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INTRODUCTION

Though so many thousands of pages have been written by students of alchemy and early chemistry within the European and Arabic culture-areas, even greater complications follow when any confrontation with the Chinese and Indian parallels is attempted, and our experience is that the necessary clarification demands the introduction of a few technical terms not hitherto generally current. Moreover we have to define in just what sense the word "alchemy" is used in our discussions. Chemistry as we know it today is of course a science like that branch of physics which deals with electricity — wholly post-Renaissance, indeed + 18th-century in character; but the pre-history of chemistry goes back far into antiquity and the Middle Ages, and "alchemy" was the framework into which the men of those times fitted their chemical observations. This concept needs closer analysis than it has yet had.

Among the ancient Alexandrian proto-chemists in the West, let us say between the + lst and the + 5th centuries, there were two groups with quite distinguishable endeavours, aurifaction and "aurifiction"; and this is a pattern which can be identified in every civilization.

Aurifiction we define as the conscious imitation of gold (and by extension, with suitable variation of nomenclature, silver and other precious substances such as gems and pearls), often with specific intent to deceive — whether by "diluting" gold and silver with other metals, or by making gold-like or silver-like alloys with copper, tin, zinc, nickel, etc., or by the surface-enrichment of such mixtures containing gold, or by amalgamation gilding, or by the deposition of surface films of appropriate tints produced by exposure of the metal to the vapours of sulphur, mercury and arsenic, or volatile compounds containing these elements. The

deception of the client, or the aim of deception, is not essential in this definition, for he may be quite content with substances of a gold-like appearance, imitations which may serve his purpose, but the proto-chemical artisan must be aware that his product would not stand up to the fundamental test of cupellation. He must therefore know it to be, in the workshop sense, "false"; though the very same processes may be employed by the philosophical proto-chemist to give a result which was considered, in the philosophical sense, "genuine".

Aurifaction, on the other hand, we define as the belief that it is possible to make gold (or "a" gold, or an artificial "gold") indistinguishable from, and as good as (if not better than) natural gold, from other quite different substances, notably the ignoble metals. This was the conviction of philosophers rather than artisans, as we shall see. The self-deception of the proto-chemical philosopher is essential in this definition, not because of any credulity or unworthiness on his part but because in an age before the visualization of the persistence of the atoms of the separate metals in the alloy, certain properties or qualities of the artificial "gold" were precisely what justified its name. It was not thought necessary that all the properties of the yellow metal should be identical with those of natural gold so long as at least one of them was — heaviness, softness, ductility, malleability, internal uniformity, but colour was always by far the most important. As the poet said: "the glitter is the gold". We believe that proto-chemical philosophers, both in East and West, often did not know of the test of cupellation (and for this we shall suggest a sociological reason), but even when they did they probably regarded it is irrelevant to their nomenclature, taking "gold" to mean whatever had the form, accidents or qualities, more or less, of gold. This complex of ideas is of course that which has so often been thought in the past to comprise the whole of "alchemy", but we find it is extremely helpful in clarification to distinguish an aurifactive element from a macrobiotic element.

Macrobiotics is a convenient term for the belief that it is possible to prepare, with the aid of botanical, zoological, mineralogical and above all chemical, knowledge, drugs or elixirs (*tan*) which will prolong human life beyond old age (*shou lao*), rejuvenating the body and its spiritual parts so that the adept (*chen jen*) can endure through centuries of longevity (*chhang shêng*), finally attaining the status of eternal life and arising with etherealised body as a true Immortal (*shêng hsien*). Such was the Taoist concept of material immortality. But there was another predisposing cause for alchemical ideas in China, the absence of any prejudice against the use of mineral drugs analogous to that which existed so long under the Galenical domination in Europe; indeed the Chinese went to the other extreme, compounding with remarkable persistence through the centuries all kinds of dangerous elixirs containing metallic and other elements (mercury, arsenic, lead, etc. as well as gold) which caused untold

harm to those who resolutely took them. However the Taoist, if he chose, could avoid these dangers, for there were many other techniques available in the quest for material immortality, not only alchemical and pharmaceutical but also dietetic, respiratory, gymnastic, sexual, heliotherapeutic and meditational. With all these could he aspire to incorporation into the ranks of the invisible bureaucracy of the universe, or seek for transformation into a *hsien*, an Immortal, purified, ethereal and free, able to spend the rest of eternity wandering as a kind of wraith through the mountains and forests, enjoying the company of similar enlightened spirits and the cycle of the seasons ever repeated yet with glory ever renewed.

The three key conceptions which we have now described are, we believe, applicable to all the aspects of early chemistry in every civilization, and serve best to bring them into interrelation. From these definitions it is clearly essential that alchemy should be distinguished both from aurifiction and aurifaction; if so, the Hellenistic proto-chemists ought not to be called "alchemists" for there was little or no macrobiotics in their thinking. The word "elixir", in the opinion of many, serves well to define "alchemy" itself for the macrobiotic preoccupation came into Europe only with the transmission of Arabic chemical knowledge from the + 12th century onwards, and since alchemy is after all a word endowed with the Arabic prefix it is appropriate not to speak of it in Europe until that age had dawned. It then took some time to exert its full effect, but the emphasis on a longevity which chemistry could produce reached full force in the writings of Roger Bacon (+1214 to +1292). There was plenty of aurifiction, aurifaction and proto-chemistry in general in the West before that time, but not the attempted preparation of longevity-promoting substances, or what we may conveniently call "macrobiogens". On the other hand Chinese proto-chemistry (*lien tan shu*) was real alchemy from the very beginning, and precisely because of the conception of material immortality dominant there and only there. It was no coincidence that the sentence on longevity written at the beginning of the previous paragraph was illustrated by Chinese technical terms, for that was the civilization where they really meant something, and although there were certain counterparts in the Hellenistic world such as the *pharmakon tēs* athanasias (φάρμακον τῆς ἀθανασίας) they turn out on closer inspection to be much more metaphorical.

The two ideas of macrobiotics and aurifaction came together first in the minds of the Chinese alchemists from the time of Tsou Yen in the — 4th century onwards, for the first time, it seems, in any civilization. As we shall see, there was aurifiction in China too, sufficiently widespread to evoke an imperial edict in — 144 forbidding unauthorized private minting and the making of "false yellow gold"; and if these metallurgical proto-chemists had no other interests they were certainly not

alchemists in our sense. But only a few decades later, by — 133, when Li Shao-Chün was urging the emperor to support his researches, and — 125, when Liu An's group of natural philosophers was compiling the *Huai Nan Tzu* book, the connection between aurifaction and longevity-immortality (probably originating from Tsou Yen's earlier school) is clearly recognizable. Thus began that association between the manufacture of the imperishable metal, gold, and the attainment by man of earthly imperishability, which was to spread in later conturies throughout the whole world. At first it took the form that plate and vessels of artificial gold possessed a magical property of conferring longevity or immortality upon whoever should eat and drink from them; functioning doubtless as containers for the elixir substances of vegetable origin, the "herbs of deathlessness (*pu ssu chih tshao*)" which the proto-feudal princes of the Warring States, and then the First Emperor, Chhin Shih Huang Ti himself, had been so eagerly looking for since the middle of the — lst millennium. The aurifactive "art of the yellow and the white (*huang pai chih shu*)", initiated, it seems, by Tsou Yen and his companions, comes clearly into focus with Li Shao-Chün and Liu An, as also Liu Hsiang (ca. —60) and Mao Ying (ca. —40). What is more, the process of "projection", whereby a small amount of a potent chemical or powder (the familiar "philosopher's stone" of the mediaeval centuries), appears in China at least by the end of the —lst century, though we cannot be sure whether to place the story of Chhêng Wei about +15 or in the neighbourhood of —95. Meanwhile the idea that artificial or natural gold should not be confined to rustless vessels but should actually be ingested, taken into the human body in some form or other, was also growing up. One of the oldest references to the consumption of gold occurs in the text of the *Yen Thieh Lun*, ca. —80, and by the +lst century Fêng Chün-Ta was taking mercury while Wang Hsing had some undescribed preparation of "potable gold (*chin i chih tan*)". Older adepts had tried consuming powdered cinnabar, with other mineral and metallic substances; a practice for which we have much better evidence than the Taoist hagiographic texts, for an official report of the physician Shunyü I tells how in —160 he attended another medical man who had made himself ill by taking excessive amounts of mineral drugs.

