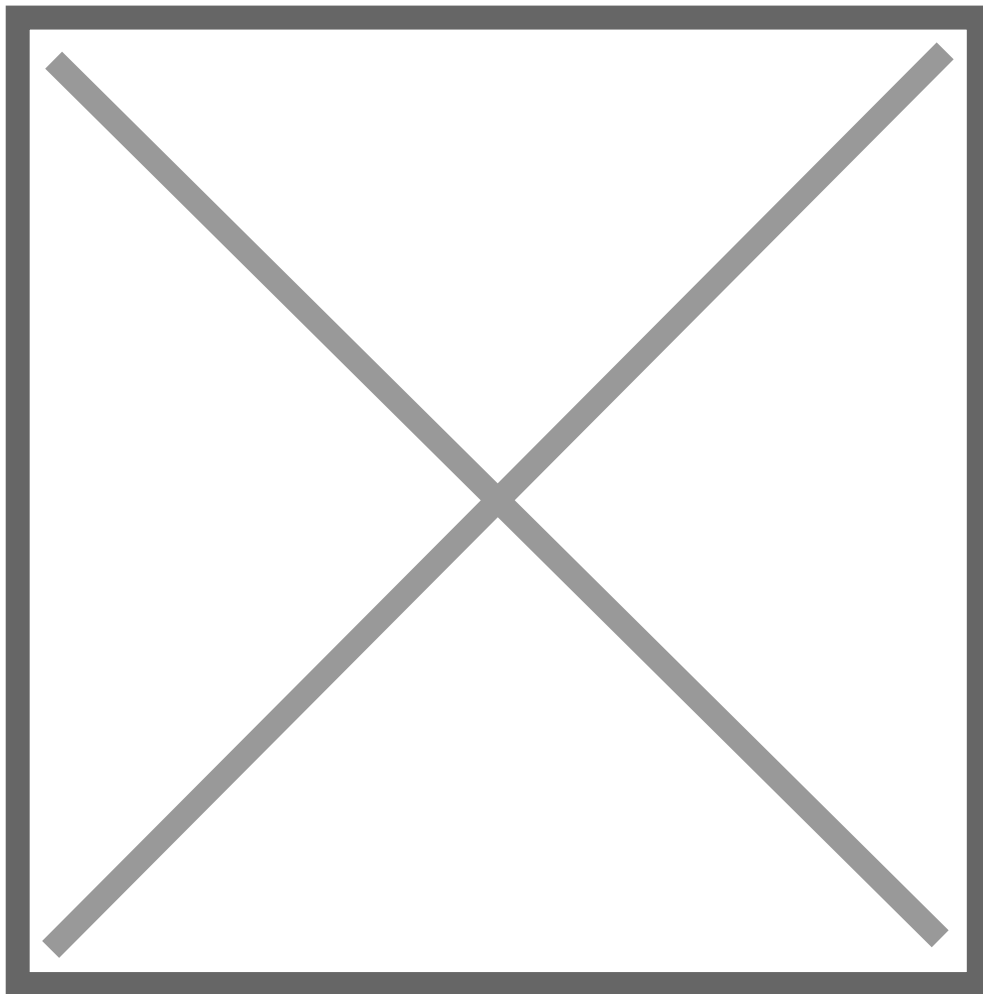


# 32 Albertus Magnus

Albertus Magnus, "Albert the Great", was a German who became a monk then a university lecturer, at the University of Paris, 1240. He stayed only five years, as he moved a lot during his lifetime. He was a lifelong learner and complete fan of Aristotle, and, following Aristotle's plan for learning, studied physics, psychology, celestial phenomena, geography, botany, zoology, minerals, medicine, optics, and theology. He was the master of Thomas Aquinas, who single-handedly introduced Aristotle as being in line with Catholicism so convincingly that the Church, by 1500, had adopted Aristotelianism into its doctrine.



At the University of Paris he taught theology, but considered himself the "New Aristotle."

He read and commented extensively on all of Aristotle's writings. He was also reading Avicenna and Averroes (ibn Rushd, an Islamic fan of Aristotle who lived in Grenada during the Golden Age of Islam, essentially an Islamic version of Albertus; another contemporary was a Jewish fan of Aristotle, also in Spain, Maimonides).

