Rediscovery of the Elements

Paracelsus

Figure 2. Locations where the authors have found vestiges of Paracelsus in the form of monuments, museums, and plaques. In addition, there are about 30 villages or cities in this area which Paracelsus visited, but where nothing beyond eponymous streets can now be found (not marked in this figure). In his wanderings Paracelsus is documented to have traveled much more extensively than the area indicated in this map, virtually throughout all of Europe and even to Constantinople and perhaps northern Africa. (Note 1)

James L. Marshall, BetaEta 1971
Virginia R. Marshall, BetaEta 2003
Department of Chemistry, University of North Texas, Denton TX 76203-5070, jimmar@unt.edu

Phillipus Aureolus Theophrastus Paracelsus Bombastus von Hohenheim (1493–1541) was given his Christian name "Phüllip Theophratus" by his parents. He adopted "Aureolus" (meaning golden, or shining) at an early age. His family's name was "von Hohenheim," sometimes including "Bombast" from nobility two generations before. Later in his career (after 1529) he assumed "Paracelsus," meaning "better than Celsius," the legendary Roman physician.

Introduction. One of the most fascinating and enigmatic personalities in the history of chemistry is Paracelsus (Figure 1). He was a contemporary of both Agricola (1493–1546) and Martin Luther (1483–1546), living during a time of revolutionary change in European culture.1 Like Agricola, he was a humanist and strove for knowledge, but he shared the fiery and obsessed temperament of Luther. Throughout his life he was a wanderer, gaining medical and chemical information from scholars, physicians, surgeons, barbers, women, black artists, clergymen, nobles, commoners, both educated and ignorant.2 Instead of accepting by blind faith the teachings of the classical physicians, he conducted experiments on his own, carefully documenting the effect of agents on his patients.3 In contrast to ancient pharmaceutical concoctions of cow dung, snake fat, and feathers, he used purified inorganic compounds, each of which was targeted for a specific disease. He won admirers as he effected his "magical" cures, but also created jealous enemies through his successes and his belligerent attitude.

In the field of medicine Paracelsus' greatest contribution was recognizing that the human body, being a chemical entity, should be treated with chemical agents to combat diseases. Thus was created the tradition of alchemy-chemistry (medicine-chemistry), which lasted for another century.4 He is perhaps best known for his dis-
covery of mercury compounds as a cure for syphilis—still used into the twentieth century—and the use of opium ("laudanum," which he named) to alleviate pain.4

In the area of mining and inorganic chemistry, Paracelsus recognized bismuth, antimony, zinc, and arsenic, and perhaps was the first to prepare arsenic in its elemental form.6 Paracelsus asserted that elements were not the Aristotelian agents of fire, water, earth, and air. Instead he proposed three chemical substances that combined in various proportions to constitute all materials—mercury, sulfur, and salt.7 This list may sound primitive to modern chemists, but it must be remembered that this was 2 1/2 centuries before Lavoisier’s Traité.

Rediscovering Paracelsus. As an adult, Paracelsus never lived in his own “home” and one might think it would be difficult to find traces of his travels after almost five hundred years. Nevertheless, there are several sites where monuments, plaques, or museums (Figure 2) have been erected by citizenry proud to claim a piece of his legacy (Note 1).

Paracelsus was born near the Teufelbrücke (“Devil’s Bridge”) crossing the Sihl River in Egg, near Einsiedeln, Switzerland (Figure 3). Born Philipp Theophrastus, his father Wilhelm Bombast von Hohenheim was a physician, originally from the Stuttgart area, who migrated to Switzerland and married a local woman, Elsa Ochsner. Today a plaque beside the bridge commemorates his birthplace, and a neighboring restaurant/bar displays various Paracelsus memorabilia, such as old drawings of the reputed likeness of the original house.

