their own laws as long as these did not conflict with public laws, as Paulus writes in the passage on the Senate in the paragraph "On points of dispute".

Suetonius describes how the Emperor Vespasian greatly favoured not only intellectual, but also manual work, which was called mechanical, and made sure that even the most humble classes of workers found employment and a means of earning, so much so that when an architect boasted he could transport an enormous amount of material to the Capitol at little expense, the Emperor replied, "you must not stop me from feeding my people".

Thus, since both in the past and nowadays, laws have been enforced in civilized cities to protect workers, it is only right that medicine makes its own contribution to help and alleviate those the State is trying to help. Particular attention should be paid to looking after their health, an aspect that has been neglected until now, so that they are able to carry out their profession without danger as far as possible. I, for my part, have done my utmost, and did not believe it beneath me to enter the most humble workshops to observe the characteristics of their manual labour. On the other hand, nowadays the field of medicine also applies observations that are derived from mechanics. I would like to point out, to my medical colleagues in particular, that in actual fact all the trades I have described are to be found in all situations and, furthermore, that the same trades may be practised in a different manner in certain regions. This means that the diseases caused by those trades may differ from the ones I have described. In artisan workshops, through first-hand observation, I have therefore tried to gather all pertinent observations and suggest medical recommendations for both the treatment and prevention of the illnesses that usually afflict these workers. So when a doctor is summoned to treat a patient, he should not immediately feel his pulse without inquiring about his circumstances and pronounce judgement as he usually does. Just like a judge, the doctor should sit down, on a stool or bench if needs be, or on a gilded chair in the house of the rich and should talk to the patient amiably before he decides whether he should be offering medical advice or humane compassion. There are numerous questions the doctor should ask the patient or those around him. In De affectionibus Hippocrates says, "When you come to a patient's house, you should ask him what sort of pains
he has, what caused them, how many days he has been ill, whether his bowels are working and what sort of food he eats”. One more question should be added to this list: “what is his trade?” When the patient belongs to the common folk, this question is of the utmost importance, as it helps identify the cause of his illness. In practice, doctors rarely ask their patients this question. However, if for some reason the doctor already knows what trade he carries out but pays little heed to it, he is actually compromising the effectiveness of any treatment. I therefore ask you, dear reader, to give this treatise a friendly reception as, although it might not be a work of great art, it was written for the good of society as a whole and for the comfort of workers; or if you prefer: “Accept this work, which was not written in the hope of attaining glory, but from a sense of duty and the wish to be of use to others”. 
Diseases of miners

I believe there are two causes for the variety of serious illnesses that afflict workers. These are diseases that are caused by the very work that should give them their daily bread. The first and most important cause is the character of the materials being used which, by producing vapours and toxic dust particles, leads to certain diseases; the second can be attributed to the violent and unnatural movements that impair the very structure of the body, thus gradually resulting in serious diseases. First of all, I shall therefore list the diseases that are caused by the toxic nature of the substances being used and those that afflict miners and any other workers who handle minerals in their profession, such as goldsmiths, chemists, and those working with acids-potters, mirror makers, founders, tinsmiths, painters and others.

Miners are all too familiar with the danger mineral deposits pose, since they are forced into physical contact with them in the bowels of the earth and have to reckon with death each day.

As Ovid rightly says: “They entered the bowels of the earth, and excavating brought up the wealth it had concealed in Stygian shade, wealth that incites man to crime”.

Referring to the evil that corrupts the souls and morals of men, the poet is denouncing the avarice and madness of those men who had tried to bring that so-called treasure to the surface for, as Pliny so aptly said, “We have set a price on all that is good”, although it is the source of countless ills. The poet’s words may just as well be applied to the diseases that afflict the body. The diseases miners and other metal workers suffer from the most are asthma, phthisis, apoplexy, paralysis, cachexia, swollen feet, loss of teeth, ulcerated gums, as well as pains in their joints and palsy. In these workers it is the lungs
and brain that are affected, the former in particular. This is because the lungs absorb the dust particles and mineral gases together with the air, and are thus the first to be affected. Once the dust particles and gas reach the vital organs and enter the bloodstream, the natural constitution of the brain and nervous fluid are altered and impaired, resulting in the tremors, numbness and ills described above.

The mortality rate of those extracting minerals from mines is usually very high. This is why miners' wives marry more than once; indeed, according to Agricola, in mines in the Carpathian region there are women who have married no less than seven times.

