine depicts the highly exoergonic reaction $H_2 + F_2 \rightarrow 2HF$. A course for distinguishing forward and reverse reactions is recommended for the French philatelic service.

Chemists at Other Activities. Several chemists were honored philatelically for nonchemical activities which brought them fame. Two of them were heads of states who met opposite fates. Ignaczi Moczicki, who improved the Haber ammonia process, was the last president of Poland before World War II, fled from his occupied country, and died in Switzerland. He appeared on several Polish stamps (e.g., stamp 31). Chaim Weizmann, the first president of Israel, was torn all his life between chemical research and political activity, lived most of his life abroad, but died in Israel. The importance of his fermentation process which produced acetone for the British World War I effort led to the unconfirmed legend that the Balfour Declaration, an important step on the way to the establishment of Israel, was granted in appreciation for it. He appears on several Israeli stamps (e.g., stamp 32).

The French chemist Claude-Louis Berthollet was commissioner of the national mint and of agriculture, a scientific advisor to Napoleon, and a senator (stamp 33). Another French chemist, Marcelin Berthelot (stamp 34), who first synthesized MeOH, EtOH, and benzene, had served in several cabinet posts, including the foreign ministry.

Political involvement may be dangerous. Antoine-Laurent Lavoisier, who appears on stamps from France, San Marino, Mali, and Grenada (stamp 35), was a tax collector, member of the "commission du budget", and deputy of the "Assemblée Constituante" and lost his head to the guillotine in the French revolution. Elena Ceauşescu, who appears with her husband on a Roumanian stamp (not shown), ruled and brought destruction to Roumanian chemistry[7] before losing her life in the 1989 revolution.

Chemists were active in sport, literature, and music. Few know that Knute Rockne (stamp 36), the University of Notre Dame football coach with the highest winning percentage in football history, was also a chemistry instructor at Notre Dame. The poems and novels of Achim von Arnim, a German romantic author of the early 19th century (stamp 37), are known more than his works on chemical topics, including organic electrochemistry. The Russian professor Alexander Borodin, who published papers on aldol, benzidine, and the Br_2/RCOOH reaction, is much better known as a member of the "group of five" Russian composers with whom he appears on stamp 38. Composing when too ill to lecture, a musician friend greeted him, "I hope that you are ill". In contrast, Sir Edward Elgar, the British composer who wrote "Enigma Variations" (stamp 39), enigmatically had "stinks and bangs" chemistry as his hobby and even invented an apparatus for making H_2S.[8]

A Universal Chemist. One of the few scientists who were philatelically honored by many countries is Louis Pasteur, and stamps 40–43 are samples from a larger number. On stamp 40, a surcharge of 0.25 F was added to the usual postal rate of 1.75 F for "the unemployed intellectuals". Could some government use a similar method for funding science in the future?

By a minor variation in his pose and hairdo, Pasteur was adopted into many local societies. The French intellectual on stamp 40 looks like a noble Pole on a Polish stamp (stamp 41), like a Russian general (without medals) on the Russian stamp (stamp 42), and like an African doctor on the Comoro stamp (stamp 43).

The Periodic Table and Its Father. Different periodic tables based on philatelic material can be constructed depending on the imagination of the constructor, by using the elements' names and their etymology, their minerals, and portraits of their discoverers.[9]

It is sad that philatelic services in the west do not find the originator of the periodic table, Dmitri Mendeleev, worthy of appearing on their stamps and that he appears only on stamps from formerly Eastern block countries [e.g., Russia (stamps 44 and 45) and Bulgaria (stamp 46)]. In stamps 44 and 46, a periodic table appears at the background (including elements A and

(6) Willstätter, R. *From my life*; W. A. Benjamin: New York, 1965.

(7) *Chem. Eng. News* **1990**, Feb 12, 21.

(8) Gillard, R. D. *Chem. Br.* **1984**, *20*, 1022 and private communication.

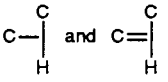
(9) For an example, see: Tirouflet, J. F. *Philatelia Chim. Phys.* **1989**, *11*, 100; **1990**, *12*, 18, 65.