The new Universities were largely set up after the Greek books were had in Europe, to spread the information found there. For all the diversity of thought taught at the early universities, it never developed beyond the curriculum of Aristotle, who himself had written on a huge range of topics:

- Philosophy
- Natural philosophy
- Politics
- Rhetoric
- Categorization (substance, quantity, quality, relation, place, time, situation, condition, action, and passion)
- Logic
- Poetry
- Ethics
- Criticism (proposition and judgment, and the various relations between affirmative, negative, universal, and particular propositions)
- Biology
- Zoology
- Embryology
- Psychology
- Realism
- Teleology
- Meteorology

Albertus wanted to master all of these, and a couple more. Aristotle had a book on minerals, but it was lost. As part of his work, Albertus traveled to mining districts to learn what he could of minerals and ores, and how metals are made from them.

By age 30 he was a Dominican monk, and had the reputation of a prodigious learner, earning the nickname *Doctor Universalis* ("Teacher of Everything") by those who liked him, and the "Ape of Aristotle" by those who didn't. He jumped teaching positions often, and was only three years at the University of Paris. He even jumped church leadership positions in two or three years.

Did any of this make him a critical examiner of past natural philosophy? It did not. He relates, for example, as truth the story of boiling a crow's egg and putting it back in the nest, so that the bird will fly to the Red Sea and return with a stone that will refresh the eggs to rawness when put into the nest. If a man puts that stone into his mouth he can understand the chirping of the birds.

“ An emerald was recently seen among us, small in size but marvellous in beauty. When its virtue was to be tested, someone stepped forth and said that, if a circle was made about a toad with the emerald and then the stone was set before the toad's eyes, one of two things would happen. Either the stone, if of weak virtue, would be broken by the gaze of the toad; or the toad would burst, if the stone was possessed of full natural vigour. Without delay things were arranged as he bade; and after a short lapse of time, during which the toad kept its eye

unswervingly upon the gem, the latter began to crack like a nut and a portion of it flew from the ring. Then the toad, which had stood immovable hitherto, withdrew as if it had been freed from the influence of the gem.

Holmyard, E. J.. *Alchemy* (Dover Books on Engineering) (p. 116). Dover Publications. Kindle Edition.

This does rather go against the promise Albertus made (along with most alchemists) that he will relate nothing but what he has seen with his own eyes.

Albertus was reading Avicenna and Averroes, and other Muslim scholars, and in his own writing (particularly his *Book of Minerals*) he followed the example of Avicenna.

Albertus does commit one rather glaring mistake concerning transmutation. The Greek alchemists (Alexandrian alchemists) were either supporting the idea that one can create gold from lesser materials using Aristotle as *the* authority for the idea, or they had recipes for "dying" metals to merely look like gold. Most Muslim alchemists supported transmutation but Avicenna did not. Avicenna was firmly against transmutation. Albertus seems to be of a mind to agree with both as ultimate authorities. So what does he make of the bold quote below which shows up in Aristotle's *Meteorology*? From his *Libellus de Alchimia*:

## “ 1. On Various Errors.

Now, in this little work of mine, I shall describe for you, briefly and simply, how you should undertake the practice of such a great art. I shall first point out, however, all the deviations, errors, and stumbling blocks of this art, into which many and, [indeed], nearly all [are inclined to] fall.

For I have seen some who, with great diligence, were performing certain sublimations and were incapable of carrying them out, because they failed to grasp the fundamentals.

I have seen others making a good beginning, but who, because of excessive drinking and other follies, were unable to carry on the work. I have seen others who made a good decoction, distillation, or sublimation, but because of the excessive length of the work, they left it uncompleted.

I have seen others who possessed the true art and who performed their operations with skill and diligence, but who lost spirits in sublimations because of porous vessels, and for this reason doubted, and cultivated the art no further.

I have seen still others who, desiring to pursue the art, but incapable of waiting the required time, performed too rapid sublimations, distillations, and solutions,

because of which they found the spirits contaminated and decomposed, and the aqueous solutions and distillates turbid; and therefore they too lost faith.

I have seen many who were carrying forward the work with diligence and yet at length failed because they did not have the necessary means of support.

Hence the verse:

When the work is in danger, mortal need increases:

You may know many things, [yet] without money, you will be nought.

Hence this art is of no value to paupers, because one must have enough for expenses for at least two years. Thus, if one should happen to err in one's work or prolong it, one need not be reduced to penury, as I have seen occur many times.

I have seen some who made pure and good sublimations as many as five times, but then were unable to make any more and became deceitful; they whitened Copper, adding five or six parts of Silver, and thus cheated both themselves and others. I have seen others who sublimed spirits and fixed them wishing with them to color Copper and Tin, and when they made no impression or penetration, they became doubtful [about the art].

