

PROFILES IN TOXICOLOGY

Paracelsus: Herald of Modern Toxicology

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“No one who can stand alone by himself should be the servant of another.”

Paracelsus, Philippus Theophrastus Aureolus Bombastus von Hohenheim, the “father of chemistry and the reformer of materia medica,” the “Luther of Medicine,” the “godfather of modern chemotherapy,” the founder of medicinal chemistry, the founder of modern toxicology, a contemporary of Leonardo da Vinci, Martin Luther, and Nicholas Copernicus, was born near or in the village of Einsiedeln near Zurich, Switzerland, on 10 or 14 November 1493. His father, Wilhelm Bombast von Hohenheim, “was the impoverished scion of a noble family of Suabia.” He was a physician and an alchemist who “had married a Swiss girl and practised medicine on the pilgrims’ road that leads to the Benedictine Abbey of Einsiedeln.” In 1502, following the death of his mother, the family moved to the mining town of Villach in Carinthia in southern Austria, where the father became the municipal physician and also taught chemistry. The father combined his interests in chemistry and medicine with his patients’ experiences in the mines and in the smelting plants and became an expert in occupational medicine. The young Paracelsus, headstrong, stubborn, and independent, grew up in a home environment where chemistry and biology were paramount and he learned a great deal from his father, who became his role model. He decided he wanted to be a physician/chemist like his father.

Paracelsus grew up during a period of Renaissance humanism when most intellectuals and scholars became enchanted with antiquity, with old manuscripts, with ancient Greek, Egyptian, and Latin writers, philosophers, physicians and scientists. Answers were sought in these old writings. There was an utter fascination with things old. Medicine turned to (rediscovered) Galen, the “Prince of Physicians.” But there was another school that was developing during this period, and this was the school of the naturalists who sought truths, including divine truths, in the study of nature and in man’s relationship to the macrocosm. Which approach would be appealing to young Paracelsus?

Paracelsus studied at a number of universities in Europe, receiving his baccalaureate in medicine in 1510 and his doctorate in 1516 from the University of Ferrara. It was at this time that he assumed the name Paracelsus (para: beside, beyond, and Celsus: a famous Roman physician). His stubbornness had evolved into a rebellious spirit and he began to challenge the system of medicine including teaching and practice. He was disenchanted with universities and noted that “The universities do not teach all things.” To broaden his knowledge, to learn more, and to gain experience, he traveled throughout Europe, the British Isles, Egypt, and the Holy Land; he was exposed to the latest developments in chemistry and medicine. He became an itinerant physician/surgeon. He returned to Villach in 1524 as the municipal physician and remained there until 1527. During that time, and as a result of his wanderings in search of knowledge, he contemplated many fundamental issues such as the meaning of life and death, health and the causes of disease (internal imbalances or external forces), the place of humans in the world and in the universe, and the relationship between humans (including himself) and God. This led to the development of a Paracelsian approach to medicine and a unique philosophy and theology. He was a free thinker, an iconoclast, and a theosophist. He became a reformer (hence the term the “Luther of Medicine”), a scientist, and a mystic. He tried to convince the members of the medical profession and the medical faculties (who conspired against him) and the public about the importance of chemistry in medicine and other concepts, but most refused to listen. “He yelled his message at them and became more and more bitter and aggressive.” For example, in 1527, he accepted the position of municipal physician in Basle. This also involved lecturing at the University of Basle, considered then (as now) a privilege. Because of his fame, his lectures were well attended. His disenchantment with the teaching of medicine at the university and with the practice of medicine reached its climax on 24 June 1527, St. John’s Day, when he publicly burned the standard medical textbooks of the day (e.g., Avicenna, Galen). He challenged the reigning medical experts and lost. This eventually led to his leaving the university and the city of Basle—a frustrated and angry free

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thinker and medical innovator, not understood by the students, not accepted by his medical colleagues, and not appreciated by the local gentry. He continued his travels. He was eventually called to treat the bishop of Salzburg, Ernest of Wittelsbach. Paracelsus died in Salzburg on 24 September 1541 at the age of 48, a bitter, frustrated, and angry reformer.

Paracelsus' publications include several almanacs and a few medical works, but his most famous text was *Grosse Wundartzney* (published in 1536), which dealt with medical problems and had several chapters on the treatment of gunshot wounds. He published *Von der Bergsucht oder Bergkranckheiten drey Bucher*, reputed to be the first book on occupational disease, (miners' disease) in 1533 or 1534. He criticized the current treatment of syphilis and the use of guaiac in his *Vom Holtz Guaiaco grundlicher heylung*, published in 1529, and in *Von der Franzosischen kranckheit Drey Bucher* (1530).

Let's examine some of Paracelsus' contributions to medicine, to toxicology, and to philosophy and theology.

"The physician must pass through the examination of nature, which is the world, and all its causation. And what nature teaches him he must commend to his wisdom, not seeking anything in his wisdom, but only in the light of nature."