In sum, the ancient Chinese alchemical tradition can be shown to have arisen from three distinct roots: (a) the pharmaceutical-botanical search for macrobiotic plants, (b) the metallurgical-chemical discoveries of processes for aurifiction and aurifaction, and (c) the medical mineralogical use of inorganic substances in medical therapy. All three must have started at least as early as the Warring States period, well before the Chhin and Han, and the unified tradition must have taken its permanent form by the end of the + lst century if not by its beginning. Systematised by Ko Hung early in the +4th, and extended by

men such as Thao Hung-Ching in the +5th and Sun Ssu-Mo in the +7th, it necessarily forms the basis of the history of early chemistry in China.

The thought linkage thus established between gold and immortality was destined to have nearly twenty centuries of life, taking on in due course the formulation that all the other metals, rusting and corroding, suffered from the same illness as mortal man, so that the philosopher's stone would be the supreme medicine of men as well as of metals. Both of them it would cause to put on incorruptibility, its essential tendency being to transmute "imperfect" things into "perfect" ones.

That Arabic alchemy had a far more medical stamp than Hellenistic proto-chemistry, primarily metallurgical, is well known, but this is even truer of Chinese alchemy, where Taoism, medicine and alchemy were always intimately connected, not only theoretically but *in propria persona* time after time. There can now be no doubt that the Arabic experimentalists and writers were deeply influenced by Chinese ideals and discoveries, perhaps indeed hardly less than by the Hellenistic aurifactive proto-chemistry which Byzantine culture had preserved. One could even go so far as to say that what had happened in East Asia was largely responsible for setting the definitive alchemical style which lasted in European culture from about +1150 till the age of Libavius, Boyle, Priestley and Lavoisier (+1600 to 1800), giving rise in all three civilizations to a wealth of discoveries in chemistry and chemical technique. When Paracelsus soon after +1500 uttered his great watchword: "the business of alchemy is not to make gold but to prepare medicines" he linked together indissolubly ancient Chinese macrobiotics and modern Western, now oecumenical, chemo-therapy.

HELLENISTIC PROTO-CHEMISTRY

If it was really in Chinese culture that the tie-up between gold, gold-making and immortality first took place, what kind of immortality was it that was meant? Notions about life after death and the possible avoidance of death have naturally always been vague in all early civilizations, but it is possible to show by a brief comparative study how far indigenous Chinese ideas differed from those of certain other cultures. Also we can give approximate dates for the various phases of development of these ideas. Essentially what has to be demonstrated is that it was in Chinese culture, and in Chinese culture alone, that the eschatological conditions were right for the origin of real belief in the existence and efficacy of macrobiogens, chemical and physiological elixirs of material immortality. There was no sharp ethical polarization of other-worldly heavens or hells, and "the spirits of just men made perfect", together

with their bodies in adequately rarefied or etherealized form, would be able to enjoy eternal life either on the earth below or in the constellations of the sky — in any case still fully within the bounds of the natural world. Here there were radical differences from Indo-Iranian-European civilization. Even though the idea of the elixir spread in due course all over the Old World, its forms were modified and watered down, so how it came to crystallize in the first place matters a good deal. Before speaking, however, of the general comparative range of ideas, and describing the Arabic and Latin reactions to Chinese ideas, there is a preliminary point to make, namely that in spite of an impression sometimes found, there is almost nothing about elixirs or macrobiogens in the documents of the Hellenistic proto-chemists.

Passages which suggest this line of thought tend to evaporate on close examination. For example, a "medicine of life" (*pharmakon tēs zōēs,* φάρμακον τῆς ζωῆς) is mentioned in the *Book of Camarius, Philosopher and High Priest, Instructing Cleopatra on the Divine and Sacred Art of the Philosopher's Stone.* The title may be late, but from its content the text is certainly not among the younger works in the *Corpus* and could easily be of the +2nd century. At one point, addressing Cleopatra, Ostanes and his companions are made to say:

> In thee is hidden all the marvellous and terrible mystery. Enlighten us, illuminating the elements with thy radiant splendour. Make known to us how the highest descends to the lowest, and how the lowest ascends to the highest, and how the midmost draws near to the lowest and the highest so that they are made one with it, and what is the element which works upon them. Show us how the blessed waters come down from above to awaken the dead, who lie round about in the midst of Hades, chained in the darkness; how the medicine of life comes to them and awakens them, rousing them out of their sleep there; how the new waters that have been produced during their prostration by the action of the fire [lit. light] penetrate them. The vapour supports them; rising from the sea, it supports the waters.

And a little further on:

> They [the substances, have arisen] similarly from the womb of the waters, and from the body of the air which ministers to them; it has brought them out of darkness into the light, and from mourning to rejoicing, and from disease to health, and from death to life. And it has clothed them with a divine and spiritual glory which before they had not... They have awakened out of sleep and all arisen from Hades...

Yet in spite of the mystical language it is generally agreed that these passages are descriptions of reflux distillation in the *kēro takis* apparatus. The vapours of mercury, sulphur or arsenic arising from the material at the bottom undergo a chemical reaction with some metal held at the top, and then condense and run down the sides of the vessel so that a cyclical process continues as long as desired. The language is closely related to

that of the mystery religions, as also to Hermetic and Gnostic texts and ideas; and it has been said that nothing could be more similar lexically than this to the mystical parts of the Pauline epistles. Rebirth in "living waters", the chrism with which neophytes were anointed, and the vapour paralleling the fragrance of perfume of the gnosis, all show how near the Hellenistic proto-chemists were to the religious thought of their time. But the "medicine of life", and even the "drug of immortality", remained in this part of the world essentially metaphorical, and could frequently be applied as a poetic description of the sacraments, whether baptism or eucharist, by Christians and Gnostics alike. And the invariable context was essentially "other-worldly" for none of the Hellenistic religions envisaged a life everlasting in this present world.

Another ancient text which can serve as an example occurs in the *Letter of Ostanes to Petasius*. The "divine" (or sulphurous) water, i.e., the mixture of calcium polysulphides, is thought of as a panacea. Ostanes says:

> It is by means of this precious and divine water that the malady is treated. By means of it the eyes of the blind see, the ears of the deaf hear, the tongues of the dumb speak... Here is the preparation of the divine water... This water revives the dead and kills the living, it lightens the darkness and darkens the light, it seizes the water of the sea and extinguishes fire...

This passage undoubtedly has to do with the colours produced by surface-films of sulphides on metals, but the rather double-edged properties mentioned in the last sentence gravely detract from any impression that an elixir idea might be present. Surely the writer was simply describing in poetical terms the yellowing, reddening and blackening effects of sulphide films.