When Paracelsus was nine (1502) his family moved to Villach, Austria, a mining area principally known for its production of lead. Here his father served as a physician to the miners of the community. Paracelsus accompanied his father to hospitals in the area and became acquainted with both physical injuries and occupational poisoning of the miners. From the smelters he learned the techniques and the philosophy of the alchemists—transmutation and the conversion of the impure to the pure.8 The house where the family lived is known (Figure 4). Fifteen kilometers to the west, the area of
Bleiberg [German = lead mountain] is no longer actively mined; the village, surrounded by mountain slopes with ancient mining scars, is known today principally for its convalescent hotels with thermal baths.

Paracelsus left Villach at the age of 14 (1507) to visit several universities in southern Europe. This was not unusual, for often one would find bands of wandering scholars during the Renaissance. The next clear record of him is in Ferrara, Italy, in 1511, where he studied medicine until 1513. Probably he was attracted to this school because progressive teachers there were promoting experimentation and were beginning to question the ancient teachings of Galen and Avicenna. Two of these teachers were Giovanni Manardo (1462–1536), who opposed the teaching of astrology in medical curriculum, and Nicolao Leonceno (1428–1524), who wrote critical treatises on errors of Pliny (Figure 5).

Until the Renaissance, the study of medicine depended strictly upon the theories of the ancient physicians, who believed the health of the body depended upon the proper balance of the four humors—black bile (melancholy = sad), yellow bile (choler = anger), blood (sanguine = cheerful), and phlegm (pneumatics = calm). (The philosophical connection of these four humors to the four Aristotelian elements is obvious.) The practice of medicine was also heavily influenced by the idea of God’s retribution upon the sinful. Hence, the art of healing involved superstition and unsubstantiated theories. The physicians, well-versed in these theories, grew to be a wealthy and prestigious class, dressed in their red robes and riding about on their white horses. Meanwhile, the
prosperity of the pharmacies was guaranteed by the physicians who prescribed the most preposterous concoctions.

It was against this background of ignorance that the Renaissance was emerging. At the turn of the fifteenth century, an artistic appreciation of the human body melded with a curiosity about anatomy, and in education centers we often find a “School of Medicine and the Fine Arts.” Typically, temporary surgery theaters were used: a single table and a few wooden benches. We are reminded by Irving Stone (The Agony and the Ecstasy) that Michelangelo (1475–1564) dissected the dead to understand the musculature of the human body for his statue David.

The Ferrara location of the “Facolta di Medicina ed Arti” was a church (Figure 5, Note 2). Because of religious restrictions, one could dissect the human body only during Carnival times when one was released from the usual religious taboos; and one refrained from dissection during the summer months when putrefaction would be a problem. The curriculum of La Facolta di Medicina ed Arti was considered important for a complete education, and we find that another famous graduate of Ferrara—Copernicus—studied there less than a decade before Paracelsus (Figures 6, 7).

After Ferrara, Paracelsus entered his “wandering years” (1516–1524), mainly as an army-surgeon in campaigns in both northern Europe and in later in Italy. These travels took him virtually over all Europe (see Fig 2). He gained much first-hand knowledge and developed techniques and medicines from practical experience. In contrast to the traditional physician who shunned direct physical contact with a patient, Paracelsus did not hesitate to take on the role of a barber-surgeon and to perform surgeries on the field. He began to understand that post-operative trauma (such as the customary treatment with boiling oil) killed patients as often as the injury itself. He developed methods for cleaning wounds, allowing Nature to take its course to heal the patient.

Returning in 1524 to Villach with his famous sword (Figure 1), Paracelsus considered a medical practice there, but instead moved on to Salzburg. The house where he lived in Salzburg, next to the communal baths, is marked with a plaque (Figure 14)—ironically within a few paces of where he died seventeen years later. Paracelsus always cared for the common man, and he became involved in the “Peasants’ Revolt” (1524–1525). When the revolt was quashed, Paracelsus barely escaped the hangman’s noose and fled westward (Note 1).

Paracelsus finally settled in Strasbourg at the age of thirty-five (1526). In this progressive city (Gutenberg developed his printing press techniques here), the status of barber-surgeons was nearly on a par with physicians. Through his multiple skills Paracelsus thrived and his fame spread throughout southern Europe: the most famous episode of his life was about to take place.