Paracelsus tried to bring chemistry and the scientific method into medicine; he used chemistry and chemical analogies in his teachings to medical students and to the medical establishment, who found them objectionable (and some still do!). He believed that body organs functioned alchemically, that is, they separated pure from impure. He discounted the humoral theory of Galen, whose newly rediscovered works became the foundation for medicine. Galen postulated that there were four humors in the body (blood, phlegm, and yellow and black bile); when these were in balance, one enjoyed health, and when there was an imbalance, sickness ensued. Paracelsus, the alchemist, believed in three humors: salt (representing stability), sulfur (representing combustibility), and mercury (representing liquidity); he defined disease as a separation of one humor from the other two. Galenists believed that a disease of certain intensity would be cured by a medicine of opposite intensity (principle of contrariety). Paracelsus and his followers espoused the position that like cures like; that is, "a poison in the body would be cured by a similar poison," (principle of similitude) but the dosage is very important." Although he wrote that "nature hints at cures," he felt that many herbal preparations lacked sufficient potency to treat current diseases. Paracelsus introduced (actually reintroduced) into medicine the use of inorganic salts, metals and minerals (although some had been used by the ancients). Plants were out and chemicals were in. Paracelsus ushered in the era of "New Chemical Medicine."

Paracelsus also believed that diseases tend to localize in a particular organ (target organ), a concept developed further as target organ of toxicity. He aroused the ire of the medical establishment by denouncing Galen and his works, by bringing

chemistry into medicine, by introducing new chemical agents (inorganic salts, metals, minerals) into medicine, by stressing the dosage of the medicines used, and by trying to reform medical education. Because his approach to the body was chemical, he could be considered a chemical anatomist. He also encouraged physicians to use common sense, to sharpen their powers of observation, to gain experience, to travel, and to practice humility (and he wondered why they did not accept his advice!). He believed that medicine should be based on the four pillars of philosophy, astronomy, chemistry, and virtue. He believed that medicine was a divine mission and that physicians should not lose sight of this, and that character was more important than mechanical skill (applicable even today!). All of this was deemed heresy and not acceptable to the medical community of his time. Paracelsus was addressing the issue of educational reform for physicians, the relation of religion to science and medicine, and the value of ancient wisdom (ancient authority) in relation to evidence obtained from observation (and subsequently to experimentation). It seemed that Paracelsus was single-handedly taking on the entire medical profession. However, time would prove him correct. Unfortunately, recognition would only come after his death, but his influence on medicine was very significant.

Paracelsus may have believed that his critics were too harsh and he said of himself: "Nature has not made me subtle, nor have I been raised on figs and white bread, but rather on cheese, milk, and oat bread, and therefore I may well be uncivil to the hyperclean and the superfine; for those who were brought up in soft clothes and we, who were brought up among fir-cones, do not understand each other well. Thus I must seem rough, though to myself I appear gracious. How can I not be strange for one who has never gone wandering in the sun?"

Paracelsus extended his interest in chemistry and biology to what we now consider toxicology. This was undoubtedly due to his father's interests and influence and to his involvement in occupational medicine. He very clearly expounded the concept of dose response in his Third Defense, where he stated that "Solely the dose determines that a thing is not a poison." This was used to defend his use of inorganic substances in medicine, because his critics claimed that they were too toxic to be used as therapeutic agents. His belief that diseases locate in a specific organ was extended to include target organ toxicity; that is, that a chemical has a specific site within the body where it exerts its greatest effect. Paracelsus also encouraged the use of experimental animals to study the effects of chemicals for both beneficial effects and to identify toxic effects. As in medicine, the influence of Paracelsus on toxicology was enormous.

Paracelsus was a deeply religious and philosophical person who was concerned with many of the basic issues that still confront us today: who are we, what is our relationship with nature and with God, is there an after-life, what about the soul. This was part of his approach to psychiatry. He believed that there were two forces acting in all humans and these forces,

animal and godly, were antagonistic. To be successful (whatever that means) involves suppressing the animal forces within us. Interestingly, he denounced the view that psychoses were demonic in origin. He also espoused the notion that mind/will/spirit/soul can influence the state of the body and can cause or cure a disorder. Was he saying that we can will ourselves good health?

What a role model for toxicologists and physicians! Here was an intelligent, well- educated, free-thinking, deeply religious, and independent iconoclast. He did not blindly accept what was taught and accepted by the academic community, nor did he do what was politically correct. He challenged the experts and demanded that they rely on data/facts and not on authority; one cannot/should not argue without facts. He identified issues, deliberated on them, and developed approaches to resolving them. His approach was scientific. But he also stressed the importance of character, including virtue. Can a cad be trusted as a physician, as a scientist, or even as a human being? Would there be ethical problems in science if all scientists were of impeccable character? Highly unlikely! Paracelsus also stressed the importance of experience, as not everything that is known/knowable is in the university. Knowledge plus experience makes an expert. Maybe it is time to harken back to some of these basic tenets of Paracelsianism. Perhaps Henry E. Sigerist summed it up best when he said (in the preface to his book *Paracelsus, Four Treatises*, 1941), "In

publishing this book we wish to contribute our share in reviving the personality of an honest man who was a great physician and a staunch fighter for what he considered the truth. It is so easy to be orthodox and to reap honors by repeating what people expect and wish to hear. Progress, however, is achieved through the clash of ideas, and heretics like Paracelsus are a ferment without which there would be no life."

"And this which you must consider is something great: there is nothing in Heaven and on earth which is not in man. And God, who is in Heaven, is in man."

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