Lucretius has the following to say about miners: "Perhaps you have not seen or heard how many usually die very quickly and in what numbers?".

Thus, both in the past and today, in mining regions extracting metals is regularly regarded as a form of punishment. Indeed, those found guilty of the most serious crimes are condemned to the mines. In the past, followers of the Christian faith were also condemned to the mines, as one can read in Gallonio's treatise De Martyrum cruciatibus. There is also a letter on the subject from San Cyprian to the bishops and deacons who had inhumanely been condemned by the emperors to extract metals in the mines. In it, he exhorts them to prove themselves to be the true gold of Christ in the very mines in which they have been forced to extract gold and silver. In Pignoria's study De servis there is an ancient picture that shows just how terrible the conditions were that these people found themselves in – their heads were half shaven (to distinguish them from fugitives who were completely shaven) and covered with a coarse woollen hood. Despite the fact that they are well protected with clothes and nourished with suitable food, I do not believe the appearance of miners today is much better. Having to stay in such gloomy places without any light, when they do come out into the fresh air, they seem to have arisen from the dead. No matter what mineral is extracted, miners are afflicted by serious illnesses that cannot be treated, even if some suitable remedy is duly prescribed. One should ask oneself, however, if the actual service of medicine in "prolonging a life of misery" is truly to be considered an act of charity. However, since princes and merchants often derive great benefits from mines and the use of metals is practically indispensable in all kinds of production, their health deserves attention and
THE DISEASES OF WORKERS - MINERS

their illnesses ought to be studied so precautions and remedies may be offered. In the past as today, those who wrote about metals also took this aspect into consideration. These very authors described miners' diseases and their working and living conditions in great detail, as well as the most suitable remedies. For example, Giorgio Agricola and Bernardo Cesi, a Jesuit from Modena. In his work Mineralogia, what the latter wrote as regards those condemned to the mines and the precautions and diet metal workers should follow is of considerable interest. The same can be said of Athanasius Kircher's work Mundo Subterraneo, Francesco Lana's Magisterum artis et naturae and Ramelov's treatise in German on the paralysis and tremors of metal workers. It is essential that any kind of defence and relief from the extremely wretched conditions these workers find themselves in is to be derived from the field of medicine. Furthermore, since there are infinite kinds of mines, each of which is noxious in its own characteristic manner, studies should be carried out to see how the miner's organism is poisoned in order to identify the most effective and rapid remedies.

Some mines are damp with pools of water that have settled at the bottom while others are so dry that fire is needed to split the rocks. In damp mines with stagnant water, the miners' legs are not only affected by the dense, poisonous gases formed from the water but also, and above all, when rock fragments fall into the stagnant water, the workers fall suffocated to the ground or come out half-dead. Moreover, although it usually eliminates poison, when used to break rocks, fire brings forth poisonous vapours that then circulate and the poor miners are surrounded by all the elements that are so noxious to their health.

However, the most merciless illness miners are afflicted by comes from working in mercury mines. Indeed, in his treatise De Metalibus et fossilibus Falloppio writes that those who work in mercury mines barely survive three years' work. Furthermore, in his work Mineralogia Ettmüller writes in his chapter on mercury that within just four months, they are overcome with palsy of the limbs and suffer from vertigo and paralysis, all of which is caused by the mercurial fumes that are so harmful to the nervous system. In a letter sent from Venice to the Royal Society, in Transactions of the Royal Philosophical Society (England), one can read that in certain mercury mines in Friuli, no miner is allowed to work for more than
six hours; and in the very same letter mention is made of one miner who was sentenced to work for six months and had become so poisoned with mercury that when he held a piece of copper to his mouth or held it in his fingers, it would turn white. In the second part of his *Praxis*, Luca Tozzi writes in the chapter on asthma that mercury miners are afflicted by asthma; their teeth also tend to fall out, and to ensure they do not inhale the fumes, quick-silver refiners usually have their backs to the wind.

