Historical Note
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On the contributions of Paracelsus to nephrology

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One of the most intriguing figures in the history of Renaissance medicine is Paracelsus. He lived through a transitional period of science when Europe, having sloughed most of its medieval sheath and nearly through the first half of Renaissance scholarship, characterized by revival of early classicism, was just beginning to formulate the rudiments of its modern form. Parallel to the changes then occurring in religion with its Reformation, and in the arts with its free Baroque style, science, in general, and medicine, in particular, also were embarking on something new and completely different. This was a decisive turning away from the doctrines of the ancients to the more direct investigative approach that was to define medicine by the end of the sixteenth century. It was a century of great reformers (Luther, Vesalius, Paré, Michelangelo, Erasmus, Copernicus) amongst whom Paracelsus pursued a meteoric rise and came to occupy a distinctive, albeit challenged, position.

Life of Paracelsus

Paracelsus was born in the winter of 1493, in the Swiss village of Einsiedeln, to Wilhelm Bombast von Hohenheim, a graduate of Tübingen and practising physician assigned to the hospital of the Benedictine Abbey there, and his wife, Els Ochsner, a bondwoman of the local Bishop. He was an only child, whose mother died shortly after his birth. His early education was provided by his father, who moved to Villach in Carinthia in 1502 and practised there until his death in 1534. Having decided to study medicine, and according to the custom of the time, Paracelsus began to travel to different centers of medical learning. However, where most students would go to a handful centers, he rambled throughout Europe (by his account: Spain, Catalonia, England, Denmark, Prussia, Latvia, Poland, Hungary, Croatia, Dalmatia, and Sicily) and ventured into Constantinople and Alexandria. In August of 1524 he resided briefly in Salzburg, which he left in 1525 to appear in Strasbourg in December of 1526 where he registered as a citizen and physician, claiming to have acquired his degree from the Medical School at Ferrara in 1515 [1-5].

At the time of his alleged graduation the eminent teachers of Ferrara were Nicola Leoniceno (1478–1524), a critic of Galen and Pliny; Gian Battista de Monte (1498–1551), a proponent of bedside teaching; and Celio Calcagnini (1479–1541), a predecessor of Copernican astronomy. These Renaissance scholars could have installed the critical approach that was to characterize Paracelsus for the rest of his life, but are never mentioned by him in his writings. But then, neither is Copernicus (1473–1543) mentioned by William Harvey (1578–1657), who was a student in Padua when Copernicus was teaching there [6,7].

He must have been a successful practitioner in Strasbourg for he soon left for Basel, at the invitation of Johann Fröben (1460–1527) to treat an infection of the leg. Fröben was a prominent publisher, a humanitarian, and a friend of one of his editors, Erasmus (1466–1536). It is in Fröben's house that Paracelsus met Erasmus, and on their joint recommendation that he was appointed in June of 1527 a Town Physician of Basel, which included a position on the medical faculty at the University. He soon posted a list of his lectures in German and within 3 weeks of his appointment threw a classical medical text into a bonfire that the students had lit on Midsummer’s night. These symbolic gestures of his departure from traditional authority and intent to reform are reminiscent of those of his contemporary, Martin Luther (1483–1546), and the basis of his subsequent appellation, in scoff, 'Lutherus medicorum' or the Luther of Medicine [8]. His lectures, given mostly in German, attracted some 30 or more students compared to the half-a-dozen who attended the lectures of his peers, given in the customary Latin. The hostile environment created by the jealous ire of the local medical profession, a legal action brought by a squabble over medical fees with a prominent citizen, Canon Liechtenfels, and the death of his protector, Fröben, whom, it was whispered, had been poisoned by medications he had prescribed, soon led to his hasty departure from Basel in 1528 [1,9].
He then yielded to his restless disposition and resumed his itinerant lifestyle, sometimes travelling to treat prominent citizens who consulted him, and at other times wondering dubiously through various Swiss, German, and Austrian towns. In 1540 he sought asylum in Salzburg where he died the following year, destitute and unmourned. He is known to have anticipated his demise as he wrote his will three days before he died. Much like the rest of his life the cause of his death has been a source of controversy. It has variously been attributed to an accidental or homicidal fracture of the skull, to liver failure, and to kidney disease. In support of kidney disease is a report that the skull, examined in the 1880s, revealed stigmata of rickets. In support of liver failure, is the report that he was jaundiced during the last year of his life [1,10]. While both his kidney and liver failure may have resulted from his long exposure to potentially toxic chemicals, used in the practice of his trade, the liver failure has been attributed to heavy drinking. Congenital syphilis is another cause that has been proposed on the basis of his body build. Paracelsus was a rather short and bald man, whose appearance is preserved in at least two authentic portraits by August Hirschvogel from 1538 and 1540, as well as others [Figures 1-4]. His 'eunuchoid' features coupled with his celibacy has been a source of malign speculation [1-10].