A third text has a reference to long life which was thought to be part of the title, but in fact was only a greeting to the reader. This is the curious book which Berthelot Ruelle entitled *The Chemistry of Moses,* rightly analogising it with the Leiden Pap. X, though it also embodies Pseudo-Democritus fragments and includes material on the dry distillation of eggs. Doubtless this book belongs to a Jewish-Alexandrian tradition of proto-chemical practice which one encounters in connection with the apocryphal *Book of Enoch* and the problem of the origin of the word "chemistry"; and though it has no title nor writer's name it must be that referred to elsewhere in the *Corpus* as the *Domestic Chemistry of Moses the Prophet* or the *Fermentation Technique of Moses.* It opens with the statement that "the Lord said unto Moses: I have chosen the priest Belseleel of the tribe of Judah to be an artificer in gold, silver, copper, iron, and all workable stones and woods, and to be a master of all the crafts". It then plunges into many recipes. But first there is an invocation to the reader: "Success to the Work, a happy issue to the [processes of] fabrication, an attainment of the [end of] labour, and Length of Days!". This

"All Hail" is repeated at the very end of the text, it never did form part of the title, and it has nothing to do with medicines either of longevity or immortality.

From Hellenistic and Byzantine times this is about as much as one can find. Of course, by the +13th century, especially with Roger Bacon, the elixir idea was clearly implanted in Europe even though necessarily restricted by Western cosmology and theology to the attainment of longevity rather than material immorality. It is just this difference in the conception of possibilities open to man that we must now examine. But after the transmission from the Arabs, the "drug of deathlessness (*pu ssu chih tshao*)" was definitely incorporated in European thinking so far as it could be, and one result of this can be seen in the *De Vita Longa* of Paracelsus, written about +1526 and printed in +1562. Life, he said, is "nothing other than a certain embalsamed Mumia, which preserves the body from the mortal worms and from corruption by means of a mixed saline solution" — courageous words, with all the dew of the dawn of modern science on them. Now what we need is a suvey of the eschatological world-views of different civilizations to elucidate why the idea of immortality elixirs made so great a fortune in China, and why it could be only partially appropriated by Europe. By that time, however, it had accomplished the task of bringing alchemy to birth, and hence perhaps the greatest single stimulus for man's exploration of the chemical world round about him.

CHINA AND THE ARABIC WORLD

When between +635 and +660 the tribesfolk of the Arabian deserts, inspired by the new religion of the prophet Muhammed and determined to replace their poverty by a fuller life, poured forth into the surrounding areas of age-long culture, a fresh civilization with its own language and its own characteristic features was born. It was destined, as everyone knows, to inherit the major part of Hellenistic science and technology, and to pass it on in due course to the Latin West; a process of absorption, enrichment and transference facilitated geographically by the fact that Islam conquered not only the Near and Middle East but also North Africa and Spain. But its cultural boundaries stretched much further eastward, reaching to the borders of India and the bounds of Sinkiang, covering everywhere in fact as far east as the longitude of Lop Nor and all the space between the Chad and the Caspian. Hence it is easy to understand that Hellenistic knowledge was not at all the only river which flowed into the lake of Islam — Persian and Iranian tradition was swallowed up in it, and strong currents of influence came westward now

from India and now from China. Obviously when Arabic culture began to concern itself with chemical matters much would be added to the proto-chemistry of the Hellenistic world, and in what follows we must try to trace particularly the passage westward of Chinese alchemical theory and practice.

Arabic alchemy does not really begin until the +9th century, but it may be significant that we have a circumstantial account of aurifaction seen by an Arab envoy at Byzantium toward the end of the previous one. His name was 'Umara ibn Hamza, and being despatched on a mission by the Caliph al-Mansūr in +772 he was present at a demonstration in a secret laboratory in the imperial palace when lead was turned to silver by the projection of a white preparation, and copper to gold by the projection of a red one. The story is told in a geographical work, the *Kitāb al-A'lāq al-Nafīsa*, written by Ibn al-Faqih of Hamadan about +902. At the end of his narrative 'Umara concludes that it was this incident which awakened the interest of the Caliphs in alchemy. There is no particular reason for disbelieving the story, but whether aurifaction was really the first chemical exercise to intrigue the Arabs is doubtful, for the pursuit of macrobiotics may have been known at least as early, as we shall duly see; and that must have come from a diametrically opposite quarter.

The great days of Arabic alchemy are reached with that flood of books and tractates which go under the name of *Jābir ibn Hayyān* and can be dated with certainty to the last half of the +9th century and the first half of the +10th. Understanding of this was the solution of one of the most intractable puzzles in the history of chemistry, namely the relation of the "Geber" who wrote in Latin toward the end of the +13th century and the "Jābir" who lived in the golden age of the 'Abbāsids. The breakthrough came in two classical papers by Ruska and Kraus published side by side in 1930. Historians of the last century such as Schmieder and Hoefer generally confused Geber and Jābir, though Kopp first realized that the Geberian titles were not to be found in the Arabic bibliographies, while Berthelot&Houdas not only recognized the great difference between the two types of texts, but also knew that already in +987 the author of the *Fihrist* expressed grave doubts concerning Jābir's authorship and historicity. Jābir does not know many things which are in Geber, and Geber shows no trace of having been translated from the Arabic, though Latin translations of a few of the Jābirian works have been found. The fact is that the Jābirian writings form a *Corpus*, the work of many different writers with a common philosophical outlook; none can be earlier than about +850 and the whole collection must have been completed not only before +987 but before about +950 because there are quotations in Ibn al-Wahshīya al-Nabatī. As for the real existence of Jābir ibn Hayyān himself, it has been and still is a matter of debate, but if he is accepted

as historical his dates cannot have been far from ca. +720 to +815, perhaps some decades later. Whether he wrote any of the *Corpus* texts, even the earliest, remains undecided.

THE NAME AND CONCEPT OF ELIXIR

In Arabic alchemical thought, *al-iksīr* was the substance which when added in projection (*ṭarḥ*) to any imperfect thing brought about a change for the better in the balance or *krasis* of its qualities, i.e., a transmutation (*qalb* or *iqlāb*). Even a change to the perfect equilibration seen in gold was possible. Living things also were capable of a similar perfection, which in their case meant health and longevity, so that the *iksīrs* were naturally thought of as drugs, the "medicines of man as well as of metals". And just as *iksīrs* would powerfully work on plants, animals, and human beings no less than on mineral or metallic substances, so in their turn they could be prepared by art from any of the three natural kingdoms — a Chinese rather than a Hellenistic trait. The different schools (*ṭawā'if*) which emphasised one or other of these realms as raw material starting-points were discussed at length in one of the books of the Jābirian *Corpus*, the *Kitāb al-Lāhūt* (Book of the Divinity). In another work, perhaps older, the *Opinions of Balīnās on Mineral Substances* (*Kitāb al-Ahjār 'alā ra'y Balīnās*), it is declared that there are seven types of *iksīrs*, three uncombined, three with constituents drawn from two of the realms in different combinations, and one made of substances taken from all three realms. Processes of distillation nearly always enter into the preparations.

The provenance of the word *al-iksīr* has given rise to a good deal of discussion, for it has no obvious Arabic root. Little help is available from the Jābirian writers themselves, who engage in the manner of their time in fanciful etymologies. For example, the *Kitāb al-Rahma al-Kabīr* says:

> Al-iksīr was thus named because it has so great a power over the substances on which it is projected, transforming them and conferring its own nature upon them. Others aver that the name originated because the elixir breaks and divides itself up; and others yet again say it got its name because of its nobility and superiority.