In *De asthmate ac tussi* Van Helmont describes a particular type of asthma that he classifies as something between dry and humid asthma. He believes that this form afflicts miners, minters and other workers of this kind; the cause should be looked for in the metal fumes they inhale with the air and which then obstruct the pulmonary vessels. In his work *Pathologia medica dogmatica*, Wedel mentions mountain asthma, stating that those working with metals are prone to this illness and that Stockhausen wrote an entire treatise on this kind of asthma, attributing the cause of the illness to the mercury found in lead; indeed, there is a great deal of mercury in lead, which is what makes it so heavy. The same author describes how these metallic fumes produce this terrible illness known as mountain asthma. He believes that the illness is a result of the bronchi drying up and being blocked by soot. In his book *De consensus et dissensu Chymicorum cum Galenicis*, Sennert recounts what he was told by a doctor who practised in the metal mines in Friuli, and that is that the very same metals the miners were extracting were to be found in their bodies once they were dead. In his invitation to Massimo Giunio who was living in the Friuli mountains at that time, Statius aptly compares the miners to men from the underworld, because they come out of the mines “all pale at the sight of Dis and yellow as the gold he has unearthed”.

Thus, since the metal's characteristic colour also breaks out in the humours, “unless those humours flow inwards” as Galen writes in his first book *Aphorism*, note 2, and this is to be observed in nearly all these illnesses, it is not surprising that the colour of the miners' skin is similar to that of the metal that has entered their bloodstream. It is conceivable that the same thing occurs in miners' lungs as in furnaces where metals are smelted and pompholyx, cadmium, and other mineral concretions are produced from the soot that rises in the air.
In vitriol mines, the workers are also afflicted by serious respiratory ailments. In *De simplic. medic. facultate*, Galen describes a cave he saw in Cyprus where the miners were extracting a liquid to obtain vitriol. He says he went down almost one eighth of a mile and observed drops of green water trickling into a lake, surrounded by a suffocating and unbearable odour. He also adds that he saw naked workers carrying this water with the utmost haste and getting out as quickly as possible. Indeed, nothing is more harmful to the lungs than any acid full of vitriol. I am sure that countless clinicians would laugh if they saw a professor, a researcher in natural history, risking a descent underground to study nature's most hidden secrets. I am well aware that I was a subject of scorn when I undertook the risky search of the sources from which the Modena springs gush forth; the same occurred when I went down the petroleum wells in our mountain regions. But they should learn from Galen, who went on lengthy pilgrimages to study nature's most hidden secrets with ardent curiosity to discover the true virtues of medicines. These digressions aside, let us return to our subject.

Not only internal, but also external organs are afflicted by serious injuries - hands, legs, eyes and the mouth. In the mines around Meissen, where black pompholyx is extracted, the workers' hands and legs are eaten away to the bone. Agricola says "The nails of the houses nearest to the mines are made of wood", because it has been observed that pompholyx corrodes even iron.

There are even more serious illnesses in the mines - the cause is a sort of living pest that attacks the wretched miners, leading to their deaths. These are tiny animals that belong to the spider family. Citing Solinus, Agricola calls these spiders "light-shunners". These little animals are to be found in silver mines in particular, and when the miners sit down on them they are bitten without realizing, and according to Agricola, these bites have extremely serious consequences. Furthermore, the miners are tormented and petrified by these "little demons and phantoms". According to Agricola, this kind of demon can only be driven out by prayer and fasting. For more on this subject, see Kircher's *Mundo subterraneao*. I have been told by an expert mineralogist from Hannover, who is now surveying the mineral veins in the mountainous regions around Modena, by order of our Sovereign, that what is said about these little demots that nest in the mines is no myth, as I once believed.
In fact, in the mines in Hannover, which are relatively renowned in Germany, he assured me with the utmost seriousness that there are frequent cases of miners who say they have been attacked by demons they call *Knauff Krigen*, and very often the miners die within three days while those who survive are actually healed. These underground demons are also mentioned in the *Transactions of the Royal Philosophical Society* (England).

The aforementioned expert mineralogist also told me that in the mines of Goslar, where vitriol is extracted in the form of powder, miners work naked. Indeed, if they were to remain dressed throughout the day, when they came out their garments would be reduced to dust, and this might be why in Galen's day the workers carrying the liquid containing vitriol in Cyprus were also naked.

Since infinite kinds of minerals are to be found in the bowels of the earth (thanks to the work of chemists, the nature and character of both the minerals and fossils appear to be sufficiently understood) it is almost impossible to state which and how many specific harmful substances are to be found in this or that mine and how they affect one part of the body rather than another. For this reason it must suffice to say that that closed air, inhaled via the mouth because of the necessity to breathe, air that is saturated with particles that are extremely harmful to the lungs, brain and vital organs, results in a standstill in the blood mass and vital organs, thus rapidly leading to countless serious illnesses.