With an enlightened mind, endowed by a rebellious spirit, a creative urge, and an unquenchable thirst for new knowledge, Paracelsus never ceased to learn, explore, and write. A man of strong convictions he challenged the medical world by his insistence on experimental proof as opposed to reliance on tradition, yet he hated discursive proof and relied on his own intuitive and interpretative method that must have been perceptive and clear enough to produce the scientific contributions that are credited to him. As arrogant as he was knowledgeable, he condemned the prevalent texts, especially those of Galen and Avicenna, and abused academic physicians while praising his own studies. He was a hard headed destructive critic, and a rather vulgar intellectual bully with a volcanic temperament who made many enemies and critics, not only during his life but also after his death when his writings were finally published [11].

A copious writer, he left a larger body of written doctrine than any previous medical author since Galen. Only a few of his writings were published in his lifetime. None contain the controversial appellation of Paracelsus and all appear under his given name of 'Theophrastus von Hohenheim'. The self-bestowed Paracelsus, a latinized paraphrase of Hohenheim (High Home) according to the fashion of the time, and other acquired or conferred apppellations were not used by him. After his death, his writings were compiled by Johannes Huser and published by the Waldkirch Publishing House in ten volumes at Basel in 1589–1591. Amongst these are several attributed to followers who likely elaborated on his hurriedly written original travel notes, or straightforward plain imitators, while some of his own writings were falsely attributed to fictitious predecessors, in an effort to discredit his originality [9,12]. His manuscripts written in Old German and dog Latin are not devoid of superficiality, superstition, and grandiloquence, yet the clarity and insight he demonstrates in some of them is striking [11,12]. None more so than in what he wrote on dropsy and its treatment. A contribution he must have been proud of for the epitaph on his grave in the churchyard of Saint Sebastian in Salzburg reads:

'Here lies buried Phillipus Theophrastus, distinguished Doctor of Medicine, who with wonderful art cured dire wounds, leprosy, gout, dropsy and other contagious diseases of the body, and who gave to the poor the goods which he obtained and accumulated. In the year of our Lord 1541, the 24th September, he exchanged life for death.'

**Dropsy and mercury**

His exposition of dropsy is a good example of the insight and clinical acumen that Paracelsus could bring
to his work. His recommended treatment with mercury is one of his important contributions to pharmacology.

In medical notes about dropsy, presumably written around 1520 and subsequently published as the first of his 'Eleven Treatises on the Origin, Causes, Signs, and Cure of Individual Diseases', he comments on the accumulation of oedema using the German, Wassersucht, for dropsy water or dropsical fluid; which he stresses is different from that of water since it is a fluid generated from the solution of tissues [13]. He portrays the disease as one of progressive swelling, starting in the feet and gradually involving the whole body 'until the spirit of life is drowned in it, like a man in a flood that overtakes him'. He then describes the sense of pressure in the epigastric region, oppression around the heart, shortness of breath, and cough, concluding that: 'All these things are the disease called "Wassersucht" which in the end reddens the urine, splits open the skin and seeps through it, and there may be thirst. In some it increases quickly, in others slowly, according to the impression from the heavens; and in the same course they die'.

This succinct but masterly description is followed by that of the prognosis: 'If the patients cough continuously and lose their colour and the moon rules their lack of breath, for it is from her that the rain and impression of this disease go forth, and if thereupon there is a breaking open, spontaneous seepage, and the mouth and eyes turn yellowish, the nose becomes sharp, the fingers become thin and form wrinkles, the urine decreases and thickens, nature has quite abandoned this patient and there is little hope of bringing her back; but without these signs there is good hope'.