I have seen also those who fixed spirits, covering them with a penetrating oil, until they made a penetration into the bodies, adding yet another part of Silver, and thus they whitened Copper – which is similar to Silver in malleation and testing and in whiteness – which withstood even a second and a third testing, and yet had not been perfected, for the Copper had not been calcined nor purged of its impurity. **Hence Aristotle says: “I do not believe metals can be transmuted unless they are reduced to prime matter, that is, reduced to a calx by roasting in the fire, then [transmutation] is possible.”**

Yet I saw other wise men who finished sublimations and fixations of powders and spirits, prepared solutions and distillations from the powders, then coagulated them and calcined the metals, whitened the bodies to white, and reddened the bodies to red, after which they reduced them to a solid mass and colored them to produce Gold and Silver, which were better than the natural in every testing and malleation.

Since seeing so many who have erred, I resolved that I would write of the true and tested works and of the better [ones] of all Philosophers, among whom I have labored and have had experience; nothing else shall I write beyond what I have seen with my own eyes.

The bold quote is actually from Avicenna, but someone has appended it to the bottom of Aristotle, so firm up the authority behind it. The actual quote from Avicenna is "Those of the chemical craft know well that no change can be effected in the different species of substances, though they can produce the appearance of such change." But look what Albertus has done with it. He qualified it, saying, essentially, that transmutation isn't possible unless you can make the material pure enough. This is Albertus' great sin. We had a chance to kill alchemy half-way through its existence as a stumbling block to humanity, but Albertus magnus messed it up. All he had to do was shut up. But he never shuts up.

There is a lesson here: listen closely to those who are not always talking.

One observation: he writes remarkably clearly. Refreshingly so. I've added my own comments below in [*bracketed italics*]

## “2. How do Metals Arise?

Alchemy is an art invented by [the] Alchemist: the name is derived from the Greek *archymo*, which in Latin is *massa*. Through this art, corrupted metals in minerals are restored and the imperfect made perfect.

It should be noted that metals differ from one another only in their accidental form, not in their essential form; therefore the stripping of accidents in metals is possible. Hence, it is also possible, through this art, to bring about a new body, since all species of metals are produced in the earth from a commixture of sulphur and quicksilver or because of foetid earth. Just as a boy in the body of his mother contracts infirmity from a diseased womb by reason of the accident of location and of infection, though the sperm is healthy, yet, the boy becomes a leper and unclean because of the corruption of the womb. Thus it is in metals which are corrupted, either because of contaminated sulphur or foetid earth; thus there is the following difference among all the metals, by which they differ from one another.

When pure red sulphur comes into contact with quicksilver in the earth, gold is made in a short or long time, either through the persistence [of the contact] or through decoction of the nature subservient to them. When pure and white sulphur comes into contact with quicksilver in pure earth, then silver is made, which differs from gold in this, that sulphur in gold will be red, whereas in silver it will be white. When, on the other hand, red sulphur, corrupt and burning, comes into contact with quicksilver in the earth, then copper is made, and it does not differ from gold except in this, that in gold it was not corrupt, but here [in copper] it is corrupt. When white sulphur, corrupt and burning, comes into contact with quicksilver in the earth, tin is made, [as is indicated from the fact that] it crackles between the teeth and quickly liquefies, which happens because the quicksilver was not well mixed with the sulphur. When white sulphur, corrupt

and burning, comes into contact with quicksilver in foetid earth, iron is made. When sulphur, black and corrupt, comes into contact with quicksilver, lead is made. Aristotle says of this that lead is leprous gold.

Now sufficient has been said about the origin of metals and how they differ from one another in accidental but not in essential form. It remains now to examine the proofs of the philosophers and authorities, to see how they demonstrate that this is the true art, so that we may be able to contend with those who maintain that it is not true.

### 3. The Proof that the Alchemical Art is True.

Some persons, and they are many, wish to contradict us, especially those who neither know anything about the art nor are acquainted with the nature of metals, and who are ignorant of the intrinsic and extrinsic properties of metals, understanding very little about their dimensions and densities. To these, when they set against us the words of Aristotle, who says, "let the masters of Alchemy know that the species of things cannot be changed," we must answer that he said this about those who believe in and wish to effect the transmutation of metals that are still corrupt, but this, without doubt cannot be done. Let us, therefore, listen to the words of Aristotle which say the following: "It is true that experiment destroys the form of the species, and especially in metals, and this is the case when some metal is calcined and hence is reduced to ashes and calx, which can be ground, washed, and softened with acid water until made white and natural: and thus these bodies through calcinations and various medicines may lose the brown corrupt vapor, and acquire an airy, vivifying vapor, and the whitened calx will be reduced to a solid mass, which can be colored white or red." For this reason, Hermes says that spirits cannot enter bodies unless they are purified, and then they enter only through the instrumentality of water. Aristotle says: "I do not believe that metals can be transmuted unless they are reduced to prime matter, that is, purified of their own corruption by roasting in the fire." [*damn him!*]

To those still dissenting and unbelieving, I wish to make myself clearer because we know whereof we speak and have seen what we are asserting: we see different species receive different forms at different times; thus it is evident that by decoction, and persistent contact, what is red in arsenicum will become black and then will become white by sublimation; this is always the case.