It is probable, however, that the second of these suggestions was fairly near the mark. For since the first proposal of Fleischer in 1836 it has been generally assumed that *iksīr* was taken wholly from the Greek word *xērion* (ξηριον), found quite often in the Hellenistic *Corpus*. In one clear statement of Olympiodorus (+6th century) this is identified as the "dry powder of projection" (*epiballeis to xerion*, Επιβαλλεισρο ξηιαν, said of adding arsenic to copper); but in many other occurrences the word "projection" was supplied, not unreasonably, by Berthelot Ruelle. There is even a fragment entitled *Peri Xērion* (On the Powder), presumably

part of a lost tractate, in which it is said that the truest powder (*alēthestaton xērion*, ἀληθεστατον ξηριον) has three powers, those of penetration, tincture, and fixation. And it is interesting that the word, which originally probably meant any dry powder, had slight medical undertones, for the physicians used it to signify styptic preparations suitable for strewing on open wounds.

In the Syriac texts of the +7th to the +9th centuries, but based largely on early material in Greek, the word is perfectly recognizable in its new forms — *ksyra, ksirin, iksirin, eksirin* — and in association with projection (*arma*, from *rma*, to throw). Indeed it is used even more frequently. But it seems no longer to mean a dry powder only, for it is said to be like honey, like ice, like a metal, like rust, or a distillate, or even an oil. This suggests that by the beginning of the +8th century an inflow of other ideas was coming in to the Arabic world from some quite different quarter, accompanied perhaps by a similar sound which was identified with the *x* or *ks* phoneme, and carried with it a powerful reinforcement, of the idea (so strong as to be essentially a new thing), that the elixir partook of the nature of a medicine.

This consideration leads us to see some value in the proposals which have been made to derive *iksīr* from Chinese roots, just as in the case of "chem-" which we examined earlier. Dissatisfied with the purely Arabic or Greek derivations, Mahdihassan in 1957 suggested that Chinese phrases such as *yao chi*, "medicinal dose", or *yao chih*, "medicinal mushroom", should be perpended. The Thang pronunciation of the former would have been something like *iäk-dziei*, and that of the latter perhaps *iäk-tsi*, but unfortunately neither phrase is at all a classical one. Some years later Mahdihassan changed his mind and proposed the more unlikely *i chhi*, which would mean something like "unitary pneuma" (mediaeval pronunciation *ik-si*), not a phrase with any very close alchemical connections, if we have proto-chemical alchemy in mind. Soon afterward the eminent sinologist Dubs came in with yet another suggestion, namely *i chih*, literally "essence of a juice", or as he took it, "the substance of a fluid secretion"; the Thang pronunciation of which would have been something like *iäk-ts'it*. There, apart from criticisms by Mahdihassan, the matter has rested ever since. The suggestion as a whole does not carry the weight which, we think, can be attached to *chin*, gold, as the origin of "chem-", but it deserves perhaps to be retained for a while if only as a possible case of an erroneous but suggestive linguistic identification. if one imagines an Arab merchant of the +8th century, in Canton or Hangchow or Sinkiang discussing alchemy with agreeable Taoist contacts, one can visualize his interest at finding a phrase which sounded so like the Syriac *iksirin* or Arabic *iksīr* which he already knew, and we know how easy it always is in such cases to make an unjustifiable judgment of identity. "How extraordinary — that's just what we say!" But

imperceptibly of course he was absorbing a number of ideas which had not previously been current among the Greeks, Syrians and Arabs, e.g., that the powder of projection was also a mighty medicine, the panacea of men and metals.

THE ELIXIR IN ISLAM

In order to prove that this was how the Arabs saw the affair it will be necessary to give a number of direct quotations.

The first comes from the *Kitāb al-Imāma wa'l Siyāsa* (Book of the Religious and Civil Authority) attributed to Ibn Qutayba who died in +889, but perhaps rather by one of his contemporaries. The Caliph 'Abd al-Malik (r. +685 to +705) appointed his brother Bishr ibn Marwān as Governor of Basra, with Musā ibn Nusair as his principal adviser. Now Bishr was fond of pleasure and handed over the conduct of all affairs to Musā. While thus withdrawn from business:

> one of the men of Iraq came before him, and said: 'In God's name, is it your wish that I give you a drink which will cause you never to grow old, subject to certain conditions which I shall lay upon you?' 'What are these conditions?' asked Bishr. 'That you do not allow yourself to be angry, do not mount a horse, and have no dealing with women, nor yet taking any bath, for forty (days and) nights'. Bishr accepted these conditions, and drank what was given to him, shutting himself up from all men, near and far, and remaining secluded in his palace. And so he continued, till news suddenly reached him that he had been given the Governorship of Kufa as well as of Basra. At this, his joy and delight could not be contained. He called for a horse to go to Kufa, but the same man appeared and urged him not to stir by the least movement from his place. But Bishr would not listen to him. When the man saw his determination, he said: 'Bear me witness against yourself that you have disobeyed me!' And Bashr did so, testifying that the man was free of blame.
>
> Then he rode out to Kufa, but he had not gone many miles when, having placed his hand upon his beard, lo! it fell away in his hand. Seeing this he turned back to Basra, but remained there not many days until he died. When the news of the death of Bishr reached 'Abd al-Malik, he sent al-Hajjāj ibn Yūsuf as Governor in his room.

There may be some degree of the fictional in this story, but the fact that it was current so soon after the events suggests at the least that people were talking about elixirs of perpetual youth or life around the time of the death of Bishr ibn Marwān, which can be fixed at +694. The remarkable story is repeated in a work indubitably written by Ibn Qutayba, the *Kitāb al-Ma'ārif* (Book of Knowledge in General), where he says that Bishr died after drinking the remedy called *idhrītūs* or *adhrītūs*.

The terminology here may have been of Greek origin, taken from a passage which even ends with a poetical reference to a drug. But the

idea of a medicine of eternal youth was exceedingly un-Greek, and what is more, the story includes some remarkably typical Chinese features, especially the injunctions to refrain from all the passions during the course of the treatment or training — vital, as we know in physiological alchemy, and very likely to have been stipulated by Taoist adepts offering life elixirs. Of course there is not need to suppose that the physician-alchemist in this case was actually Chinese, only that he must have been in contact with Chinese culture; and this could have been true of one man whose participation in the events has been suggested already, namely Māsarjawayh, the Syriac-speaking Jewish physician of Basra (fl. +717), later frequently referred to by Arabic men of science, and certainly living in a great trading centre where Chinese contacts in depth may well have been likely.

The other story from this early period concerns a Nestorian bishop of the +8th century, Isaac of Harrān, and comes from an anonymous Syriac fragment edited and translated by Brooks. This Isaac was a bad character, a *budmāsh*, irregularly instituted in the first place; to him came a strange wandering monk who performed an aurifaction in his presence using an elixir. A day or two later, Isaac, accompanying him on his way, murdered him by throwing him down a well, but found in his cloak neither a supply of the *eksirin* nor instructions for making it. Isaac eventually got himself made some kind of patriarch because of his pretended art, but when he proved unable to teach it to the secular Muslim ruler, the emir had him executed in +756. Here there is nothing overt about macrobiotics save the name of the substance, but the story has an uncanny similarity to a hundred others found in Chinese texts of earlier as well as later times.

Where the Arabs went far beyond anything earlier in the West was in their actual administration of elixir preparations to desperately sick human beings — a proceeding which brought them completely into line with the lineage of Chinese alchemist-physicians. Three striking Iā birian stories have been translated out of many more, and they are worth giving entire, both for their colour and their revolutionary nature. All these come from the *Kitāb al-Khawāss al-Kabīr*.

One day [saith Jābīr], when my renown as a learned man and true disciple of my Master had already become known, I found myself at the house of Yahyā ibn Khālid. This man had a noble slave endowed with perfect beauty, intelligent, well brought up, and good at music; nobody else had anyone like her. But being afflicted by some illness she had taken a purgative which made her so sick that in view of her constitution it hardly seemed that she could recover. She vomited so much that she could hardly breathe or speak.