It will therefore be the responsibility of those supervising the mines, together with the physicians offering their services there, to make every possible effort to ensure the personal safety of the miners and to do their utmost to ensure they are harmed as little as possible, should it be impossible to remove the specific cause for these diseases. When these men fall ill, they should be treated in much the same way as those suffering from incurable illnesses and who are not usually denied the medical services or remedies to alleviate their ills. Hippocrates says one needs to study incurable diseases precisely so they cause as little harm as possible.

To purify that closed infected air, whether from the exhalations emitted from the minerals and miners' bodies, or from the combustion of lighted lamps, the mine supervisors remove the thick stale air and introduce new, purer air by means of ventilators that are connected with the bottom of the mine by shafts. Furthermore,
they usually protect the miners' hands and legs with leggings and gloves. It is a well-known fact that the ancients also worried about miners' safety; indeed, according to Julius Pollux, they would cover their heads with leather sacks.

According to Pliny, workers involved in the preparation of minium would tie bladders around their face so as not to inhale the perilous dust, but still be able to see. According to Kircher, cited previously, in mines today and in arsenic mines in particular, they wear glass masks as a safer and more suitable solution. Quoting an expert mineralogist, the aforementioned author prescribes various remedies for both prevention and treatment. He strongly recommends a potion made up of oil of tartar, laudanum and oil of colchotar be distilled to make a brew that must be taken three grams at a time. As a preventative measure, he also recommends sauces rich in fat and generous amounts of wine. For the sick, he not only advises a balsam of nettles and lodestone, but also that they season their food with salt of nitre and salt extracted from alum. In his work *Chymia experimentalis*, Junken suggests sweet spirits of salt be used against metallic vapours.

Gargling with milk is very effective against throat and gum ulcers since it absorbs the corrosive particles that have adhered to those parts. This is why Agricola, cited previously, states that butter is very good for those working in lead mines.

Pliny recommends powdered limestone of Assos for lesions on legs and hands which occurs in mines where black crude zinc oxide is mined. He continues that it has been shown that miners whose legs have been ruined by metals are healed in mines with this kind of stone. In all likelihood, this stone is able to null the corrosiveness of metals owing to its own particular erosive strength, which is why it is called *Sarcophagus*, flesh-eater. In *De metallicis* Cesalpino writes that this stone, once found in Assos in the Troad, is not to be found in our regions and suggests it be replaced with another that can be found on the island of Elba, where mineral alum is mined.

In *De aëris inspiratiónes laesa*, Etmüller suggests several specific remedies for asthmatic diseases caused by metal fumes. Common remedies are ineffective in these forms of asthma. For this serious disease he therefore suggests sweet mercury, turbeth mineral, purgatives, diaphoretic antimony, antidotal preparations of gold, and similar remedies.
Mineral dust and gases cause considerable harm to the eyes as well. Once again, the remedy is to be sought in the mineral kingdom. Horst treated eye diseases caused by metal fumes that could not be alleviated with local remedies by administering minerals internally. However, copper-scale based eye-salves are recommended, a remedy that the ancients also used. Indeed, according to Macrobio workers in copper mines were not afflicted by eye diseases due to the drying power of copper and this is why Homer called copper “flashing bronze”.

Prepared with copper scales, saffron and spodium, Celsus also favoured the eyes-salve of Cleon. Nitre may also be added to the eye-salves since, according to Pliny, “Workers in nitre mines do not have swollen eyes”, a fact that has also been observed more recently. In short, the most suitable and effective remedies to fight diseases caused by metals must be sought in the mineral world in particular, according to one of nature’s truly providential rules, that the remedy of ill lies in its origins. Or as the proverb goes, one must “use for a bad knot a wedge to match”.

It is not only the miners who are afflicted by the diseases caused by metals but also all those who work around the mines, such as those who transport, smelt, cast and refine the material that has been extracted. These workers are afflicted by the same diseases but not as seriously since they work in the open; due to the metal fumes they inhale, as time goes by they become asthmatic, splenetic, affected by sleepiness and insomnia until they become consumptive.