For treatment he recommends removal of the accumulated fluid by 'mercurial essences'. A concept that is an example of his quest for 'specific' remedies which is the basis of his being acknowledged as a founder of pharmacology: 'For example, Mercury is the specific remedy in dropsy. This is due to a morbid extraction of salt from the flesh, a chemical process of solution and coagulation. As such this process does not depend at all upon quality and complexion, but is a "celestial virtue" endowed with its own "monarchy" to which quality and complexion are subservient. Mercury will drive out the dissolved salt, which has a harmful corrosive action on the organs, and preserve the solid—coagulated state of the salt in the flesh, where it is needed to prevent putrefaction. Mercury will effect the cure specifically in everybody, although it causes vomiting in one and sweating in another. Neither vomiting nor sweating—the universal cures of the ancients—are therefore the curative factors. Hence he errs who says the patient must be cured with sweating or vomiting, as he fails to consider the manifold variety of man and that any effect of such
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remedies is merely the expression of the different reaction of individuals to the same remedy, not the cure itself. This is a remarkable description of the diuretic action of mercury that provided the basis of its use in dropsical patients. While the toxic effects of mercury limited its utility it was to remain an integral component of the therapy of dropsy well after the discovery of digitalis. Paracelsus used inorganic forms of mercury, including mercurous chloride, or calomel. Various mixtures of calomel with foxglove and squill, named after prominent physicians (Addison’s Pills, Baillie’s Pills) or famous institutions (Guy’s Hospital Pills) continued to be used for the treatment of dropsy through the second decade of the twentieth century.

His introduction to the chapter on dropsy is a good example of his use of analogy to illustrate a principle: ‘As the rain corrupts the earth, makes it too moist, drowns it, interrupts its functions, if the heavens in their impressions cause a downpour beyond temperance and measure, so it also covers man in his earth—and pours down on him. This is the dropsy with which this chapter deals’. A compelling picture which provides some insight into the writing style of this remarkable man.

The physiologic notions of Paracelsus, stripped of their cosmic terminology and astrologic connotations, are quite impressive [9,11]. He believed in a correspondence between the macrocosm, or the outer world, and the microcosm, or man. An apparently hazy concept, with celestial and astrological overtones, but one which stated otherwise really is not different from the ‘milieu exterieur’ and ‘milieu interieur’ of Claude Bernard (1814–1878). Since man’s inner nature is invisible, he proposed, the physician has to rely on the observation of the external world and then find its correspondence to the inner world. This correspondence Paracelsus termed ‘anatomy’, used in the figurative rather than literal anatomy, of which he did not think highly and termed ‘dead anatomy’, for it did not disclose how the living body functioned. His ‘anatomy’ was the one that allowed for ‘dissection’ of the outer world in order to get insight into the workings of the inner world. It is this figurative use of anatomy which forms the basis of one of his important contributions to chemistry: urinalysis [9].

Urinalysis

Natural philosophy and its successor—modern science—arose from an accurate conception of the universe and the laws governing natural phenomena. In this, Paracelsus was clearly instrumental in the transition from the chaos of alchemy to the disciplined analysis of chemistry. For this he has been acknowledged, admittedly not without some criticism, by most historians of chemistry [9–11, 14–16]. In fact, his major contribution to the medical sciences has been considered his emphasis on the role of chemistry in medicine. The quantitative approach of Paracelsus was an outgrowth of his times and can be traced to his predecessor, Nicolaus Cusanus [1401–1464]. Cusanus, a Cardinal and mathematician advocated estimation of the weight of blood and urine in clinical medicine and use of a water clock to determine the rate of pulse and respiration in the diagnosis of disease [6,9,17]. ‘Disease stands on weight, number and measure’, he wrote. It is this notion that Paracelsus developed and promulgated in his chemistry [9,14].