Yahyā having been informed of her state by a messenger asked me what I thought of the case. As I could not see her I recommended cold water treatment, for at that time I knew nothing better for use against poisons. However, it did no good, not hot treatment either, for I had counselled warming her abdomen with hot salt and bathing her feet with hot water.

As she continued to get worse, Yahyā took me to see her, and I found her half dead and greatly exhausted. Now I had with me a little of this elixir, and I made her drink two grains of it with three ounces of pure *sukunjabīn*. By God and by my Master, it was not long before I had to cover my face before this girl, for in less than half an hour she regained all her beauty.

Then Yahyā prostrated himself before me and embraced my feet, at which I begged him, as a brother, to give over. So he asked me about this medicinal elixir, and I offered him the rest of what I had with me. However, he would not take it, but from that time began to study and practice the sciences until he had acquired much knowledge. Yet his son Ja'far went beyond him in intelligence and learning.

On the exact historicity of this account there is no need to insist, what matters is the conviction that chemicals could be used in this way. "Jābir" had a similar experience with a slave-girl of his own.

According to what she said, she had taken unwittingly as much as an ounce of yellow arsenic. I could not find any remedy for her condition though I tried all the antidotes I knew. Finally I made her drink a grain of this elixir in honey and water. No sooner had it entered into her body than she vomited the arsenic and was restored to health.

And thirdly, there was a case of snake-bite poisoning.

As I went out one morning to go to the house of my Master Ja'far (may the blessing of God be upon him), I came upon a man whose whole right side was dreadfully swollen, without exaggeration as green as a beetroot, and in some places already blue. I asked what the matter was, and he answered that this had come on after he had been bitten by a viper. I therefore obliged him to take two grains of this elixir dissolved in cold water, for I believed him to be on the point of death. By God, the green and blue discolorations disappeared and were replaced by the natural colour of the body; and after some time the swelling went down and his side became normal. Having recovered his speech he got up and went home, entirely cured.

One cannot help being reminded by the indiscriminate use of the term *tan* in Chinese for elixir and compounded medicine.

Another feature of the Jābirian writers is that from time to time they actually have to do with adepts of incredible longevity. Harbī the Himyarite is a case in point. In the *Kitāb al-Hāsil* (Book of the Result), it is said, in connection with the glyphomantic part of the Balance Theory, that "Jābir" learnt the names of the metals in the Himyaritic language from this sheikh who was aged 463 years. They could then take their place in a table of such names along with Arabic, Greek, Alexandrian, and Persian. Harbī, who appears again in a number of other Jābirian books, is claimed by Jābir as his master, and actually appears in the title of one of them, so that he must have been, or was credited with having been, an alchemical adept himself. A macrobiotic sheikh of this kind ranks almost as a *hsien*.

We have now seen that there is in fact a great deal in the Arabic alchemical literature on elixirs of life and everlasting life. Of course it is different in general character and also in details from anything we find in

the Chinese texts — that would be expected — but evidently the atmosphere in the Arab world from +700 onward is radically different from that of Hellenistic proto-chemistry. If this can be sensed only on the basis of texts which have been studied in modern research and translated into Western languages, what may we expect when the literally thousands of Arabic alchemical books not yet examined are placed at the disposal of the world republic of learning? But there is one final point to be made. Immortality or longevity elixir ideas did not have to reach Europe only through Islamic culture. Nestorian contacts and transmissions sometimes took place directly, the Armenian kingdoms could sometimes be foci for ideas, and in the travels of the magnetic compass we have already seen one vivid possibility of transmission through the +12th-century Western Liao kingdom, the Qarā-Khitāi. The mid +13th century was not at all too late for direct influences, and that was just the time when Franciscans like William de Rubruquis (Ruysbroeck) were discussing sphygmology in China, and Odoric of Pordenone disputing with Mahāyanist *ho-shang* about reincarnation. The Italian merchants at Yangchow in the +14th century might have been a little on the late side, and even Marco Polo and his contemporaries too, but that there were channels short-circuiting both Islam and India we need be in no doubt. How far they carried the ideas we are here concerned with remains to be seen.

THE TEST-TUBE BABIES OF JĀBIR

There is one very important theme of Arabic alchemy which seems never before to have been set properly in the context of elixir doctrine, though Kraus gave it close and learned study. This was the so-called Science of Generation (*'Ilm al-Takwīn*), concerned with the artificial asexual *in vitro* generation of plants, animals and even men, as well as with the production of ores and minerals in Nature and in the laboratory, including the generation of the noble metals from the base. It will not do to dismiss such ideas as merely "mediaeval nonsense". They often give deep insight into the minds of the men of that age, and they may also illuminate what passed from one lot of men to another.

Let us therefore take a closer look at this extraordinary development, as we find it in the most explicit source, the *Kitāb al-Tajmī'* in the Jābirian *Corpus*. The artificial creation of minerals (*takwīn al-ahjār*), of plants (*takwīn al-nabāt*), of animals (*takwīn al-hayawān*) and even of men and prophets (*takwīn ashāb al-nawāmīs*), by human artisanal action (*sāni'*), imitating the demiurge (*bāri'*) or creator of the world, was a cardinal belief of the +9th century. These were the two sorts of generation (*kawn*) or creation (*khalq*) distinguished in the Balīnās texts, the first (*al-kawn al-awwal*), by God, the second (*al-kawn al-thānī*), by man. A Jābirian writer, speaking of the elixir, says:

> If you can succed in composing [or organizing] the isolated things, you will assume the very place of the [World-] Soul in relation to Substance, the isolated things occupying in relation to yourself the place of the [four] qualities [or natures] — thus you will be able to transform them into anything you wish.

And aurifaction was only one special case of this general principle. In Ibn Khaldūn's definition of alchemy: "It is a science that studies the substance [the elixir] through which the generation of gold and silver may be artificially accomplished, and comments on the operation leading to it". Moreover, the possibility of an artificial generation (*takwināt*) of plants and animals was not confined to Jābirian circles, it was widely believed and discussed. Ibn Washīya's *Kitāb al-Ta'fīn* (Book of Putrefaction), ca +930, has much on it, and it was well known at the further end of the Mediterranean in Muslim Spain, as is shown by the *Kitāb Ghāyat al-Hakīm* of Maslama al-Majrītī (or Pseudo-Majrītī), ca +1000 or a few decades later. It was of course connected with the idea of natural spontaneous generation, prominent in the *Kitab Sirr al-Khalīqa* (ca + 820), Perhaps significantly, the *Rasā'il Ikhwān al-Ṣafā'* and many other texts attribute the idea to India (or the Further Indies) and even place the creation of the first man by this means in India or Ceylon. One has therefore to take the whole matter seriously. And the practical directions include some fascinating detail.

What sort of thing did they involve? In one procedure, in the *Kitāb al-Tajmī'*, a theromorphic glass vessel, shaped according to the animal intended, contained the semen, blood, and samples of many parts of the organism to be reproduced, together with drugs and chemicals chosen in kind and quantity according to the Method of the Balance; all this enclosed at the centre of a cosmic model, a celestial sphere (*kura*), globular, latticed, or armillary, set in continuous perpetual motion by a mechanical device. Meanwhile a fire of the first, or unit, intensity (i.e. a mild one) was kept burning underneath. If the exactly correct time was not reached, or if was exceeded, no success whatever would be achieved. Other schools were partisans of "putrefaction" (sēpsis, σῆψισ *ta'fīn*), or stressed the importance of aeration and stronger heat, or considered that blood was more essential than the chemicals; some said that semen was indispensable if the new being were to have the power of speech, and parts of the brain if it were to be endowed with thought, memory and imagination. It was even averred that higher beings would come forth from the apparatus equipped already with the knowledge of all the sciences. There can be no question that the origin of the famous homunculus of Paracelsus lies here, but how far Aldous Huxley would have been surprised to find his *Brave New World* of separated totipotent blastomeres and artificially incubated "test-tube babies" anticipated in the dreams of these Arabic alchemists we would not undertake to say.