X rather than Ar and Xe on stamp 44). An example of a deduction and prediction of a missing element appears on stamp 45.

Space dictates only a few examples of stamps related to the periodic table. Most elements can be displayed in different ways, and an example for the presentation of uranium, dominated by the phenomenon of nuclear fission, is given in stamps 47–51. The uranium source, the pitchblende mineral, appears on a Zaire stamp (stamp 47) (as petchblende). Stamps 48 and 49 from the FRG and the DDR represent the nuclear fission reaction in two alternative forms, and the DDR stamp also displays Otto Hahn's (Nobel prize, 1944) approving face. Hahn's two co-workers in this endeavour are also philatelically commemorated. Young Lise Meitner appears on a German stamp (stamp 50). Only the name of Fritz Strassman, who showed that the fission product is Ba rather than Ra, appears on stamp 51 showing the core of a nuclear reactor. However, he should be remembered also for his personal courage during the second world war.[10]

Arbitrary examples of building blocks for the periodic table are stamp 52 (sulfur from New Zealand), stamp 53 from Portugal showing the mineral wolframite (for W), stamp 54 from Thailand displaying a zircon (for Zr), and stamp 55 from South Africa displaying chromium, which was chosen in order to recommend teaching the story bearing its name in Primo Levi's *The Periodic Table*[11] in analytical chemistry courses.

The Liberty Taken by Stamp Designers. Benzene, a symmetrical molecule with a D_{6h} symmetry and C–C–H bond angles of 120°, usually loses its symmetry on the drawing board of stamp designers. The 1964 FRG stamp (stamp 56) having white carbons and green hydrogens has a somewhat elongated benzene[2] and four sets of C–C–H angles of 90°, 120° and 150°. The DDR benzene is from 1979 (stamp 57) and is the Kekulé hybrid of stamp 56, including the wrong angles. The Belgians who celebrated in 1966 the benzene centennial tried to fit Kekulé's elongated face into a benzene ring and ended with a squeezed benzene having six parallel C–H bonds with some C–C–H angles of 180° (stamp 58). In the Argentinian 1971 version (stamp 59), the hexagon is perfect but carbon mitosis converted all C–H bonds to C–C–H bonds and the benzene to hexacarbenobenzene. Upper Volta honored Linus Pauling in 1977 for his 1954 chemistry Nobel prize (stamp 60). Pauling would probably prefer stamp 4 rather than a nuclear explosion at his back and will probably be surprised by the new bonding features: The H3 and H4 hydrogens are differently located in the two resonance structures, and the C3–C4–H angles differ in both. Inspection also shows a double bond to hydrogen (i.e., C=HC) and bonds to the center of the C—H σ bond which we call ϕ (for philatelic) bonds.[2] The Upper Volta benzene has two types of semi-ϕ-bonds, linking a carbon to the center of a C–H bond by a single or a double bond, i.e.,



Philatelofamilies. Both scientific families (cf. stamps 18, 19, 21, and 26) and related families [husband/wife, parent/child, and brothers-in-law like Guldberg and Waage on a Norwegian stamp (not shown)] appear on stamps.

The most famous philatelofamily are the physicists Pierre and Marie Curie. However, since isolation of Ra was an analytical chemistry task and Marie Curie received both the physics and chemistry (stamp 25) prizes, we regard her as one of us. The combination of a strong-willed woman, a science pioneer, a first woman in mostly a man's world, the fierce Polish nationalism, and her persistence in following her scientific goals resulted in her appearance on close to 100 stamps, either alone (e.g., stamps 62–67) or with her husband (e.g., stamp 61 from Monaco). In her mother country, Poland, after which she named the new element Polonium, she is a national symbol and is commemorated on many stamps (e.g., stamp 62) and numerous postal cancellations. She appears with her equipment (stamps 65 and 66), with the symbols of Ra and RaA (stamps 63 and 64), and on many stamps devoted to the fight against cancer, including stamp 67, where she personally stabs cancer with her own spear.

