

Distinguishing Alchemy from Science

How Clear is the True Distinction?

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"The Alchemist in Search of the Philosophers Stone" (1771), by Joseph Wright

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With the development of the Scientific Revolution in Western thought, and with social changes such as the rise of patronage and the Church's failing authority clearing the path for this development, the sixteenth and seventeenth centuries saw the beginning of the distinctions between what we now know as the many and varied fields of science and mathematics. In the course of this differentiation, it would seem that the more ancient, magical, and thus supposedly useless attributes of natural philosophy had eventually been winnowed from the calculating empiricism and accuracy of mechanical philosophy and what would emerge as the new science. However, more specifically to this essay, to what degree can we say the practice of traditional alchemy was disparate from modern chemistry, what Herbert Stanley Redgrove has termed, "The Outcome of Alchemy" (sec. 68)? In studying the recorded practices of American chemist George Starkey (and his esteemed alter ego, alchemist Eirenaeus Philalethes), and in ascertaining the breadth of his influence on notable scientists such as Robert Boyle, we are confronted with the startling practicality of traditional alchemy and must search for what might have wrought this present-day distinction between the two.

According to Redgrove, "Chemistry as distinct from Alchemy and iatro-chemistry commenced with Robert Boyle...who first clearly recognised that its aim is neither the transmutation of the metals nor the preparation of medicines, but the observation and generalisation of a certain class of phenomena" (sec. 71). This is not to say that Boyle did not believe that such transmutation was possible, for, by evidence of his continuing "chrysopoetic preoccupations...he remained a dedicated believer...and seeker for the Philosophers' Stone [the legendary stone which was to have the power to transform any base metal into highest quality

gold] until his death in 1691” (Newman and Principe 273). Rather, Boyle did acknowledge that “his goal is to show how chymistry can be a useful ancilla to natural philosophy” (Newman and Principe 17); he felt that the sole purpose of chemistry was to provide a storehouse of empirical information wrought from experiment, from which the natural philosopher, the alchemist included, may gain calculative backing for his (or her) logically based theories (much in the same way that Johannes Kepler submitted his own planetary calculations to the wealth of meticulous observations left behind by Tycho Brahe; refer to Kuhn, page 211). Boyle considered his chemistry to be subservient to alchemy, “not a theoretical field in its own right but an empirical bulwark for the ‘new’ natural philosophy” (Newman and Principe 17).

From this we may ask, what was it that began setting alchemy apart from the emerging chemistry? Perhaps it was the ability of alchemy to bring together in one universal scheme the essence or being of matter, its relation to man, and its purpose within that scheme (Taylor 214). Alchemy was a theory belonging to natural philosophy, “aimed at giving experimental proof [for] a certain theory of the whole system of nature, including humanity” (Redgrove sec. 8), and “[i]t opened to man the possibility of *knowing* nature by the cultivation of his powers, instead of merely chronicling her external changes” (Taylor 223).

In “Alchemy: Ancient and Modern”, Redgrove states, “The alchemists held that the metals are one in essence, and spring from the same seed in the womb of nature, but are not all equally matured and perfect, gold being the highest product of Nature's powers” (sec. 9). It was by his or her studies and experimental work that the alchemist endeavored to emulate nature’s generative processes and bring baser objects into perfection, that is, inciting a chemical transmutation of ignoble metals to the perfection of purest gold. The earliest ideas of transmutation stem “from Aristotle’s notion of the four elements and the concept that one

material may, under the correct conditions, be converted...into any other by adjusting the proportions of its constituent elements”; the Arabs later modified this concept and replaced the four elements with sulphur, mercury, (and sometimes salt) as the basic composition of metals (White 109-10), which, after these writings had emerged in Europe, remained as truth for the alchemists in Boyle’s day (refer to Newman and Principe 101).