A parallel passage about a perpetually rotating spherical cosmic model within which the transmutation of all the base metals into gold was performed, occurs in the *Kitāb al-Rāwuq* (*Book of the Filter*), and may be read in the translations of Said Husain Nasr and Kraus.

All these constructions seem very un-Hellenistic, but they do signally recall the Chinese armillary spheres and celestial globes kept in continuous rotation by water-power, instruments which derived from polar-equatorial, not ecliptic-planetary, astronomy, and came into use much earlier than anything of the kind in the West. Similar Indian ideas, especially concerning perpetual motion, are also recalled. On alchemical cosmic models as such there are also plenty of Chinese analogues and predecessors, as we have duly seen. So much for the rotating cosmic shell.

As for the central vivification, Kraus's ingenuity was much exercised to find Hellenistic antecedents, but little was available save spontaneous generation, automata, and rituals for the animation of religious images, none of which is very much to the point. Artificial generation in the Arabic sense was, Kraus admitted, unknown in Greek writtings. Spontaneous generation on the other hand was of course widely believed, as of bees from the corpses of lions, and so on, throughout the European centuries, faith in it dying out only with the growth of modern biology in the Enlightenment period. It was equally widespread in Chinese culture. But it was uncontrollable by men. As for moving and singing automata or puppets there is surely no need to refer to the works of the Alexandrian mechanicians, but there were other more uncanny Graeco-Egyptian stories of speaking statues and ever-rotating columns which the Arabs inherited. However, honours are about even here again, for Chinese culture also had a wealth of legends concerning automata, some of which, like the Taoist robot of King Mu of the Chou, came very near indeed to being artificial flesh and blood. On the third point "Jābir" connects the artificial generation schools with the image-makers (*eidolopoioi*, Εἰδωλοποιοί, *musawwirūn*), raising therefore the matter of theurgic animation techniques. It was not a question necessarily of causing statues of the gods to move, but rather preparing them in such a way as to serve as the real abodes of the spirits which were to be worshipped through them, to assure the real presence, as it were, of these gods and spirits.

The Neo-Platonists accepted the idea and wrote much on the practice; from one source we learn that the liturgists observed the heavens to get the right time, and then placed the appropriate herbs, gems and perfumes in the statue which itself had been moulded from clay mixed with holy water, aromatic plant and other material powdered and sieved, together with comminuted metals and precious stones. But once again there was not much to choose between Hellenistic and East Asian practices, for in China and Japan there was the readying of images for the presence

of gods, *lokapalas, bodhisattvas,* etc., even to the insertion of model viscera to make them complete, then their formal consecration by the dotting in of the pupil of the eye. One can only conclude that the Arabs did not have to rely exclusively on Hellenistic culture for what they knew (or thought they knew) about spontaneous generation, mechanically operated simulacra, or the animation of religious images. All this may have a certain relevance yet it does not get to the root of the matter.

No, the fundamental feature of the Arabic creation of the rabbit out of the hat lay, as we see it, in those chemical substances which were added to the animal materials in the central container, for they represented nothing other than the *al-iksīr* of life, and the entire pattern of pseudo-scientific operations — how far ever tried out in practice remains somewhat obscure — was simply a new and original Arabic exercise using the powers of the life-giving *tan.* The Chinese elixir idea was at the centre, and the Chinese perpetual-motion cosmic model surrounded it; beyond this some part was doubtless played by earlier Mediterranean ideas on the subjects just discussed. In general, therefore, this giving of life to the lifeless, by chemical means, was, we conclude, a particular Arabic application of a characteristically East Asian conception, the giving of eternal life to the living, by chemical means. It reminds one of Kungsun Cho in the — 4th century, saying with typical Chinese optimism: "I can heal hemiplegia. If I were to give a double dose of the same medicine I could probably raise the dead!"

Summing it all up, we think one could say that Arabic alchemical theory was a marriage between the Taoist idea of longevity and immortality brought about by the ingestion of chemical substances and the Galenic rating of pharmacal potency in accordance with the *krasis* or balance of the four primary qualities (the natures). Gruman was quite right in remarking that Arabic alchemists generally emphasised their ties with Hellenistic literature and traditions, that is indeed the dominant impression one gets in studying their writings — but perhaps if those were the books that they read, the Persian, Indian, and especially Chinese ideas and practices were what they talked about, few or no texts from those lands being available in Arabic translation at any time. The macrobiotics of China seems to have come westward through a filter, as it were, leaving behind inevitably the concept of material immortality on earth or among the clouds and stars; for after all, Paradise for Muslims was quite similar to the Heaven of the Christians, irretrievably subject to "ethical polarisation". Nevertheless some vital smaller molecules filtered through — (i) the conviction of the possibility of a chemically induced longevity, validated always by the example of the Old Testament patriarchs, (ii) hope in a similar conservation of youth, (iii) speculation on what the achievement of a perfect balance of qualities might be able to

accomplish, (iv) the enlargement of the life-extension idea to life-donation in the artificial generation system, and (v) the uninhibited application of elixir chemicals in the medical treatment of disease. This last new development was the subject of a classical paper by Temkin, who emphasised that the whole course of Hellenistic proto-chemistry was primarily metallurgical, aurifictive and aurifactive as we should say, while Arabic joined with Chinese alchemy in the profoundly medical nature of its prooccupations. Ko Hung, Thao Hung-Ching and Sun Ssu-Mo had glorious successors of the same cast of mind in al-Kindī, the Jābirians, al-Rāzī and Ibn Sīna. Temkin found no link between chemistry and medicine in Greek until the poems of Theophrastes (ca +620) and Heliodorus (ca +716), for although Dioscorides and Paul of Aegina of course knew of mineral medicines, Gnostic philosophy was as oil and water with the Hippocratic tradition, and chemical macrobiotics was quite foreign to the Hellenistic world. Then eventually the first two of the ideas just listed, together with the fifth, passed through into the Latin culture of Western Europe at the time of the translations in the +12th century. If nothing living was ever seen to step forth from Jābir ibn Hayyān's cosmic test-tubes, chemo-therapy with all its marvellous achievements of today was assuredly born from the Chinese-Arabic tradition, with Paracelsus as its midwife.