Johannes Froben, a successful publisher in Basel, Switzerland, was suffering from an ailment of his leg—probably necrosis arising from diabetes. His personal physicians suggested amputation, but Froben sought the advice of Paracelsus, who responded and journeyed to Basel in 1527. Paracelsus decided against drastic action, and through a regimen of more gentle treatment Froben was cured.

Having taken advantage of the new technological revolution in printing, Froben was very wealthy, and through his influence Paracelsus gained the title of City Physician. Although he was not a professor in the university, the new status of Paracelsus allowed him the privilege of giving lectures. This was the opportunity of his life! He now had the ability to rise to professional and social prominence.

At this critical juncture of Paracelsus’ career, he elected to use the university podium to promote his controversial views. Instead of teaching methodically in the “proper” language Latin, he blistered in colloquial German, as had Martin Luther. Thundering his stinging criticisms of Galen and Avicenna, he cried, “There is more wisdom in the laces of my shoes than in these old men.” During the 1527 summer solstice festivities (June 24) in the Marktplatz, he tossed copies of the books of the grand masters into the celebratory bonfires.

These university books were ancient hand-copied tomes and were expensive! Such a controversial figure could not long survive. His enemies consisted not only of the orthodox university regime, physicians, and apothecaries, but also the church and the aristocracy of the city. It was just a matter of time before Paracelsus was banned from Basel. The final issue was over a fee of 100 guilders Paracelsus claimed from a wealthy patient who offered only six; Paracelsus sued but lost.

Figure 9. The stairs lead up Totengsassein (“Lane of the Dead”) to St. Peters Church. This is the route taken from the Marktplatz to the church by those carrying the dead to be buried at the church graveyard. The Pharmacy Museum is immediately to the left (not in view).

Figure 10. Dr. Michael Kessler, expert of medieval history, is curator of the Pharmaziehistorisches Museum, This is the actual building—called “zum Sessel” for centuries—where Froben built his manor and publishing house, and where Paracelsus lived for a short duration in Basel.
Figure 11. This is the lodge at Bad Pfäfers, Switzerland (N 46° 58.46; E 09° 29.26). One can reach this area by a rigorous uphill hike or by local bus from Bad Ragaz (3.5 km). This building holds excellent exhibits on the history of the thermal baths there, and boasts the best museum dedicated to Paracelsus found anywhere. Mainfeld, famous for the setting of Johanna Spyri’s Heidi, is directly across the Rhine River from Bad Ragaz, whose baths are mentioned often in the novel.

Figure 12. In this 16th century copper etching, on exhibit at the Paracelsus-Gedankstätte (museum) at Bad Pfäfers, the purported healing powers of guaiac wood are depicted. To the right a house servant chops a log of guaiac which will be burned in the fireplace, whose smoke will pervade the home. To the left the patient afflicted with syphilis is ministered by the physician. Paracelsus discredited this treatment and proved the efficacy of mercurial salts.

Figure 13. Taminschlucht (Tamina Gorge) is a fascinating geological cavern through the mountains, carved over the eons by the mineral springs. A 300-meter walk up this trail takes one to the thermal baths, steading at 36°C. Paracelsus visited these baths in 1535 and wrote a paper describing its medicinal powers.

Basel) who was a close companion of Paracelsus and who carefully wrote down his observations of this dichotomous figure. Oporin noted that “noblemen, peasants, and womenfolk adulated him like a second Asclepius” (God of healing), but he was appalled that there were “hardly two hours in a day” when Paracelsus was not drunk.6 Oporin noticed that Paracelsus was a spendthrift, frequently with no money whatsoever, but then miraculously would appear back at the house “with his purse well-filled.” Originally fascinated and devoted, Oporin followed him for two years but could take no more of his uncouth ways and abandoned him.