If, by chance, someone should say that such species can easily be transmuted from color to color, but that in metals it is impossible, I will reply by citing the evident cause through various indications and proofs, and will thoroughly destroy their error.

For we see that azure, which is called transmarinum, is produced from silver; since, as is more easily seen, when it is perfected in nature losing all corruption,

the accidental is destroyed rather than the essential. We see, furthermore, that copper receives a yellow color from calamine stone, and yet neither the copper nor the calamine stone is perfect, since fire acts on both.

We see that litharge is made from tin, but tin through too much decoction turns a golden color; however, it is possible to convert it to a species of silver, since it is of this nature.

We see iron converted to quicksilver, although this may seem impossible to some; why it is possible I have already stated above; namely, that all metals are made from quicksilver and sulphur; wherefore, since quicksilver is the origin of all metals, it is possible also for iron to be reconverted to quicksilver. Do you not perceive, for example, that water solidifies in the winter time through excess cold, and becomes ice, and that ice melts by the heat of the sun and returns to water as before? Thus from quicksilver, wherever it is in the earth, and from sulphur, if this also is present, a union of these two comes about and through a very mild decoction over a long period of time, in which they are combined and hardened to a mineral stone, from which the metal may be extracted.

Likewise, we see that cerussa is made from lead, minium from cerussa, and lead from minium.

Behold, now, it has already been sufficiently proved how species are changed from color to color even to the third or fourth form. From this it must not be doubted at all, that corrupted metals can become pure by their own medicines. [*anecdotal examples are not proof, but he thinks they are*]

Since the foundation for this art has now been laid, let us see what we shall build upon. For if we build upon hay or wood or straw, fire will consume all. Therefore, let us procure stones, which are neither destroyed by fire nor by decay; then we will be free from all anxiety.

From what we have said concerning the difficulties of the art – its principle, and, finally, concerning its proof – it is evident that we have established that it is the true art. Now it remains to be seen how to proceed, and at what time and in what place. [*what follows are advice to alchemists, good advice, history informs us*]

First, at the outset, certain precepts are to be laid down. The first precept is that the worker in this art must be silent and secretive and reveal his secret to no one, knowing full well that if many know, the secret in no way will be kept, and that when it is divulged, it will be repeated with error. Thus it will be lost, and the work will remain imperfect.

The second precept is that he should have a place and a special house, hidden from men, in which there are two or three rooms in which are carried on the

processes for sublimating and for making solutions and distillations, as I will show later. [*the lair*]

The third one is that he should observe the time in which the work must be done and the hours for sublimations and solutions; because sublimations are of little value in the winter; but solutions and calcinations may be made at any time: All these things, however, I will show clearly in [the discussion of] these operations.

The fourth is that the worker in this art should be careful, and assiduous in his efforts, and not grow weary, but persevere to the end. For, if he begins and does not persevere, he will lose both materials and time.

Fifth, it should be done according to the usage of the art: first in collecting [supplies], second in sublimations, third in fixations, fourth in calcinations, fifth in solutions, sixth in distillations, seventh in coagulations, and so on in order. If he should wish to color besides subliming, and to both coagulate and distill, he will lose his powders, because when they will have been volatilized he will have nothing left of them whatever, but they will be very quickly dispersed. Or, if he wishes to color with fixed powders which are neither dissolved nor distilled, they will neither penetrate nor mix with the bodies [to be colored].

The sixth is that all vessels in which medicines may be put, either waters or oils, whether over the fire or not, should be of glass or glazed. For, if acid waters are placed in a copper vessel, they will turn green; if placed in an iron or lead one, they will be blackened and corrupted; if placed in earthenware, the walls will be penetrated and all will be lost.

The seventh is that one should be on one's guard before all else against [associating oneself] with princes or potentates in any [of these] operations, because of two dangers: If you have committed yourself, they will ask you from time to time, "Master, how are you succeeding? When will we see some good results?" and, not being able to wait for the end of the work, they will say that, it is nothing, it is trifling, and the like, and then you will experience the greatest dissatisfaction. And if you are not successful, you will suffer continued humiliation because of it. If, however, you do succeed, they will try to detain you permanently, and will not permit you to go away, and thus you will be ensnared by your own words and caught by your own discourses.