THE ELIXIR IN BYZANTIUM

If the general picture so far outlined is approximately correct, namely that there was a passage of the elixir idea from the Arabic alchemists to the Latins, reaching full acceptance by them, according to their lights, in the time of Roger Bacon; then it might be expected that similar macrobiotic hopes would have become known in Byzantine culture a couple of centuries earlier. This is exactly what we find. If we open the history of fourteen Byzantine rulers written by Michael Psellus about +1063, his *Chronographia*, we can read a very peculiar passage about the reign of the Empress Theodora (+1055 to +1056). Psellus wrote:

> The extremely generous persons [installed by her in positions of authority in the church] who surpassed all bounds of liberality with their munificent gifts, were not angels carrying messages to her from God, but men, who imitated the angelic beings in outward appearance, yet at heart were hypocrites. I am referring to the Naziraeans of our time. These men model themselves on the Divine, or rather they have a code of laws which is, superficially, based on the imitation of the Divine. While still subject to the limitations of human nature, they behave as though they were demigods among us. For the other attributes of Divinity they affect utter contempt. There is no effort to harmonize the soul with heavenly things, no repression of the

> human desires, no attempt by the use of oratory to hold in check some men and goad on others. These things they regard as of minor importance. Some of them utter prophecies with the assurance of an oracle, solemnly declaring the will of God. Others profess to change natural laws, cancelling some altogether and extending the scope of others; they claim to make immortal the dissoluble human body and to arrest the natural changes which affect it. To prove these assertions they say that they always wear armour, like the ancient Acarnanians; and for long periods of time walk in the air—descending very rapidly, however, when they smell savoury meat on earth! I know their kind and I have often seen them. Well, these were the men who led the empress astray, telling her that she would live for ever; and through their deceit she very nearly came to grief herself and brought ruin on the Empire as well.
>
> They predicted for her a life going on centuries without end. Yet in fact she was already nearing the day which Fate had decreed should be her last. I ought not to use such an expression — what I mean is that she had nearly finished her life and the end was at hand. As a matter of fact she was assailed by a very terrible illness...

And indeed she died in the summer of the second year of her reign, aged 76.

From this it seems clear that Theodora was under the influence of a group of monks who claimed to be in possession of macrobiotic techniques. Though these are not described, they could well have been psycho-physiological as well as chemo-therapeutic, and the whole passage has a very Taoist, or perhaps one should say rather at such a time and place, a Sufi, or even Siddhi, character. Walking on air is just what one expects of a Taoist *hsien*, and the remark about the failure to repress human desires might be an obscure reference to something like that physiological alchemy (*nei tan*) which was so important in China. Unfortunately none of the commentators has anything whatever to say about this strange group of Christian monks, so one can only record their existence.

The name of Michael Psellus ought to strike a familiar note in the mind of anyone who is familiar with the Greek proto-chemical writings. For he was indeed none other than that Psellus who addressed an *Epistle on the Chrysopoia* to the Patriarch of Byzantium in +1045 or 1046. He wrote a preface to the *Greek Alchemical Corpus*, and may indeed have been its first collector. He was in touch with Arab scholars, and had Arabs among his pupils, this at a time when many Arabic writings were being translated into Greek. In another place in the *Chronographia* he has an interesting passage on the chemical interests of the Empress Zoe, who died in +1050 aged 72 under Constantine IX; she turned her apartments into a veritable laboratory and never tired of investigating the properties of perfumes and their combinations. Michael Psellus is a man whose life and times would repay, it seems, much further study by historians of science.

THE ELIXIR IN THE LATIN WEST

At last we can come to the Latin West. Albertus Magnus (+1206 to +1280) is already clear that the alchemical elixirs are effective as medicine. Far more daringly does Roger Bacon (+1214 to 1292) affirm time after time that when men have unravelled all the secrets of alchemy there is almost no limit to the longevity that they will be able to attain. It was but a part, of course, of his general scientific and technological optimism that makes him seem so modern a figure, so far ahead of his time. Toward the end of his *Opus Majus,* addressed to Clement IV in +1266 or +1267, there is a section entitled *Capitulum de secunda praerogativa scientiae experimentalis.* Here, in the second "Example" he says:

> Another example can be given in the field of medicine, and it concerns the prolongation of human life, for which the medical art has nothing to offer except regimens of healthy living. In fact, there are possibilities for a far greater extention of the span of life. In the beginning of the world the lives of men were much longer than now, when life has been unduly shortened...

Bacon goes on to say that many believe that this has been according to the will of heaven, adding dubious astrological arguments about the senescence of the world, but he will have none of this, and recommends not only hygienic regimen but also marvellous medicines, some already known and some yet to be found out.

Bacon did not disparage the Hippocratic and Galenic systems of regimen which had come down from antiquity. He added a reference to the effects of sin, possibly out of respect for his cloth not at all devoid of psychological validity. But what was uppermost in his mind was the actual prolongation of the human life-span by natural and chemical means. The traditional hygiene had aimed simply at fulfilling the "natural" span of life; what Bacon offered was, as Gruman says, something radically new in the Western world, a methodical rationale for the prolonging of human life beyond its "natural" span.

After all, it was agreed throughout Christendom that the soul was immortal. Why should it not be retained by art a good while longer in its mortal husk? As Bacon wrote elsewhere:

> The possibility of the prolongation of life is confirmed by the consideration that the soul is naturally immortal and not capable of dying. So, after the Fall, a man might live for a thousand years; only since then has the length of life gradually shortened. Therefore it follows that this shortening is accidental and may be remedied wholly or in part.

Here the reference is to Methuselah's 969 years, but there is no doubt from other passages that Roger Bacon took heart from the examples of all the Old Testament patriarchs, just as the Arabic alchemists had done before him. In this way could the material immortality of China find a foothold in Europe.

A few pages further on Roger Bacon takes up the powers of alchemy. A paragraph full of burning enthusiasm ends as follows:

> And the experimental science [of the future] will know, from the 'Secret of Secrets' of Aristotle, how to produce gold not only of twenty-four degrees but of thirty or forty or however many desired. This was why Aristotle said to Alexander 'I wish to show you the greatest of secrets', and indeed it is the greatest. For not only will it conduce to the well-being of the State, and provide everything desirable that can be bought for abundant supplies of gold, but what is infinitely more important, it will give the prolongation of human life. For that medicine which would remove all the impurities and corruptions of baser metal so that it should become silver and the purest gold, is considered by the wise to be able to remove the corruptions of the human body to such an extent that it will prolong life for many centuries. And this is the body composed with an equal temperament of the elements, about which I spoke previously.

Here then is Ko Hung (and Jābir too) in Latin dress at last.

Bacon also adduced a number of case histories to demonstrate the possibility of extraordinary longevity, and if they sound very unconvincing to us they may have carried more weight with his contemporaries. The "oriental" reference is significant — Artephius, for instance, wandered all over the East seeking knowledge, much of which he got from Tantalus the teacher of the King of India, so that he was enabled to live for 1025 years, by "secret experiments on the nature of things..."

This comes out in another way in other books. Thus in the *Opus Tertium* (+1267) there is an interesting passage on speculative and operational alchemy which treats explicitly "of the generation of things from their elements", not only inanimate minerals and metals but also plants and animals. This is the very idea of the Arabic *takwin,* and now and then we can even catch Roger Bacon in the use of Arabic phrases so typical as "if God wills". There was nothing very new in the belief that Art could produce in a single day what Nature takes a thousand years to accomplish, but we ought not to miss the point that Roger was also extremely interested in the possibility of perpetual motion machines, probably to be achieved with magnets, as indeed his friend Pierre de Maricourt was constantly occupied in attempting. Here then were the two components of the Arabic artificial generation system, though Bacon probably never knew its full details; he would have been very excited if he had, and would certainly have found some ingenious way of reconciling it with Christian theology.