Children sometimes follow their parents, and stamp 6 commemorates the father and son team of the Braggs. Irène Joliot-Curie, Pierre and Marie's daughter, followed her parents' radiochemical research. She and her husband, Frédéric Joliot, who after marriage added the name Curie to his name, shared the 1935 chemistry Nobel prize "for their synthesis of radioactive elements", thus increasing the number of the family prizes to five. They are shown on a French stamp (stamp 68). Frédéric Joliot-Curie also appears alone on several stamps from formerly eastern block countries, as demonstrated by those from Albania (stamp 69) and the DDR (stamp 70). He is honored there as the first president of the communist world peace movement and appropriately looks leftward in seven out of the eight stamps on which he is displayed.

Polymers. Complex molecules such as sugars, natural products and DNA which appear philatelically are demonstrated by some polymer-related stamps. Leo Baekeland, the inventor of Bakelite, one of the first commercially used polymers, is displayed on Belgian stamp 71. Both the monomer isoprene and its polymer, i.e., rubber, are shown on Malaysian stamps 72 and 73, although the stereochemistry of the latter deserves attention. The related ethene–propene copolymer appears on stamp 29. Polyethylene glycol terephthalate (Dacron) appears on a German stamp (stamp 74), a polypeptide having S–S bonds appears on a Japanese stamp (stamp 75), and a mysterious polymer appears on a Russian stamp (stamp 76).

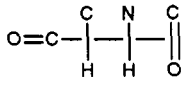
Great Chemists. Many of the pioneers of chemistry, including alchemists (e.g., Paracelsus, not shown), appear on stamps. An arbitrary sample includes Robert Boyle (Grenada, stamp 77), Joseph Priestley (USA, stamp 78), Joseph Louis Gay-Lussac (France, stamp 79), Justus von Liebig (FRG, stamp 80), and Carl Wilhelm Scheele (Sweden, stamp 81). Do we recognize in the solemn Gay-Lussac the scientist who ascended in a balloon to 7016 m without an oxygen mask and who asked his German supplier of glass tubing to seal the pieces and classify them under the custom-free item of "German air"? Did he realize that by training young Liebig (stamp 80) he transferred the French hegemony

(10) Ehrman, R.-H., letter to *Chem. Eng. News* **1987**, July 13, 47.
(11) Levi, P. *The Periodic Table*; Schocken Books: New York, 1984.

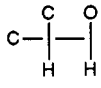
in chemistry to Germany? Who has priority in discovering oxygen, Priestly (stamp 78) as the British and probably the American post office think, or Scheele (stamp 81)?[12]

Some Organic Structures. Wohler's urea synthesis from ammonium isocyanate, which still opens introductory courses in organic chemistry, is shown on stamp 82. A very simple philateloorganic species is CH_3, shown on Mexican stamp 83. Whether this "molecular symbol of carbon" is CH_4 with one hidden hydrogen or a methyl radical, its two H–C–H angles of >120° and yellow carbon and red hydrogens of equal sizes are of interest. We note that a recent stamp from China (not shown) uses methylene CH_2 (rather than CO_2) for synthesis of $NaHCO_3$. A fully saturated carbon species is adamantane, found in Czechoslovakian petroleum, whose structure was deduced in Prague. Appropriately, it is displayed on a Czech stamp (stamp 84) commemorating the centennial of the Czechoslovak Chemical Society.

Of the many medicinally important natural products which appear philatelically, we mention stamp 85, which shows Alexander Fleming near the Hungarian penicillin, which is isomeric with regular penicillin due to its three ϕ bonds, i.e.,



Two ϕ bonds, i.e.,



and N–H–H–C bonds appear in the structure of quinine, displayed near its discoverers Pelletier and Caventou on stamp 86.