The medical chemistry that Paracelsus most influenced was the analyses of mineral waters and urine. A strong opponent to the prevailing art of uroscopy, or simple inspection of the urine to identify diseases, Paracelsus championed instead the chemical ‘dissection’ of urine [9]. He reasoned that since urine is comprised of wastes derived from the entire body its chemical analysis would provide the same information that could be derived from dissecting the body. ‘The urine’, he wrote, represents ‘spagyrical man hidden in his own urine’. He maintained that no information could be obtained from the urine short of its dissection by extraction, coagulation and distillation. Extraction was to reveal its salt content and true sweet, bitter and sour qualities, coagulation to separate the morbid ‘species’ out from the urine, and distillation to examine the residue. The urine was to be assessed also by weight, thus introducing the assessment of specific gravity. Clearly a solid and scientific approach, which
Unfortunately swayed from mainline science in its intricate use of the distillation process [9].

As suggested by him and developed by an early follower, Leonhardt Thurneisser (1530–1595), the dissection of urine entailed its distillation in gauged cylinders, shaped to correspond to the human body in which the urinary vapours ascending in distillation were said to condense at that part of the still which corresponded to a region of the body (Figure 5). The various fractions of distillate and its residue were then interpreted to reveal the type of disease and its location in the body. While the instructions he gave for the ‘reading’ of these deposits have been stigmatized by his critics as a new brand of uroscopy, his overall approach to analysis of the urine definitely constitutes a progressive step.

Independent of their subsequent criticism, the methods of Paracelsus unquestionably relegated medieval uroscopy to the history books and laid the foundation of chemical analysis of the urine. The new system incorporated sound scientific principles such as careful collection of urine in inert containers, its accurate measurement and weighing and some chemical analysis. It is the assertion that the urine mirrors human anatomy that was its weakness. Under any circumstance, out of the revolt in urinalysis started by Paracelsus developed the idea that the qualitative components of urine could be expressed quantitatively—in numbers rather than in descriptive terms. It was to provide an impetus for its subsequent scientific reform by the Paracelsus naturalist Johanne Baptist Van Helmont (1577–1644), a Capuchin friar, physician and chemist, who described carbon dioxide. Van Helmont made significant advances in the analysis of urine and the more extensive use of the balance to determine specific gravity as an aid to diagnosis and prognosis [9].

His use of urinalysis prior to rendering diagnosis or prescribing therapy is preserved in the court records of Basel and the diary of his friend and patient, Nicolas Gerbel, secretary to the Strasbourg Cathedral [18]. In his ‘Paramirum’ (Tract IV, Book 3) he comments on the diagnosis of kidney disease from the examination of the urine: ‘This excrement is contained in the urine and excreted with it and is the deposit (hypostasis): Hence the deposit appraises the kidneys in their distempers’ ... ‘The separation of urine from its deposit requires a special technique, through which the way to diagnosis of kidney disease is opened’ [9].

Proteinuria

Paracelsus considered ‘albumen’ in the urine an important indicator of disease, which he precipitated by the addition of acid [9]. In the chapter ‘On the Milk of the Kidneys’, from his 1527 lecture in Basle on ‘Diseases Due to Tartar’ (Book 2, Tract 3, Chapter 3), he writes: ‘Food and drink are separated in the stomach into an impure excrement of the nature of Sulphur and a fluid which is transmitted to the liver, where it changes the colour of the food to red. The part of this fluid that the liver does not keep for its own nutriment is sent to the kidneys. The kidneys digest this in turn, and the first product is white, like milk, because of the Sulphur contained in the fluid; the second product is red; from the third phase of digestion, the kidney retains its nutriment and excretes the rest with the urine. Each of the three digestive phases takes 50 minutes. Failure of the second digestion in the kidney will leave the milky product of the first phase unchanged, and milky urine will be voided. If rennet is added to this (‘ein Kässmaigen’), it curdles and produces a whey (‘molcken’), or if vinegar is added, a separation takes place. The deposit is not pus, but milk. I have seen a beggar who voided ‘milk’ with his urine for five years and this weakened him to death. When he added wine or vinegar to this milk, it coagulated, or when he left it standing for a few days, cream separated on top’ [9].

This chemical manipulation of the urine to detect proteinuria clearly pre-dates those of Frederik Dekkers (1648–1700) and Domenico Cotugno (1735–1820).