The eighth precept is that no one should begin operations without plenty of funds, so that he can obtain everything necessary and useful for this art: for if he should undertake them and lack funds for expenses then he will lose the material and everything.

#### 4. The Kind and Number of Furnaces that are Necessary.

Now it must be seen how furnaces are made as well as the number and kind needed.

Regarding which it should be observed that the quantity of the work at hand should determine the number of furnaces to be made. For if you have sufficient supplies and want to undertake a great amount of work then you should construct many of them. If, on the other hand, there is a scarcity, construct the furnaces according to the amount of powders and medicines you have.

I desire to set forth a plan of furnaces as well as the number, which will be suitable to the rich workers as well as to the poor ones.

First, the philosopher's furnace must be described. Build it near a wall, where the wind can approach: so that the furnace is about an arm's distance from the wall, in this fashion. Dig a pit in the earth to the depth of the elbow, about two spans wide or a little more, and spread all over with the clay of the master [potter]: above this [pit], erect a circular wall lined with the same clay. [*yes, that was a one-item list*]

## 5. On the Quality and Quantity of Furnaces.

Take common clay and to four parts add a fifth part of potter's clay and grind well, and add a little sand, grind again (some prudently add manure or salt water in which manure will have been dissolved); after doing this make a wall, as mentioned before, above the pit, two feet high or a little less, one span thick, and permit to dry. Then have a disc made of potter's clay, which can sustain strong fire, everywhere perforated with fifty or sixty holes, according to the size of the disc [with the perforations] made like a finger, the upper part narrow and the lower wider so that ashes can easily descend. Below, in the earth, make a canal through earth and wall before the disc has been put in place; this should be narrow at the pit end, while outside, at the wall, it should be wider, about one span in width, so that the wind may enter. This canal should be lined with clay; then the disc should be placed on top, in such a way that the wider openings of the perforations are on the underside. Next a wall is built upon the first wall and the disc, to the thickness of one span, but the wall should be above the disc to about the distance of one arm. The furnace should have a hole in the middle above the disc where the coals will be laid. At the top there should be a hole through which calcining vessels may be placed: this hole is to be covered over afterwards with a tight cover. The furnace may also have beneath four or five small holes about three digits wide.

This is the general plan of the furnace.

Note also that a clay tripod should be placed above the disc, upon which are to be placed the calcining vessels, and under which the coals.

## 6. How many, what kind, and of what use are the Sublimation Ovens?

Now sublimation ovens must be considered, of which there should be at least two or four, and made throughout with disc, canal, and perforations like the philosopher's oven, but smaller in size: moreover, they should be in one place for convenience [of supervision].

## 10. The Four Spirits of Metals which Color.

Note that the four spirits of metals are mercury, sulphur, auripigmentum or arsenicum, and sal ammoniac. These four spirits color metals white and red, that is, in Gold and Silver: yet not of themselves, unless they are first prepared by different medicines for this, and are not volatile, and when placed in the fire burn brilliantly. These spirits fashion Silver from Iron and Tin, or Gold from Copper and Lead.

Thus, as I shall say briefly, all metals may be transmuted into Gold and Silver, which are like all the natural metals, except that the iron of the Alchemist is not attracted by adamantine stone and the gold of the Alchemist does not stimulate the heart of man, nor cure leprosy, while a wound made from it may swell, which does not happen with natural gold. But it is evident that in all other operations, as malleation, testing, and color, it will last forever. From these four spirits the tincture is made, which in Arabic is called elixir, and in Latin, fermentum.

## 11. What is Elixir, and how many of the Metals are Transmuted through these Four Spirits?

Elixir is the Arabic name and fermentum is the Latin: because, just as bread is leavened and raised through good yeast, so the matter of metals may be transmuted through these four spirits into white and red, but especially through mercury, because it is the source and origin of all metals.

## 12. On the Genera of Medicines and their Names.

The following is a list of the other spirits and medicines and how they are named: sal commune [common salt], sal alkali, sal nitrum, sal borax, Roman alum, alum from Yemen, tartar, atramentum, green copper, calamine stone, copperas, tutia, cinnabar, minium, cerussa, hen's eggs, eggshells, vinegar, urine, cadmia, marchasita, magnesia, and many other things of which we have no need in this book.

These substances do not color, but the spirits are serviceable, for they are quickly prepared and dissolved, and with their solutions they macerate the calx of the metals, and [cause] these bodies to take on rectifying vapors.

Their preparation, occurrence, and the manner of calcining and solution, we will show in order in the following chapters.