In just a few words, Hippocrates gives us an apt description of the appearance of a metal worker: “The right hypochondrium of a man who works metals is taut, his spleen enlarged and his abdomen swollen and rather hard, he breathes with difficulty, is pale and suffers constant pain in his left knee”. Such a careful commentator in Epidemiorum, it is astounding that Valles paid scant attention to that passage by Hippocrates. Indeed, he has disregarded this disease complex in relation to metal workers. No other commentator perceived the importance of this account although Galen did actually pay heed to this passage, but only to concentrate on what Hippocrates meant with the word pneumatodes, whether the swelling of the abdomen or his laboured respiration. There is no doubt that with just a single word Hippocrates intended to identify the cause of such serious illnesses. For the majority of those who
work metals are asthmatic and splenetic, their abdomens are extremely hard and their faces anaemic. Foes translates Hippocrates' expression "the mine workers" more extensively, thus embracing both those mining the minerals and those working in the vicinity. Therefore, not just the miners, but anyone living in the vicinity of the mines is afflicted by the effects of the metal fumes that dampen their vital spirits and souls, upsetting their bodily functions. All these people should also be prescribed the same remedies described above, but in milder doses.
Chapter II

Diseases of gilders

From the mines to the workshops of Vulcan where “the red-hot iron bars glow and hiss in the caverns and the blaze comes out of the furnaces”, we come to the cities where there is no lack of workers who have been afflicted by minerals. Everyone knows all too well what terrible ailments goldsmiths suffer as a result of their contact with mercury, especially during the gilding of silver and copper objects. Indeed, since this cannot be done without amalgam, when the goldsmiths evaporate mercury using fire, even if they turn their faces away, they cannot help but inhale these poisonous fumes. It is for this reason that within a brief span of time those very workers suffer from dizziness, asthma, paralysis, and assume cadaverous features. Very few of those who continue this profession reach old age and, if they do not die young, they are in such a terrible state that one would wish them dead. In his work *Chymia experimentalis* Junken wrote that these workers suffer from palsy of the neck and hands, they lose their teeth, their knee joints fail, and they have scurvy. Fernel writes the very same in *De abditis rerum causis* and in his book *De lue venereal*, in which he describes the sad case of a goldsmith who became dazed, deaf, and almost completely dumb while he was gilding a silver object and inhaled mercury fumes. Forest describes a similar case in which a goldsmith was paralysed after involuntarily inhaling mercury fumes. In *Acta Medica et Philosophica Hassiensi*, Olaus Borrichius gives a detailed description of a German who spent his life gilding sheets of metal. The author recounts that when the latter imprudently inhaled mercury fumes, he was overcome with dizziness and a great sense of heaviness in his chest, his face became pale as death, his limbs trembled, and he showed signs of asphyxiation, so much so that it seemed he was
about to die. The gilder recovered once he had been administered various antidotal potions and, in particular, a tea made of pimpernel root and saxifrage that made him sweat profusely. Borrichius believes that when these tiny mercury particles evaporate, they come into contact with the nerves, thus causing tremors and then, once they enter the bloodstream, hindering regular circulation. If I were to include all the descriptions of this kind that are to be found in medical literature, it would be very tedious. Such episodes are extremely frequent in large cities in particular, since nowadays, nothing is considered sufficiently refined or elegant unless it glitters with gold. In the homes of the rich one can see gilded chamber pots and stool-pans, so it would appear that emptying one's bowels is more costly than drinking, as Martial observed in one of his satires of a certain personage.