The kidney

In one of his authentic texts, ‘Paramirum’, a theoretical work on the etiology of diseases, he writes: ‘In the body, take note, are embedded seven members. These seven members do not take in any food; they rather exist in themselves like the seven planets which feed on their own resources and none feed off the other nor imbibe from the other heavenly bodies. The explanation follows: Jupiter is a planet such as does not require fertilizer for the maintenance of its body. When created, it received...
sufficient endowment. Likewise the liver has no need for being fertilized, for it maintains its nature without manure’ ... ‘The same as you have comprehended these things in the case of Jupiter and the liver, understand likewise that the brain is the Moon, the heart the Sun, the spleen Saturn, the lungs Mercury, the kidneys Venus. As the firmaments above have their course and aspect, identically the same understand take place in these’ [19].

A more liberal reading of Paracelsus, granting him the use of analogy and metaphor, does add to the wisdom of what he goes on to say about the organs, beginning with the heart: ‘The heart is the Sun’ ... and on to the kidneys: ‘The kidneys have their venerial disposition and the exaltations more or less like Venus according to how both have been predestined. The effect which Venus has serves to bring forth fruit on earth. In a similar manner does the influence of the kidneys extent over the human fruit, so that it is not Venus that produces anything in the body or exercises any influence. Only the kidneys have that power, and nothing else. Just as Venus is stimulated by receiving that power from the Ens Magnum, so do the kidneys received it from man’s mind’ [19]. Paracelsus’ use of the planets, a remnant of the late Middle Ages when this practice came into fashion, has been faulted. Can this detract from his scientific contributions? If so, then what of William Harvey, who over a century after Paracelsus, accorded the heart the exalted position of the ‘Sun of the Microcosm’?

Of interest with regard to the kidney is his correspondence with Erasmus [5]. Shortly after the cure of Fröben’s foot, Erasmus consulted Paracelsus by letter about his health, which, Paracelsus diagnosed as gout, inflammation and kidney disease. His response, written in Latin, addressed: ‘To the Distinguished Patron of Theologians, the worthy Master Erasmus of Rotterdam, most skilled in all learning’, signed simply as ‘Theophrastus’, reads as follows concerning the kidneys: ‘The third disease—to speak more openly—occurs when some substance—be it internal pus, congenital or accidentally gathered phlegm, sediment from the urine, tartar from the vessels, mucus from the residue of sperm, internal nutriment humour, degenerate bituminous fatty tissue—or something of the sort—begins to coagulate through the effect of salt (in which resides the principle of Coagulation). I have not diagnosed that these substances have been generated in your case, but all my views on the subject of the little lumps of marble-like mineral matter of the kidneys themselves will be found under the heading “Coagulated Substances”’. Erasmus, also writing in Latin responded: ‘... I have been aware of the kidney trouble for many years. This third ailment I do not sufficiently understand, still it seems to be probable that there is some harm. If there is any citric solution that can ameliorate the pain, I beg that thou will communicate it to me ....

**Conclusion**

In summary, a survey of the life and works of Paracelsus reveals a scientist who worked in a chemical laboratory, but one who never dissociated himself from mythical terminology; a physician who was an astute observer and shrewd clinician, but one who never distanced himself from cosmology; and a pharmacologist who established specific therapy for specific diseases, but one who never abandoned ‘arcana’ and secret remedies. He can specially be faulted for his disdain of anatomy and physiology which were beginning to develop and were to emerge as the major advances in medicine by the end of the century. All these shortcomings notwithstanding, he was clearly an original thinker, who having critically marshalled the contributions of his predecessors and contemporaries, formulated them into the skeleton of a discipline that came to be known as Paracelsian. However crude some of his late writings might have been, read selectively and deprived of his free use of myths, analogy, and metaphor they stand out clearly enough to establish a direct line to modern medicine. To quote George Sarton, a founding father of the history of science; ‘Once we understand the special context in which he is to be perceived he proves marvellously productive of ideas’.

Some of his writings may appear non-rational to us, but others are as lucid as anything found in the literature today, as shown in this brief but selective review of his contributions to nephrology. It is only fair that nephrology should adopt him as one of its own, as have chemistry, pharmacology and other sub-specialties of medicine [11,14,20].

**References**