The Author's Favorites. Stamps 87–90 and post card II (Figure 3) are a few of the author's favorites. Chinese stamp 87 was traded with a Hong Kong scientist for many reprints of our work. It displays the insulin molecule which was first synthesized in China, using a new, apparently efficient, type of catalysis ("Holding aloft the great banner of chairman Mao Tse-tung's thinking and manifesting the superiority of the socialist system, we have achieved under the correct leadership of our party, the total synthesis of bovine insuline").[13] Russian stamp 88 displays the structure of the $[Re_2Cl_8]^{2-}$ ion, whose structure was first determined by USSR chemists, who however missed the special meaning of the short Re–Re bond which was recognized as a quadruple bond by F. A. Cotton. Stamps 89 and 90 offer a philatelic rationale to recent behavior in the Middle East. The amino acid displayed on 1975 Iranian stamp 89, which was issued on the occasion of an Iranian Chemical Society Symposium and mentions milk and protein, has the "abnormal" *R* rather than the natural *S* configuration. Israeli DNA stamp 90 also displays the "abnormal" helicity of DNA. Post card II (Figure 3) should console chemists who feel uneasy with the rapid progress of theoretical and computational chemistry. Even WATOC (World Association of Theoretical Organic Chemists) clearly recognizes that the Schrödinger equation is wrong, as shown by the inequality on the post card issued for its 1987 conference in Hungary.

Philatelic Chemitowns. Many postal cancellations with chemical themes are known. I will end this Account with a subgroup of these: cancellations from places carrying chemistry-related names, i.e., philatelic chemitowns.

Warnings are in order. A letter sent to Bukit Timah (Tin Hill) in Singapore will return with a "Singapore" cancellation. If one obtains a postal cancellation of Ytterby, it is not from the place which gave its name to four elements (erbium, terbium, yttrium, and ytterbium) and has no post office, but it is from a chemically irrelevant Ytterby. Nevertheless, there is an appreciable number of chemitowns, and Figure 4 displays 15 cancellations from USA chemitowns, on the ACS stamp (stamp 2).

Ancient metals such as lead (Lead, SD, No. 1), silver (Silver, TX, No. 2), and mercury (Mercury, NV, No. 3) are well represented, as are cancellations from Copper and Iron, which are not displayed. The names arise mostly from the presence of a nearby mine, which in most cases is already abandoned.

A popular chemitown name is Sulphur (No. 4–6), which is spread from Indiana to Louisiana either alone or in combination (e.g., Sulphur Springs). For example, Sulphur in Louisiana supplied 75% of the sulfur produced in the USA at the beginning of the century, and the Frasch method of mining sulfur was invented there.

The second row in the periodic table is represented by Boron (CA, No. 7), Carbon (IA, No. 8), and Ozone (AR, No. 9). The size of Carbon does not correlate with the importance of the element since Carbon had a population of 45 in 1987, including a mayor and five council members.

Cancellations from Radium (KS, No. 10), Barium Springs (NC, No. 11), and Calcium (NY, not shown) represent the alkaline-earch metals. The name Barium Springs arises from a barium-containing local spring. The other uranium fission product, Krypton (KY, No. 15) is another philatelic chemitown. The origin of the name is unknown to me. The atmosphere above another noble gas chemitown, Neon (KY, No. 14), is not especially Ne-rich. According to its postmaster, it received the name "when the railway came to the area and passengers have to put their *knee on* a box in order to board".

Anionic chemitowns also exist. The name of Telluride (CO, not shown) derives from the presence of tellurium in nearby mines. Two anions which appropriately end our Account are Br^- and Cl^-. Bromide (OK, No. 13) is a town with 175 inhabitants, and according to its postmaster, the name arises from the "abundant supply of mineral water 'bromide of sulphur' in the area". Chloride (AZ, No. 12) is larger (population 12 000). The k_{Br^-}/k_{Cl^-} (population) ratio of ca. 0.03 is the lowest known, and it will make the "discoverer" of the "k_{Br}/k_{Cl} element effect"[4,14] and the first editor of *Accounts of Chemical Research*, to whom this paper is dedicated, frown about its mechanistic meaning.