### 13. What is Mercury and what is its Origin?

Mercury is viscous fluid united in the interior of the earth with a white subtile earth, through the most moderate heat until there is equal union of the two. It rolls on a flat plane with ease and, despite its fluid nature, does not stick to it, and it may possess a viscous form because of its dryness, which tempers it, and prevents adherence [to a surface].

It is the matter of metals when combined with sulphur, that is, as a red stone from which quicksilver can be extracted; and it occurs in the mountains, especially in old drains, in great quantities.

By nature mercury is cold and moist and is the source of all metals, as has been said above. It is created with all metals, is mixed with iron, and without it no metal can be gilded.

ADDITION. Quicksilver and sulphur, sublimed with sal ammoniac is converted into a brilliant red powder, but when burned in the fire returns to a fluid and humid substance.

### 14. What is Sulphur, its Properties, and its Occurrence?

Sulphur, the fatness of the earth, is condensed in minerals of the earth through temperate decoction, whereby it hardens and becomes thick; and when hardened it is called sulphur.

Sulphur has a very strong action, and is a uniform substance throughout; for this reason its oil cannot be separated from it by distillation, as from other substances having oil, but rather by means of acute waters, by boiling sulphur in them. It occurs in the earth, sometimes in the mountains and sometimes in the marshes. There are many varieties; namely white, red, green, yellow, or black: and besides it occurs in the dead form. It is living when extracted from fusible earth, and is effective against the itch. It is dead when it is poured into cylinders, as it is found among apothecaries.

ADDITION. Sulphur has a fiery nature, liquefies as gum and is entirely smoky.

### 30. What is Sublimation and in how many ways can it be done?

Sublimation is the volatilizing of a dry substance by fire, causing it to cling to the sides of the vessel. Sublimation in fact is diversified according to the diversity of

the spirits of those things to be sublimated. One kind [is accomplished] by ignition, as with marchasita, magnesia or tuchia; another with moderate ignition as with mercury and arsenic; and still another with a low fire as with sulphur. Indeed, in one type of sublimation of mercury the separation of its earth will result and there will be a change in its fluidity. On the other hand, it is natural that superfluous earth very often is mixed with things with which it has no affinity, hence its sublimation has thus to be repeated more often. Examples of these are the calx of eggshells and of white marble, and finely ground glass, and every kind of prepared salt. From these latter, it [the earth] is cleansed, from others it is not, unless the bodies are [in a state of] perfection; however, they are rather more corrupt, because all such things have sulphureity which, ascending with it in sublimation, corrupts the work. Because of this, if you sublimate from tin or lead you will note that after the sublimation it is contaminated with blackness. Therefore, sublimation is better accomplished with those things with which it does not agree [in nature]. However, sublimation, in general, would be more readily accomplished with those things with which it [the substance to be sublimated] agrees [in nature] if it were not for the sulphureity [in any of the components] with which it does not agree [in nature]. A method of removing moisture is to mix and grind with calxes - with which the sublimation should be done - until the metal can no longer be detected, and then the moisture is removed by slow heating. As [the moisture] of [the mixture] recedes, the moisture of the mercury will recede with it, as I shall teach you in the following sublimations of spirits.

## 31. What is Calcination and in how many ways can it be done?

Calcination of any kind is the pulverizing of substances by fire to remove the moisture uniting the parts. Bodies diminished of their own perfection are calcined.

There are also different kinds of calcinations. Bodies are calcined so that the sulphureity corrupting and defiling them may be removed. In fact, each sulphureity may be burned from the substance with which it is combined, but which without calcination cannot be removed. Soft bodies are, indeed, particularly hardened by it, but they [also] take an impression more clearly and harden more readily. Spirits are calcined the better to fix them and bring them more quickly into solution. Every kind of calcined body is more fixed, and more easily sublimed than the uncalcined; hence, soft bodies can be easily calcined through fire; hard bodies need very strong fire [to be calcined], as I shall teach you at the end [of this book].

ADDITION. Silver may be calcined thus: take an ounce of purest Silver, or more if you wish, and from this make plates thin as the [finger] nails of the hand. Add a third part of common salt, from the preparation commonly prepared and

calcined, and a fourth part of sublimated mercury, making a powder of said mercury and salt by grinding. Afterwards cement the plates together in the sublimatory, by placing first a layer of the powder, then a second layer of the sheets, and follow layer by layer; then sublime with a slow fire until all the moisture of the mixture evaporates. Close well the opening and increase the fire through the natural day; take care not to remove the vessel from the fire immediately, but let it cool [for] three hours. Do not open the vessel until it is cold, because the spirits will evaporate. When the vessel is cold, take out the sublimed mercury, clear as a crystal, and set [it] aside; then take out the silver that remains half-calcined with the common salt. If possible, crush the salt and the half-calcined Silver at once above the *porphyry*. If it cannot be ground, put it into a glass cassola and separate the whole salt with fervent waters, until you perceive no salty taste; dry the remaining calx in the bottom of a *paropsis*, and calcine once again with new salt and mercury sublimed five or six times. Alternate the calcining and washing of the Silver calx until you detect no salty taste. Your calcined Silver will then be the whitest and cleanest [kind], like the rays of the stars, so that if you melt part of the said calx with borax, or with good sal nitrum or sal alkali, you will find your Silver converted to white gold.