Much in Basel can be seen today relating to this chapter in Paracelsus’ life (Figure 8). The old premises of Froben today house the historical pharmacy museum (Pharmaziehistorisches Museum), consisting of several buildings off the steep stone passageway of Totengässlein. The name of the street is derived from the fact that it was used to carry the dead from the Marktplatz to the St. Peters Church cemetery (Figure 9). The area of Froben’s printing presses now holds special art exhibitions of the museum. What was once the chapel of Froben is now a mock-up of a medieval pharmacy, complete with furnaces, retorts, and other implements. The Pharmaziehistorisches Museum (Figure 10) is arguably the best pharmacy museum in Europe (Note 3).

The character of old Basel is beautifully preserved in the neighborhood of St. Peter’s Church; some of the buildings date back to the 1300s. The Marktplatz is used for the same merchandising purposes today as it has for centuries. The site of the old university, situated on the Rhine River, and where Paracelsus lectured, still exists and is now part of the Biology Department.

From Basel Paracelsus migrated to Zürich (1527), where a plaque identifies his temporary lodgings (Note 1). Spreading propaganda leaflets, he was threatened to be locked up, and

Figure 14. Tourists in Salzburg, Austria, are familiar with (F) Mozart’s birthplace at 9 Getreidegasse, and (G) statue at Mozartplatz. Paracelsus’ legacy includes: (A) his tomb at St. Sebastian Church, 41 Linzer Gasse (N 47° 48.23; E 13° 02.83); (B) his last home at 3 Linzer Gasse (N 47° 48.11; E 13° 02.71); (C) his statue at Kurfürstpark (N 47° 48.36; E 13° 02.40); (D) where he died, 10 Kaigasse (N 47° 47.86; E 13° 02.93); and (E) his home years earlier in 1523-24 at 11 Pfeiffergasse (N 47° 47.88; E 13° 02.99).
he fled to Colmar (1528), then Esslingen (1528) (identified by a plaque, Note 1), then to Nürnberg (1529) (Note 1), where he administered to prisoners afflicted with syphilis, known as the "French disease" ("morbir gallicus").

This was a new malady, apparently imported to Europe from the New World beginning with Columbus' first voyage. Paracelsus' clinical diagnosis of the disease, reported in several essays, was classic, detailing the stages of the sickness. His treatment, utilizing mercuric salts in prescribed doses, showed that he understood the proper balance of toxic vs. effectual doses of poisonous substances, and he cured (or at least alleviated the symptoms of) several patients. The use of mercurial salts proved to be the most effective cure of syphilis for centuries, until the modern drugs of the 20th century.

Paracelsus was angering a broad segment of the important citizenry of Nürnberg. The physicians, who were confounded by the disease, were embarrassed by this unorthodox vagabond; and the pharmacists were distressed by Paracelsus' proclamations that their preparations were worthless. But most importantly, the powerful Fugger family held a monopoly on guaiac wood, a fashionable treatment for the disease (Figure 12), and they were not about to let anyone interfere with their lucrative trade in this exotic West Indies import. After Paracelsus' initial essay, he was forbidden to write any more. After Paracelsus ignored the ban and printed three essays surreptitiously, he was hounded out of town.

Paracelsus moved to the rustic and peaceful Beratzhausen, where he wrote Paragranum (1530) (Figure 1). Typical of Paracelsus' writings, Paragranum is a blend of superstitious and rational thought. Listing the four fundamentals of medicine as philosophy, astronomy, alchemy, and ethics, it proceeds to recommend specific chemicals to treat diseases rather than the ancient vile concoctions of the ancients.

The following year Paracelsus moved on to St. Gallen, Switzerland (Note 1). Because of the Reformation, the monastery was vacated, and he was given a kitchen in which to prepare his chemicals. This was a special treat for him, because he ordinarily prepared his medicines on an ordinary hearth beside the simmering soup of an inn's daily fare. In St. Gallen he wrote Opus Paramirum (1531), where he first postulated mercury, sulfur and salt as the basic chemical elements.