I recently had occasion to observe a young gilder who died after a two-month illness. Having taken little heed to protect himself from the mercury fumes, he first became afflicted with cachexia, his face then became yellow and cadaverous, his eyes swollen, and his breathing laboured, while his mind became dulled and he was unable to move; bitter smelling ulcers formed in his mouth which emitted vast quantities of a terribly purulent liquid. He died without ever having a fever. I found this particularly surprising, since I could not understand why such putrefaction of the humours did not raise the body temperature in the slightest. Once I had consulted literature on the subject, I was no longer amazed. Baillou describes a case with suspected syphilis and quartan fever who was cured of the quartan after mercury was applied, but which then led to an increase in saliva secretions. In De lue venereal, Fernel also mentions the case of a sick man whose brain dissolved and oozed out of his eyes but who lived for years without a fever before he finally died. However, the author also states that he had formerly been rubbed with mercury. Fernel himself also confesses his surprise that the man had never had a fever. In his second book of De abditis rerum causis, he then goes on to give an explanation, stating that mercury reduces the body temperature thanks to its narcotic characteristics and is therefore also able to alleviate any pain and stop haemorrhaging, while also alleviating inflammation of the bile and curbing abrasions. Does mercury, therefore, act as an antipyretic? Perhaps one day the mineral kingdom itself will be able to provide medi-
cine with an antipyretic that is as enigmatic as the one proposed by Rivière, as was the case for the vegetal kingdom which gave us the famous antipyretic from Peru and the remedy for dysentery that was recently discovered and about which Leibniz published a treatise. Since experience is the teacher of all things, in cases of intermittent fever it might not be imprudent to prescribe mercury purgatives such as those derived from sweet mercury, a remedy that is not as terrible as one might be led to believe. However, one needs to be extremely prudent, as it is very similar to mercury, especially if it falls into inexperienced hands as Borrichius' famous anecdote, wherein he describes the case of an illustrious gentleman who was suffering from a very high fever and, following the advice of a charlatan, applied two compresses full of mercury that not only took away the fever, but also his life. The benefits from such an untrustworthy and treacherous enemy are so dubious that one can apply the words Virgil wrote on the subject regarding the god Mercury to the element: "he calls the pale ghosts from Orcus and sends others down to gloomy Tartars, gives or takes away sleep, and unseals the eyes in death".

Let us return, however, to our main subject. If we are to treat the injuries caused by mercury fumes, it is necessary to consult the works of those who write about poisons and minerals. Preparations that stimulate the soul and blood circulation and therefore increase perspiration are generally recommended. As we have already seen, this is because mercury usually slows down the circulation. This has also been shown in the results of autopsies that revealed the presence of coagulation in the cardiac ventricles, as was the case of the monkey that had drunk mercury, described by Avicenna. Cordial waters with spirits and wine spirit itself may also be used. Furthermore, spirit of smelling-salt, turpentine, our local petroleum, and volatile salts such as those of stag-horn, snake and the like are also recommended. Owing to its opium content, treacle should be avoided. Teas of antidotal plants such as the blessed thistle, water germander, scorzonera and the like are more effective than distilled waters from those plants that van Helmont rightly calls "sweat-plants". If metals and fossils are involved, Falloppio recommends gold dust and gold leaf, since there is no other element that amalgamates mercury as intensely as gold. As a remedy
against the effects of mercury, in *Exercitatio de lue venereal*, Martin Lister recommends guaiac tea since it has similar characteristics to those of pepper, which one can also taste. In *Pharmacopoea spagyrica*, Poterie recommends a sulphur sublimate brewed in wine, in particular for those who have accidentally inhaled mercury fumes or have been rubbed with mercury salves. Should emptying of the bowels be necessary on account of an excess of humours, much stronger medication must be prescribed than in other illnesses, because the torpor and reduced reaction to stimuli results from the metal. Any products containing antimony overcome both these drawbacks perfectly. Venesection should be avoided more than the proverbial dog or snake, since the spirits and humours need to be stimulated rather than weakened. As we can read in Pliny, in the past miners would cover their faces with loose bladders while extracting red-lead and mercury. As has already been mentioned above, in his work *Mundo subterraneo*, Kircher considers glass masks to be a better protective measure against the mercury fumes. Physical exercise is also to be recommended to warm the body, as well as staying in a warm room next to a burning fire. This is because there is nothing mercury avoids more than fire and to escape it "it binds winged sandals to its feet".