## 32. What is Coagulation and why is it used?

Coagulation is the reduction of liquid substances to a solid mass by deprivation of their vapors. It was devised to harden mercury and purify medicinal solutions of moisture mixed in them. Mercury is coagulated by its frequent precipitation with violence to the dryness of the fire. The dryness of the fire removes the moisture. This is accomplished in a long narrow vessel.

## 33. What is Fixation and in how many ways are Bodies fixed?

Fixation is the appropriate tempering of a volatile substance in fire. It was devised so that every coloring, and every alteration is perpetuated in another and is not changed: for bodies, whose perfection has been diminished through calcination, are fixed when they are freed from corrupting and volatile sulphureity. Sulphur and arsenicum are fixed in two ways: one method is the repetition of their sublimation from one state to another, or until they achieve stability. Spirits are also fixed in another way, either with the solutions of metals or with oil of tartar, as I shall say below.

ADDITION. Take sublimed mercury, an equal amount of sal ammoniac, and sublime seven times, or until melted, [then] let the stone remain at the bottom; crush it and expose to damp air so it will become a liquid. Soak metallic arsenicum in this water, dissolve in distilled vinegar, and distill seven times, or congeal, and dissolve, and a stone will result.

Metallic arsenicum is made by melting one part of arsenicum with two parts of white soap. Another [procedure] is given in Geber's [*Liber*] *Fornacum*: where you may read [it], if you wish.

Either sublime mercury, or sulphur, or prepared arsenicum, or several of these, at the same time, along with sal tartarum or saltpeter, or sal ammoniac. Do this many times until they remain fixed, then extract [them] with warm water.

### 34. What is Solution and in how many ways is it done?

Solution is the resolution of any calcined substance into water. It was devised so that the intrinsic qualities of substances might become extrinsic and vice versa, and so that they might be made suitable for distilling; thus they are freed from every contamination. Solution is achieved either by heat and moisture or by cold and moisture, as I shall teach in the following [chapters].

ADDITION. Some [substances] dissolve after being calcined with an equal weight of sulphur, with water or the juice of limes, in a closed crucible.

### 35. What is Distillation and how is it done?

Distillation is the rising of the vapors of a liquid in its own container. There are different methods: with and without fire, that with fire is of two kinds; one, through rising vapors, as with an alembic; the other through a descensory, as with a pipe, and through fire superimposed on vessels.

The general purpose of distillation is [the] purification of a liquid from its dregs. We can see that the distillate is rendered purer [than the original liquid]. The special purpose of pure water is the imbibition of spirits and clean medicines, so that we can have a pure solution when we need one, for the dregs that can contaminate our medicines and purified spirits will have been removed. Distillation was invented to extract, through a descensory, an oil pure in its nature, whenever we cannot [evidently] have an oil combustible in its nature, as is true of petroleum. However, distillation, through filtration, is devised solely to obtain a clear liquid.

### 36. What is Ceration and how is it done?

Ceration is the softening of dry and nonfusible substances. It is clear that this process was invented to mollify a body with a view to change (or inceration) and thus permit penetration of other substances, for a body deprived of liquefaction permits no penetration. Some think that ceration should be done with liquids and liquid oils, but that is an error; for in no substance is the whole moisture found better than in sulphur and arsenicum. By this method [sulphur and arsenicum] their sublimation may be multiplied a great many times because of the softened substance, to the point where, finding moisture in them, they attain

a good fusion; on the other hand, this cannot be accomplished without perfectly cleansing them of all corruption. But it seems better to me that their oils should first be fixed by oil of tartar and with these oils every ceration can suitably be made. Concerning these things this will suffice.

## 42. From what substances is Fire made?

Since the principle of sublimation of spirits has been presented, it remains now to investigate the substance of fire. I assert, therefore, that fire should be made of coals for two reasons: first, because it is less work to lay coals than wood; second, because wood gives much more smoke and, because of the smoke, the work cannot be observed well. Vessels are broken by the heat of the fire, as happens oftener when the clay is not good or they [the vessels] are not well baked. And when they break to pieces, white smoke at once appears, which may easily be seen over a fire that is made from coals; hence when the vessels smoke let them be taken from the fire at once or else the sublimation will be lost. Take care that this does not happen.