After an excursion into Italy, Paracelsus returned to Bad Pfiefer, Switzerland (1535) where he analyzed the mineral water, assessing it for its curative powers. Paracelsus wrote a report on the healing qualities of the baths for Johann Jakob Russinger, the local magistrate. Today Bad Pfiefer boasts a magnificent museum devoted to the history of the baths and to Paracelsus (Figure 11). This museum is the best available for a scholar of Paracelsus; it includes facsimiles of his books and letters (Figure 12). Tourists can visit not only the museum and the historical baths, but also the mysterious Tamina gorge (Figure 13).

After having endured so many scandalous episodes, Paracelsus was finally reprimed by a brief resurgence of fame. In Pressburg (modern Bratislava, Slovakia) he was honored by a ceremonial dinner by the city magistrate (1537), now commemorated by a plaque (Note 1). He held audiences with Ferdinand I in Vienna (1538); today Vienna remembers Paracelsus with a memorial in the beautiful Donaupark (Note 1). However, by now Paracelsus was aging; he was rambling more, becoming more of a preacher than a physician. Bishop Ernst of Wittelsbach took pity and invited him (1540) back to Salzburg for refuge—the city from he fled years before. Here Paracelsus spent his final year, expiring on September 24, 1541.

Today Salzburg remembers Paracelsus by a number of plaques and memorials (Figure 14). City tours are careful to include the memorials of Paracelsus along with those of the famous son of Salzburg, Wolfgang Amadeus Mozart. Although Paracelsus lived north of the river just across the present Staatsbrücke, he frequented the more socially active south Salzburg and "died as he lived, on a bench in the chimney corner of an inn" (Figure 15). A man of strong Christian faith, his funeral was held at the cemetery of St. Sebastian, where he was interred. After two centuries his bones, as well as the gravestone, were moved inside the church (Figure 15).

**The Legacy of Paracelsus.** To Paracelsus' credit are 364 books, with 122 titles of chemical interest. Most of these books are posthumous, frequently copied from manuscripts gathered by Oporin; several titles are of doubtful origin and perhaps were written by devoted followers. Steeped in the culture of the times, we find his writings alternatively superstitious and modern—at one moment he is discussing the effect of the planets on the body, and the next is brilliantly diagnosing an illness.

Paracelsus was a genius, well before his time. His knew the old beliefs were wrong, but he was restricted in his advance of chemistry because the language of the scientist did not yet exist. Paracelsus attempted in vain to understand the "invisible influences" which were ascribed to magic, and he could only describe phenomena in alchemical or astrological terms. However, he had the insight to utilize experimentation in his quest—and thus was involved in the birth of "natural magic" i.e. science. He urged alchemists to stop searching for the philosopher's stone and ways to make gold, and instead to find true medicines. As he hungered for answers that were beyond his grasp, he raised the dignity of chemistry by removing it from the alchemist's forge and by demonstrating its necessity for medicine.

"Believe in the works, not in the words; words are an empty shell, but the works show you the master."

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(continued)
Notes.

Note 1. More detail regarding the sites identified in Figure 2 follows.

1493, Einsiedeln, Switzerland. A monument at the city park (4.5 km south of Paracelsus' birthplace) is inscribed with many of Paracelsus' quotations (Schiedenstrasse, N 47° 07.66; E 08° 45.06). Engravings of Einsiedeln's landscape, dated during the 1500s, may be viewed in the Bad Pfäfers museum (see Figure 11); they include the Teufelbrücke and the reputed home of the Hohenheims with its characteristic "gothic cross" weathervane.

1525, Bad Liebenzell, Germany. Today in the Schwarzwald (Black Forest) a luxuriant thermal bath/hotel complex "Paracelsus Therme" (1. Reuchlinweg; N 48° 46.16; E 08° 43.99) caters to the well-to-do. Two large plaques describe the history of the area and the visit of Paracelsus.

