

## Public Health Classics

This section looks back to some ground-breaking contributions to public health, adding a commentary on their significance from a modern-day perspective. For this month's theme, Binswanger & Smith relate environmental health to the myth of Dr Faustus.

## Paracelsus and Goethe: founding fathers of environmental health

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The writings of Paracelsus and Goethe were separated by nearly three centuries and were published long before public health was a recognized profession, yet they could hardly be more relevant to environmental health problems today.

In his great dramatic poem *Faust*, 1832, Goethe (1) confronts the promises and pitfalls of the Industrial Revolution and the economic growth that it generated. As finance minister at the Court of Weimar he was well placed to comment on these developments, and his insights remain astonishingly relevant. As we ponder whether the new riches that we are amassing in some parts of the world are real or illusory, it is worth taking a closer look at how Goethe dramatizes this question (2, 3).

Goethe shows how, through a combination of economic activity and technological progress, the subjugation of nature and natural forces is effected. In his poem, a section of coastline was enclosed by a dyke and transformed into a garden "like an Eden". It seems miraculous, a feat of alchemy: what had been economically worthless became something valuable. Faust, representing modern man, carries out this massive project of economic progress, but Goethe also shows the existing and potential dangers associated with it. Human progress entails curbing nature by constructing an artificial world of cities, industry, transport, and intensified agriculture, symbolized in *Faust* by land reclamation. Goethe shows us that such interference in the natural environment may have unforeseen consequences because nature reacts according to its own laws, which humans can never entirely predict. Unanticipated consequences may wipe out, wholly or in part,

the successes gained by earlier interventions or cast retrospective doubt upon them.

Goethe draws attention to three dangers. First, environmental damage may ensue, exemplified by a "foul morass" in the reclaimed land because there is no outflow for the stinking water. This is a consequence of the shortsighted construction of the dyke, which led to the formation of algae and the silting up of drainage channels. As attempts are made to correct these mistakes, new ones are made, requiring further corrections. Thus Faust's megalomaniac project is never-ending.

Secondly, to realize his plans, Faust needs more and more land. So he drives out the established population — the old couple, Baucis and Philemon — from the dunes above the newly embanked land. The beauty of the natural landscape, which had evolved and been carefully maintained over centuries to become everything we associate with the idea of "home", is now ruined.

Thirdly, novel risks arise that could completely destroy Faust's entire project. For example, the dyke that he sets against the might of the ocean could break. Faust knows this, but he believes that if all available forces are coordinated, all possible dangers can be overcome (Part II, Act V):

*How'er may rage the angry baffled tide,  
Striving to sap, to force an entrance, each  
And all rush swiftly to close up the breach.*

But Mephistopheles disagrees:

*Yet all your labour's spent for us alone.  
With your fine dams and bulwarks vast,  
You're but preparing a superb repast  
For Neptune, the sea-fiend, to feast upon.  
You're trumped and done for every way,  
Into our hands the elements play,  
Destruction onwards is striding fast.*

The real danger is that Faust — modern man — will not acknowledge the need for careful planning to forestall such damage as he pushes on relentlessly,

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not seeing what is going on around him. Goethe symbolizes this blind irresponsibility by Faust's loss of eyesight. In other words, Faust is so obsessed with his plans to subdue nature that he loses sight of realities that may call for careful reflection and possibly a total rethinking of the project. Thus mankind compounds its natural limitations — its inability to understand nature's complexity — with blindness induced by hubris.

In these ways Goethe's poem can be seen as a founding classic of environmental health sciences. Particularly striking is how Faust finds his greatest sense of fulfilment in what today we would call economic development, building dykes to drain land for new and better factories and farms, pushing back nature for the good of humanity. The unforeseen consequences of these efforts have a familiar ring: pollution and noxious waste, destruction of traditional habitats, and new types of catastrophic risk. It would be difficult to make a more succinct list of the current concerns in environmental health.

The first famous poet to be inspired by the Faust myth was Christopher Marlowe, who wrote *The tragical history of the life and death of Doctor Faustus* (probably first acted in 1592). His Faust made a straight bargain with Mephistopheles: 24 years of supernatural power through immense knowledge in return for his soul. When the time was up he went to hell (4). Goethe's Faust makes a wager, which is not at all the same as a bargain (5, 6):

*If e'er at peace on sluggard's couch I lie  
Then may my life upon the instant cease!*

Mephistopheles quickly takes him up on it, and Faust makes it even more clear (Part I, lines 1692–1702):

*My hand upon it! There!  
If to the passing moment e'er I say  
'Ob, linger yet! thou art so fair!  
Then cast me into chains you may  
Then will I die without a care!*

He commits himself to losing his soul if he ever becomes satisfied with the immense new powers he will gain, opting for a long ride on the tiger's back, to mix in a Faust-like myth from Asia. Does he want to win or lose?

Our own Faustian arrangements also tend to be more bets than bargains, since the important ones involve great uncertainty about the risk to human health involved. To what extent are we endangered by the immense increase in the production of synthetic chemicals? How might loss of biodiversity through habitat destruction harm us? How will we be affected by climate changes caused by greenhouse gases from energy production?