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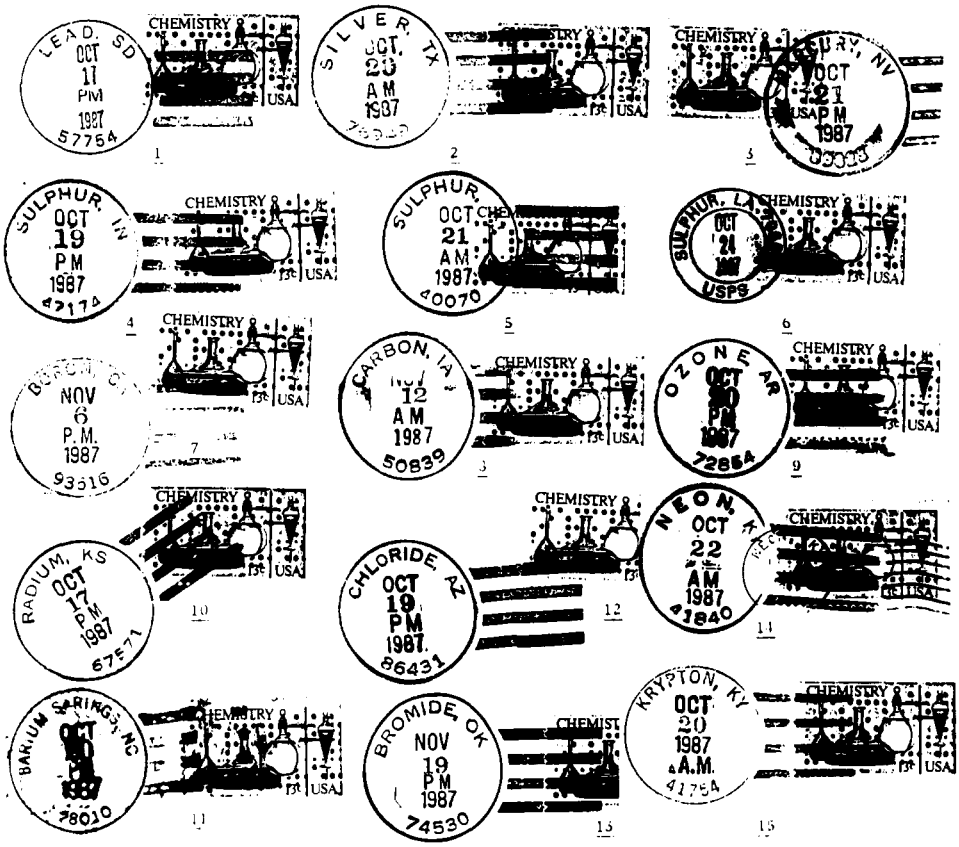

Figure 4.

chemists who supplied chemophilatelic material over the years. Thanks to Dr. David Darom for his help in photographing the stamps. I thank in advance readers who will share their chemophilatelic knowledge with me.

Supplementary Material Available: A list of countries, years of issue, and Scott catalog numbers of the 90 stamps (2 pages) will appear following these pages in the microfilm edition of this volume of the journal. Photocopies of the supplementary material from this paper or microfiche (105 × 148 mm, 24× reduction, negatives) may be obtained from Microforms Office, American Chemical Society, 1155 16th St., N.W., Washington, DC 20036. Full bibliographic citation (journal, title of article, author's name, inclusive pagination, volume number, and issue number) and prepayment, check or money order for $10.00 for photocopy ($12.00 foreign) or $10.00 for microfiche ($11.00 foreign), are required. Canadian residents should add 7% GST.

Reactions of Halodiazirines by S_N2' and Electron Transfer Initiated Processes†

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Diazirines **1** are an intriguing class of heterocyclic compounds.[1] Like their acyclic and better known isomeric diazo compounds **2**, diazirines can be induced to lose molecular nitrogen under thermal or photochemical conditions to generate carbene intermediates. Diazo compounds **2** are available from a variety of

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† Dedicated, with appreciation, to Professor Joseph F. Bunnett on the occasion of his retirement and on the 25th anniversary of his founding of this journal.

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