Note that the upper vessel, namely an aludel, should be glazed, but this is not necessary for the lower [one]. It is customary also to harden the medicine that cannot be sublimed, on a scutella. This is not to be doubted, but it [the medicine] should be ground a second time and mixed with a little more of the dregs and it will be sublimed thoroughly.

## 44. The Revelation and Teaching of the Secrets of this Art begin here.

Now I have already taught you how to collect various flowers full of the fine fragrances, redolent with health and beauty, and the glory of this world: this is the flower of flowers, the rose of roses, and the lily of the valley. Rejoice therefore, O Youth, in thy adolescence and gather the flowers, since I have introduced you into the garden of Paradise; make from these a wreath for your head, that you may rejoice and enjoy the delights of this world.

I have disclosed to you the meaning, now I will help you to understand the secrets of this art, and what was hidden for such a long time, I shall now bring to light.

Previously, I taught you how to sublimate and to collect the flowers of these substances, therefore, now I shall teach you how to plant them so that they may bear much fruit, and their fruit may last forever. I shall teach you how to fix the powders sublimed, that they may remain in the fire, be combined and mixed with bodies, and [I shall show you that this may be done] in two ways.

## 45. The Fixation of Powders, so that they can mix with Bodies, is taught here.

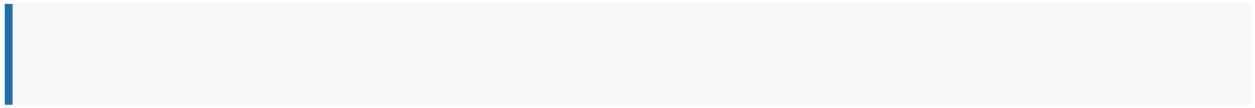
Take as much [powders] of these as you wish, one pound or two without anything else, and place in the vessel of fixation, and shape off the opening with good clay, not glazed, of the glassmakers, one digit thick, and close the cracks with good clay, namely, clay of wisdom.<sup>13</sup> When this is done, put [it] upon a sublimation furnace, and apply fire for a whole day. Now if done in summer, the amount of heat is as of sublimed mercury after mid-day; however, if it is done in the morning, turn the upper layer underneath, alternate two times at least, then open and see in this way if the powder is fixed; place a little of it over the coals: if it smokes, it is not yet fixed, but if it does not smoke, then it is fixed, and this is the sign of every spirit. If, however, it is not fixed, return to the furnace, closing the vessel as before, and apply fire for five days or until at length you hear a sound in the vessel like falling stones, as very often happens, when it is dried up too much. (Another direction says that it may be tested over a burning plate to see if it melts or flows, or fails to give off smoke.)

A second way [to fix powders] is with the imbibition of oil of tartar. However, you can do it this way: take sublimed arsenicum or sulphur or auripigmentum, and crush over the stone with oil of tartar, until all becomes liquid. Then place in a glass phial in ashes, which have been sifted through a fine sieve, and place the vessel with the ashes over a distillation furnace, and apply the fire at first very slowly as [is done] in masticating, lest the vessel be broken. After heating the glass, increase the fire; then dry the medicine in an open vessel, if you wish, but it is better [to do it] in a closed one. Place above it an alembic which collects the water distilled from it, because [this distillate] is useful for many things. When the medicine is dry, the vessel has to be broken, since you cannot empty it otherwise, and you will find the powders hardened like stone. This has to be well ground as before with the distilled oil [of tartar]. Using the same procedure, again break the glass, remove, grind well, place in another ampulla, and set [it] in a warm dung pit for seven days, and then it will be dissolved into a liquid. Then place the vessel in warm ashes and heat with a slow fire, then you will have the spirits fixed; and the color will remain firm and lasting. And of this powder, add one part to fifty parts of calcined Iron or Copper, and this will be good for every malleation and testing.

## 51. How can Gold and Silver be Calcined?

The calcination of all metals must now be noted. First, take the calcination of Gold and Silver. Place the filings of either one you wish in vinegar for nine days. Then remove and, when dried, crush into dry powder; afterwards add water [and] sal ammoniac, crushing and drying six times. Then place over a stone, as I have taught for dissolving, and distill and put aside; and from this liquid take the powder for the solution.

Note this, however, that you should use liquids of Gold for making red solutions and [liquids] of Silver for white [ones].



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