1526, Strasbourg, France. Thirty statues of famous persons associated with the ancient university adorn "la cimaise" (roof ornamental molding) of the Palais Universitaire, including the likes of Kant, Leibniz, Goethe - and on the wall south, Paracelsus (Rue de l'Université, N 48° 35.06; E 07° 45.73).

1527, Zürich, Switzerland. The Hotel zum Storch en Zürich (Am Weinplatz, N 47° 22.28; E 08° 32.52) bears a plaque commemorating the visit of Paracelsus. On the walls inside the lobby and coffee shop are attractive mural paintings portraying the area in 1576 and in 1770.

1528, Esslingen, Germany. The attractive, half-timbered historical home where Paracelsus stayed is remembered by portraits and plaques on the outside walls (corner of Untermetzgerbach and Plieniausstrasse; N 48° 44.40; E 09° 18.32).

1529, Nürnberg, Germany. Although no specific memorial exists for Paracelsus, the Germanisches Nationalmuseum (1 Kartäusergasse, N 49° 26.92; E 11° 04.52) furnished much information about the stay of Paracelsus in Nürnberg, describing how he was involved in the ancient monastery (Kartäuserkloster), located at the precise spot of the museum. These cloister buildings, built of carved red sandstone, have been incorporated into the museum and give the visitor a true feeling of the times of Paracelsus.

1530, Regensburg, Germany. Paracelsus finished the final draft of Paragranum in Regensburg, which gives tribute to him by his bust being included in Walhalla (hall eulogizing the famous German dead) on the Danube River (48 Walhallastraße, Donauaust; N 49° 01.88; E 12° 13.44).

1531, St. Gallen, Switzerland. Paracelsus spent 117 days at a house "zur Wahrheit" (52 Gallusstrasse; N 47° 25.35; E 09° 22.53), still beautifully preserved, before departing for Augsburg. The monastery (Kloster St. Gallen, 200 meters northwest) where he practiced in his "alchemical kitchen" has been designated a UNESCO site. The exact location of this laboratory kitchen is not known.

1537 Pressburg (modern Bratislava, Slovakia). The site where Paracelsus visited and was entertained by the local nobles is now the "Primate Palace" (Primácie Námestie; N 48° 08.65; E 17° 06.60), famous because of its Hall of Mirrors picture between France and Austria in 1805. A plaque (in Latin) on the east wall commemorates the visit of Paracelsus.

1538 Wien (Vienna), Austria. The site where Paracelsus had audiences with Ferdinand I was in "Schweizerhof," now part of the huge castle complex (near Josefplatz, N 48° 12.41; E 16° 21.98). In the Donaupark, north of the Danube River, a memorial and flower garden has been dedicated to Paracelsus (N 48° 14.50; E 16° 24.70). This memorial is 300 meters north of the conspicuous Donauturm (tower restaurant) in the park.

Note 2. F. Jaeger presents a photograph erroneously ascribing the site of Paracelsus' medical studies as a building he identifies as "Die Universität zu Ferrara." This building (via delle Scienze 17, N 44° 49.98; E 11° 37.31, 700 m SW of San Domenico) is actually the "Palazzo Paradiso," built in 1391 which indeed housed a major portion of the university but did not absorb the medical school until 1567. The building now serves as the Biblioteca Communale Arostea (opened in 1753), a source of much of the information used by the authors. A wooden anatomy theater built in 1731 still exists in Palazzo Paradiso.

Note 3. Wotiz suggested the best pharmacy museums in Europe are the Pharmazie-historisches Museum in Basel, the Deutsches Museum in München, and the Apoteker Museum in Heidelberg. In the authors' view, the most grandiose museum is in München, the most attractive to the beginning student is in Heidelberg, but the most detailed and scholarly is in Basel.

References.

11. Essays from Nürnberg include Von Holz Guyaco griechischen Helling [On the healing powers of guaiac wood], 1529; Three different essays on Von der französischen Krankheit [On the French disease], 1530, combined into Drei Bücher just before Paracelsus left Nürnberg.