Many of our Faustian wagers tend not to be so grand, however. The history of the environmental health risk transition has been dominated by little ones. We solve the hazards of the household (dirty food, water, and air) to some extent by pushing them out to the community where they become urban air pollution, hazardous waste and the like, in the hope

that we will later be able to deal with them. Then, as in most of the industrialized world, community-level hazards may be brought under reasonable, if not ideal, control, but at the cost of the long-term global risks such as those associated with greenhouse gas emissions and biodiversity loss. In each of these cases, the risk is pushed further off in time and space, but not eliminated (5, 6).

Marlowe, writing in Renaissance England, took his story from a combination of historical and fantastical tales. Two of the more prominent historical characters were a Dr Faustus (1480–1538) and Paracelsus (1493–1541), who were contemporaries of Copernicus, Leonardo da Vinci, Christopher Columbus and Martin Luther. Faust, whose name was taken for the myth, was a German magician-cum-charlatan, a braggart, and an extraordinary character, who probably had hypnotic powers (7). Paracelsus had similar traits but in many ways was as much of a revolutionary as the other Renaissance giants (8). Born near Zurich as Theophrastus Bombastus von Hohenheim, he upset his colleagues by vigorously condemning all medical teaching not based on experience. He made a number of advances that laid the foundation for transforming medical science from its medieval to modern forms. His statement, "Solely the dose determines that a thing is not a poison" (9), though often misquoted (10), is an essential tenet of modern toxicology and, through the disciplines of environmental transport, exposure analysis and risk assessment, of environmental health science itself.

Last decade, to mark the 500th anniversary of Paracelsus's birth, a number of commentaries were written in health science journals about his life and work (e.g. 11–14). His influence on the Faust myth was missed, however. It was Paracelsus's success in describing phenomena accurately and accomplishing cures where others had failed that imbued the Faust myth with credibility and a sense that his powers were somehow derived from the supernatural. Not given to modesty (his penname implies that he goes beyond Celsus, the first-century Roman medical encyclopaedist whose work was the first medical text to be printed, in 1478), Paracelsus fuelled this impression. "We shall be like Gods", he wrote. "Natural magic will make it possible to see beyond the mountains, to divine the future, to cure all diseases, to make gold, and even to duplicate God's greatest miracle — the creation of man himself" (8). Many would argue that science has either achieved or will soon achieve most of these things in one way or another, but some would also worry about what Faustian wagers are made in the process.

The life and writings of Paracelsus thus come down through half a millennium to provide the basis for two of the most important principles of environmental health sciences:

- the dose makes the poison;
- be wary of solutions that are Faustian wagers in that they just postpone problems rather than solving them.

Indeed, given that we live in a world of finite lifetimes for individuals but indefinite lifetimes for societies, a concern for “dose” really means a concern with “dose rates” (15). Reducing dose rates sufficiently to protect individuals may not necessarily protect society indefinitely. In this sense, then, both principles as written here are actually two different ways of stating the same one.

Sustainability is only possible if our society understands that less can be more, that in economic production what matters is not so much the amount

produced but its increased utility, and that, accordingly, both quantitative and qualitative growth can benefit humanity without damaging nature or pushing risks off into time and space. Perhaps modern humanity, may never, as Faust once hoped and Paracelsus predicted, reach levels of accomplishment that bring a moment so lovely that we would want to hold on to it forever. But if we strive to develop a more respectful relationship with our environment, we may come closer to creating such a moment. ■

## References

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F A U S T :

A DRAMATIC POEM,

BY GOETHE.

TRANSLATED INTO ENGLISH VERSE

BY

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M D C C C L X V .

DEDICATION.

**Y**E come, dim forms, as in youth's early day  
Ye bless'd these eyes, which now so lonely  
grieve!  
Still, still, to hold ye fast shall I essay,  
Still let my heart to that delusion cleave?  
Ye throng me round! Well! lord it how ye may,  
As from the mists ye rise, that round me weave!  
Ye waft a magic air, that shakes my breast  
With youth's tumultuous, yet divine unrest.

Visions ye bring with you of happy days,  
And many a dear, dear shade ascends to view;  
Like some faint haunting chime of ancient lays,  
Come love, first love, and friendship back with you;  
The heart runs back o'er life's bewilder'd maze,  
And pangs long laid to sleep awake anew,  
And name the loved ones lost,—before their day  
Swept, whilst life yet was beautiful, away.

Alas, alas! These strains they cannot hear,  
The souls to whom my earliest lays I sang;  
Gone are they all, that band of friends so dear,  
The echoes hush'd, that once responsive rang:  
My numbers fall upon the stranger's ear,  
Whose very praise is to my heart a pang,  
And all who in my lays took pride of yore,  
Are lost in other lands, or else no more.

And yearnings fill my soul, unwonted long,  
To yonder still, sad, spirit-world to go;  
Now, like Æolian harp, my faltering song  
Rises and falls in fitful cadence low;  
A shudder thrills me, as old memories throng,  
The strong heart melts, tears fast on tear-drops flow;  
What I possess seems far, far-off to be,  
And what hath pass'd away becomes reality.