While mercury is a formidable remedy for worms – indeed, there is no more effective and harmless means of killing worms in children than that, whether prepared as an infusion, brewed, or simply mixed with some conserve – when inhaled via the mouth and nose it is so dangerous it can kill almost immediately, as is commonly to be seen in silversmiths employed in gilding. Is one perhaps to believe that this depends on the fact that once it is separated from the amalgam by heat, mercury is reduced to such tiny and highly penetrating particles that once they enter via the mouth and nose, they spread to the lungs, heart and brain? Once mercury has penetrated the organism in this form, it is capable of damaging the soul and slowing down all the fluids. An infusion or tea however, or even a dose of up to ounces or even a pound administered orally, as is the case in intestinal illnesses, causes none of the above-mentioned effects. This is because the heat of the animal bodies does not suffice to dissolve or convert it into vapour; on the contrary, it remains totally compact and can find a way out overcoming any obstacle whatsoever owing to its weight. According to a tale by
Ausonious, it was used in this fashion by a jealous husband whose unfaithful wife poisoned him and then gave him mercury to hasten his death. It is therefore true that while it neutralises many poisons, fire transforms certain harmless substances into poisons or exalts the characteristics of other poisons. Ambroise Paré describes how Pope Clement VII died from inhaling the toxic smoke of a poisonous torch brought before him and states: “the notion that fire cleans everything perfectly and consumes everything with its purifying powers is a total misconception and may prove ruinous to those who are not on their guard!”. For this reason it is only right to doubt the advisability and legitimacy of burning the garments and furniture of victims as is common practice when the plague is raging. Rather, one should ask whether it would not be more advisable to bury these things together with the corpses in deep graves. The Twelve Tables of the Roman Law prohibited the burning of corpses in the city or near houses and the main reason was to avoid polluting the air with the smoke this produced. Therefore, depending on the varying composition of the substances it is acting on, fire produces diverse effects; in one case it might augment the powers of a poison, while in another it might diminish them. Mercury is a relatively clear, but surprising example of this. Although it can be administered orally without causing serious harm, once sublimated with salts this metal assumes corrosive characteristics. If more mercury is added to these mercurial salts, the ensuing heat forms sweet mercury which, if properly prepared, is one of the best at removing phlegm from the humours and remedying syphilis.
Diseases of those who administer ointments

Mercury is harmful to those who administer ointment in severe cases of syphilis in which all other remedies have failed. From the very moment this terrible illness invaded Italy after the siege of Naples and then spread throughout Europe like lightning, of the many treatments medicine tried to curb the scourge of syphilis, mercury was the most popular and was to remain so without interruption for two centuries. For many years, doctors had already observed that there was nothing more effective than mercury to cure scabies thus, when they saw that the skin of those with syphilis was covered with boils and ulcers, they proceeded in an analogous fashion, achieving positive results with the use of that metal. Known as Carpi because of his origins and the most famous surgeon and anatomist of his time, it is believed that Jacopo Berengario was the first to use mercurial ointments, as can be seen in his writings from which, due to their rarity, later anatomists gleaned numerous important observations without naming the author. In his treatise De morbo gallico, Falloppio recounts how Jacopo da Carpi, “from the treatment of this French disease, using ointments alone, earned more than fifty thousand gold ducats, and although the majority were cured, he did actually kill a great many”. With far greater skill than the alchemists, that ointment healer was able to transform mercury into gold by a genuine metamorphosis. Such fortune was rare indeed and differed greatly from what one can observe today, so much so that Sennert himself expressed his amazement.

Today, those who usually administer mercurial ointments for syphilis are of a low professional rank and do so only for financial reasons. Surgeons of greater prestige are careful to avoid such a repulsive and hazardous activity. Those who exercise this profession
usually wear gloves; nevertheless, it is impossible to stop the mercury particles penetrating the leather and thus their hands since this is usually done in front of a blazing fire, the metal fumes enter the body through the mouth and nose and then reach the nervous system. Hildanus describes the case of a woman who was present while her husband was being treated with mercurial ointment and, just by inhaling that air saturated with mercury, suffered excessive salivation and ulcers formed in her throat. In *De lue venereal*, Fernel writes that those who have applied mercurial ointment to patients with syphilis for prolonged periods suffer from palsied hands, while Framboisiere describes an ointment healer who suffered from dizziness with a blurring of the vision while he was administering the usual ointment.

In this regards I can only suggest that such healers adopt the same strategy that a doctor in this area has also learned at his own cost, realizing that the earnings did not compensate the harm. Indeed, after suffering from diarrhoea, colic, and excessive salivation, he realized that such ointment was more harmful to him than to the person he was treating. From then on, he would prepare the mercurial ointment and assist the patients who needed to be treated, insisting they apply it themselves with their own hands which, he said, was beneficial to him and even more so to them, since not only was he subjected to no harm in that fashion, but with the heat generated from the arm movements, the patients were making the ointment more effective and had no reason to fear a treatment that they hoped would cure their ills. Should those who apply ointment already be suffering from the effects of mercury, such as palsy of the hands, dizziness, and abdominal colic, as mentioned above, guaiac tea will prove beneficial. Indeed, if mercury is an effective remedy for syphilis, since it disperses the disease and provokes sweating, guaiac is a suitable cure for the torpor and weakness of the nerves caused by the metal. Very often a combination of these two remedies, that is mercury and guaiac, is able to cure syphilis completely. As a matter of fact, first of all guaiac attacks syphilis and weakens it, then mercury engages in a more violent fight until guaiac is able to destroy the enemy and disband what forces remain.
Diseases of chemists