Another interesting tractate is that called *De Retardatione Accidentium Senectutis* which can be dated between +1236 and +1245. There the seven *occulta* turn out to be as follows, first gold (as just stated), second ambergris or spermaceti (that which swims on the sea or is cast up by it), third the flesh of vipers or lizards, "dragons", from Ethiopia, fourth rosemary, sixth a bone believed to come from the heart of the stag, and seventh lign-aloes (the "plant" from India). The fifth proves to be some-

thing more remarkable than any of these, namely *fumus juventutis*, i.e. the exhalations or effluvia of healthy young persons. As the *Secretum Secretorum* says: *Si sentis dolorem in stomacho... tunc medicina necessaria tibi est amplecti puellam calidam et speciosam.* This was a kind of contagion, for Bacon also says: *Infirmitas hominis in hominem transit, ita est sanitas.* The geriatric benefit supposedly derived from proximity to a healthy and beautiful young girl, with the absorption of her breath, is an idea presumably as old as King David, and it was certainly still current in the +16th, +17th and +18th centuries; but when we go on to read that coitus entirely destroys the effect we can no longer forbear from recalling Chinese physiological alchemy (*nei tan*), and it looks as if Bacon was recommending the transfer of *chhi*, for what else could *fumus juventutis* mean? Strangely also, if this happy solution was unattainable, Roger Bacon recommended as a substitute some kind of arcanum prepared from human blood. For more reasons than one, therefore, he probably felt it necessary to be as discreet as possible in discussing elixirs with the Pope or with his Franciscan colleagues. But his texts remain for us the supreme and first great example of *hsien* medicines and *hsien* hagiography in the Western world.

Any intimations of chemical macrobiotics which one can find in Europe reinforcing Roger Bacon's convictions during the following half-century or so, are obviously of great interest for the theme of transfer from the East. Hence we should not overlook a striking passage in Marco Polo which occurs in his account of India (Maabar). Speaking of men whom we might think of as *sadhus* he says:

> And these Braaman [Brahmins] live more [i.e. longer] than any other people in the world, and this comes about through little eating and drinking and through great abstinence which they practise more than any other people...
> Moreover they have among them regulars and orders of monks according to their faith, who serve the churches where their idols are; who are called 'ciuqui' [and] who certainly live more than all others in the world, for they commonly live from 150 years to 200. And yet they are all quite capable in their bodies so that they are well able to go and come wherever they wish, and they do well all the service which is needed for their monastery and for their idols, and though they are so old they render it as well as if they were younger...
> And again I tell you that these ciugui who live so long time... eat also what I shall explain, and it will seem indeed a great thing to you, very strange to hear. I tell you that they take quicksilver and sulphur and mix them together with water and make a drink of them; and they drink it and say that it increases their life, and they live longer by it... They do it twice in the week, and sometimes twice each month, and you may know that those people use this drink from their infancy [so as] to live longer, and without mistake those who live so long use this drink of sulphur and of quicksilver...

And he goes on to expatiate on the gymnosophists. The passage is particularly interesting because both the dietetic-hygienic element and the elixir-pharmaceutic element are both so prominently present; Li Shao-

Chün's cinnabar is living again in Rusticianus' Latin. Marco Polo was a contemporary of Roger Bacon; he reached China in +1275 and left for India in the year of Bacon's death, +1292, returning to Italy by +1295, so that the dictating of his reminiscences belongs to the ensuing decade. Of course Marco's information did not spread with the rapidity of a mass-produced paperback of the present day, but it attained diffusion in a considerable number of manuscripts which were widely read, and what he reported of the chemically-induced longevity of Asian saints and sages must at least have chimed in with those other notes which emanated from specifically Arabic sources.

Henceforward the elixir idea becomes a universal commonplace. Thomas Norton, speaking of the Ruby Stone of the Philosophers in his *Ordinall of Alchemy*, ca +1440, wrote:

> Whereof said Mary, sister of Aaron
> 'Life is short, and Science is full long,'
> Natheless it greately retardeth Age
> When it is ended [accomplished] by strong Courage...

HYGIENISTS AND IATRO-CHEMISTS, PRECURSORS OF MODERN CHEMICAL MEDICINE

After this there is little more for us to say by way of conclusion. In the field of macrobiotics with which we are concerned there were two great movements during the scientific revolution. First, the tradition of medical hygiene, which had by no means been repudiated by Roger Bacon and the alchemists who followed him, gained from their elixir beliefs a new impetus and a new lease of life. In +1550 Luigi Cornaro published his *Discorsi della Vita Sobria*; this, though largely dietetic, laid much emphasis on the avoidance of psychological strains and submission to the passions. In these ways the innate moisture could be conserved. Widely translated and approved, Cornaro's book had many successors, notably Lessius' *Hygiasticon* of +1614 and Sir William Temple's essay on health and long life (+1670). In +1796 came Christopher Hufeland's *Art of Prolonging Life*, in which the term macrobiotics was first used, appearing indeed in the original German version of the title. The influence of Hufeland, who was a friend of Goethe, Schiller and Herder, extended all over the world, and his prescriptions for longevity, in themselves very reasonable, passed into Japanese literature in the translations of Ogata Kōan, as has been shown by Achiva Gorō in his interesting study of the theory of nature-healing in the Rangaku period. Hufeland also exerted a great effect on many nineteenth-century writers on medical hygiene and macrobiotics, following the ideas of William Godwin and A. N. de Condorcet.

The other great movement just mentioned was of course that of iatrochemistry, especially as it developed to the fullness of the Paracelsian form. This was the great empirical phase of chemistry developing in opposition to Galilean-Newtonian mechanicism, along with movements of lesser scope such as that of the biologically-minded Cambridge Platonists. Necessarily it too had Pythagorean and Neo-Platonic, not so say Gnostic and Hermetic, roots. How far it could have had certain East Asian roots, transmitted eitheir through the Arabs or by way of more direct contacts in the +13th century and later, it would be very hard to say, yet it really is the case that much of the Paracelsian thought-world has a strangely Chinese air. For example, the very idea of an organic universe, with an interconnectedness of all things, the prominence of the macrocosm-microcosm analogy, and the readiness to conceive of action at a distance, based on resonance and "magneticall" phenomena — in all these things one has to speak of a least a parallelism with traditional Chinese worldviews. But there are more detailed and disturbing similarities. Robert Fludd coined the words "volunty" and "nolunty", the former to express sympathy, light, warmth, life and expansion, the latter to express antipathy, dark, cold, death and contraction — can they have been anything other than Yang and Yin respectively? By this time Jesuit-transmitted knowledge could have been coming in, a phase of contact which might also have been responsible for the play which he made of the "light" and "heavy" antithesis (*chhing, cho*) in cosmogony. After such parallelisms it is hardly surprising to find Fludd engaging in symbolic correlations between spatial directions and the viscera of the body; while all the Paracelsians wrote on sympathies and antipathies, categories of reactivity, and numerology rather than mathematics. Pervading all was their characteristic empiricism and their emphasis on the medical and macrobiotic side of alchemy. We are not saying that all these traits were marks of the future that modern science had before it, obviously in many ways the exact reverse was the case, but among them certain great convictions stand out, notably that chemo-therapy in unimagined power was a realizable goal for man; and if indeed there were East Asian contributions, however indirect, to these ideas, then some invaluable sense came through along with the nonsense. About the intermediation of the Arabs enough has already been said; for this period one should perhaps look for more direct contacts.

As a concluding epilogue, let us read the exquisitely Taoist words of one of the great Paracelsian physicians, Peter Severinus, archiater to the King of Denmark. In his *Idea Medicinae Philosophicae* (+1571) he wrote of the necessity of replacing book-learning and scholastic philosophy by practical experience of natural phenomena, and practical experimentation. Only so could the inspiring Paracelsian aim be achieved, that alchemists should make not gold but medicines. So to his readers he said:

Sell your lands, your houses, your clothes and your jewellery; burn up your books. Instead of those things, buy yourselves stout shoes and travel to the mountains, search the valleys, the deserts, the shores of the sea and the deepest depressions of the earth; note with care the distinctions between animals, the differences of plants, the various kinds of minerals, and the properties and mode of origin of everything that exists. Be not ashamed to study diligently the astronomy and terrestrial philosophy of the country people. Lastly purchase coal, build furnaces, and watch and operate with the fire never wearying. In this way, and in no other, will you arrive at a knowledge of things and their properties.