CHEMICAL ANALYSIS AND MEDICINE

by John H. Lienhard

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Today, medicine leads us to modern chemistry. The University of Houston's College of Engineering presents this series about the machines that make our civilization run, and the people whose ingenuity created them.

Change was afoot in the 16th century -- what we call the Renaissance. It was a new age of art and music but, even more, a new way of learning. Medieval scholars had tried to deduce the truth through logic. Now we began, systematically, to observe the material world around us. Science, as we understand the word today, was just coming into being. And our modern concepts of chemistry were forming within the field of medicine.

Medieval alchemists believed that matter was made of subtle essences: earth, air, fire, and water. They tried to deduce, logically, how imbalances of the essences caused illness. They expected body fluids, especially urine and blood, to reflect those essences.

Medical historian Stanley Reiser tells how a physician would fill a special flask with a patient's urine and hold it up to the light. He'd associate its gradations in color with areas of the patient's body. A certain coloration near the top meant that the illness was affecting the patient's head, and so forth.

One alchemist knew that was a shell game. The Swiss doctor Paracelsus spoke like an alchemist. But he used the means of modern science. He said, if you want to know how urine relates to illness, distill the fluid and study its solid residue.

So Paracelsus steered us into methods of analytical chemistry. The examination of body fluids was giving alchemy a new purpose and new means. Today, our own doctors use centrifuges instead of distillation. But their purpose is the same as Paracelsus's.

The other obvious fluid, blood, is harder to read than urine. Most of its story must be told on the cellular level. It was more than a century after Paracelsus that science was ready to deal with blood. In 1684, two English scientists published papers that practically demanded that medicine begin serious chemical analysis.

Thomas Willis renewed Paracelsus's call for the analysis of urine by distillation. That, he argued, was how we could learn its salt content. At the same time the great scientist Robert Boyle wrote an extended treatise on distilling blood.

But Boyle didn't deal with the sick. The blood he studied came from healthy people. Boyle grumbled that he, at least, had shown what the composition of healthy blood ought

to be. And so the line between chemists and physicians remained blurred until only 150 years or so ago.

None of these analyses could bear full fruit until we had microscopes that could descend to the cellular level, until we had a molecular theory of matter, and until we understood bacteria.

But the need to understand how our bodies work is primal. That need finally drove us to invent a new chemistry of analytical observation -- and to finally replace the old alchemy of pure mind.

I'm John Lienhard, at the University of Houston, where we're interested in the way inventive minds work.

(Theme music)

Reiser, S.J., *Medicine and the Reign of Technology*. Cambridge: Cambridge University Press, 1978. (See especially Chapter 6.)