Although chemists boast they know how to make all minerals harmless, they themselves are not immune to their toxicity. Indeed, all too often they fall victim to the very same illnesses as those who work the minerals and, although they deny it, this can be seen in the colour of their faces. Leonardo da Capua writes that the two famous alchemists Theophrastus and van Heimont became seriously ill while preparing medicaments. In his book *Chimia experimetalis*, Juncken discusses antimony and says that when stibium is reduced to powder and smoked during the production of glass from antimony, the workers become asthmatic and suffer from dizziness. Ettmüller says that once, while preparing an antimony compound, the tubular retort accidentally broke and he inhaled the sulphur and antimony fumes, giving him a cough that lasted four weeks although he had been perfectly fine before. He attributed the cause to none other than the acid fumes that had irritated his respiratory organs. In *Hippocrate chymico*, Tackenius also describes something curious that happened to him. He was trying to sublimate arsenic to make it solid and, after numerous attempts, he opened the jar and was amazed at the unpleasant smell; half an hour later he had stomach pains like an ulcer, difficulty breathing, and blood in his urine, colic, and spasms in every limb. The author says he felt slightly better once he had drunk some oil and milk, but throughout the entire winter he suffered from symptoms similar to hectic fever, which he finally cured with a tea made of wound healing herbs and by eating cabbage tops. I met Carlo Lancellotti, a famous alchemist in our region, who suffered from palsy and an ocular illness; he had lost his teeth and was asthmatic, malodorous, and his very appearance was enough to ruin the fame and prestige of
his medicaments, in particular the cosmetics he was promoting. Nevertheless, I do not consider such endeavours to be in vain; on the contrary, I have great admiration for alchemists who dedicate themselves with such seriousness to little known substances and who enrich the natural sciences for the good of mankind without fearing for their own lives. And neither can they be blamed for not taking sufficient precautions against the poisonous effects of the substances they are trying to transform into medicine. If medicinals are to be prepared in accordance with accepted standards and administered without any risk, these chemists have to be present and observe each and every phase of the process near the blaze of the fire. Indeed, the slightest variation or carelessness while manipulating chemical products might modify their characteristics to such an extent that they become part of the category of poisons, as Descartes rightly says. In his introduction on this matter, Juncken states that medicines prepared chemically cannot be administered by a doctor in all tranquility unless he himself or an expert chemist has prepared them before his own eyes. Just as one cannot blame a horse-breaker if he falls occasionally or is kicked while trying to tame a proud, rebellious horse, one cannot ridicule a chemist who comes out of his laboratory as ashen and dazed as someone coming up from the after-life.

Several years ago there was a heated debate between a citizen and merchant in Modena who, in a town called Finale under the jurisdiction of Modena, had a large laboratory for the production of sublimate. A citizen sued this merchant, demanding that he should move his laboratory to the outskirts of the town or elsewhere, since he was poisoning the entire neighbourhood whenever the workers were calcining the vitriol to make sublimate. To prove the accuracy of his accusation, he produced not only the testimony of a doctor from that town, but also the parish death register. From the latter it could clearly be seen that in that town and in the areas nearest to the laboratory more citizens died each year than in other towns. Furthermore, the doctor also testified that the citizens who lived close to the laboratory died mainly of wasting and of pulmonary diseases, which was mainly to be attributed to the diffusion of vitriol fumes that polluted the nearby air, thus harming the lungs. Doctor Bernardino Corradi, Commissioner of ordinance in the Duchy of Este, defended the merchant, while Doctor Paolo
Stabe de Cassina, doctor there at that time, defended the plaintiff. Elegant documentation was produced by both parties, disputing, as it were, the shadow of smoke. In the end, the judge found for the merchant and vitriol was declared completely innocent. Whether the legal expert judged correctly in this case or not, I shall leave to the opinion of experts in natural sciences.

To return to my subject, I would consider it an offence to chemists were I were to suggest any remedy, whether preventive or curative, for all those situations in which chemists suffer more harm than profit from practising their profession. Indeed, I know not one illness for which chemists do not already have a remedy waiting in their cabinets, so it is time we went on to other professions.