On the aforementioned generative process, Taylor describes it thusly: “[T]he generation of new things depends on the marriage of the fire and the moisture in the womb of earth” (222) – which were themselves subtle elements, held at first in a “huddle or limbus” at Creation, but separated “by a sort of cosmic distillation or sublimation”, pierced by the Light of God which “formed in [the mass] a model or pattern which contained potentially all that was to be in the world” (Taylor 220); therefore, “*what* new thing was to be generated [by the alchemist] depended on a portion of the original light seeded in the substance in question...This is what determines, e.g., that a lion shall beget a lion, and not a dog, or that gold should be begotten of gold, and of no other metal” (Taylor 222). “[T]heir endeavor to change...copper into gold,” Taylor continues, “was planned as the removal of the form of copper...to be followed by the introduction of a new form” (9). Thus, the basic elements of generation consisted of seed, soil, breath of life from heaven, and gentle warmth (Taylor 10); the transformation needed to take place “by the corruption of the material to be transformed and the generation of a new form within” (Taylor 17).

It is important to note here that some have speculated that this drive to perfect that which is base – this symbolic death of a form and resurrection into another perfected form – was more of a spiritual journey for the alchemist, representing, not a literal chemical process, but rather a mental process through symbolism (Taylor 116), a mystical self-regeneration (Taylor 227); or

“that, by conducting a series of seemingly mundane tasks, they were following a path to enlightenment” (White 127). While it is true that, “[t]he genuine alchemist was absolutely firm in his belief that the emotional and spiritual state of the individual experimenter was involved intimately with the success or failure of the experiment” (White 128), this does not, on the whole, lessen the reality of the alchemist’s endeavors.

It is widely recognized that, regardless of symbolism and spirituality, alchemists were the fathers of modern laboratory technique. “The alchemists were the first and, before the latter part of the sixteenth century, almost the only laboratory workers. They had developed a small-scale technique of separating and combining the constituents of bodies, and to their equipment and technical methods, chemistry added almost nothing until...the middle of the eighteenth century” (Taylor 191). Newman and Principe add, emphatically, “that there did exist a strong experimental tradition in the alchemy of Western Europe from the High Middle Ages through the seventeenth century. Not only did alchemy involve considerable laboratory experience and practice in a general sense, but many alchemists were even deeply concerned with testing” (38); such empirical tests included those for the discrimination of salts (40), determining the nature of metals (44), and distinguishing natural from artificial gold (41). Further, beyond mere laboratory equipment and assaying methods, “alchemy had always been an experimental pursuit” and was “[a]nother major source of the experimental method” (Henry 44). These practical aspects behind the misleading mysticism of alchemy are blatantly embodied in the work of George Starkey, and it is to him we now turn.

Starkey was “the Bermuda-born son of a Scottish minister and...graduate of the fledgling Harvard College”, who by twenty years old, “in a distant outpost of English civilization on the edge of the vast wilderness of the New World...was already involved in practical

experimentation involving both chymical medicine and the search for the secret of metallic transmutation” (Newman and Principe 7). In the autumn of 1650, after years of making do with the limited implements and materials in New England, Starkey set sail for London from Boston, “where glassware, implements, chemicals, and books were more readily available” (Newman and Principe 8). As a point of comparison, Robert Boyle, who was the same age as Starkey, and who is credited as “standing in the vanguard of the ‘New Chemistry’” (Newman and Principe 3), only at this point discovered the “‘Elysium’ of the chymical laboratory” (Newman and Principe 8). Therefore, by the time Boyle and Starkey had met through the Hartlib circle around the beginning of 1651 and “began corresponding and collaborating on chymical experiments and preparations...Starkey had been carrying out experimentation since 1644 and so had seven years of experience behind him, while Boyle’s work in affairs of the laboratory had been under way for just a little over a year” (Newman and Principe 9).

We can see already that the traditional embodiment of ancient alchemy in Starkey and modern science in Boyle becomes problematic, in that the two were, at the time at least, “interested in the same issues and pursued the same goals” (Newman and Principe 12); these two supposedly disparate worlds seemed to coexist, and this historiographic dilemma is further compounded when we find that “Starkey was Boyle’s primary tutor in chymistry” (Newman and Principe 12). “We now know that the clean division of alchemy from chemistry...did not exist for most in the seventeenth century...Moreover, various characteristics widely attached to alchemy that seemed to render a neat division from chemistry possible have turned out to be largely exaggerations or anachronistic assertions” (Newman and Principe 12-13). It is from the details of Starkey’s meticulous experimental methods as recorded in his notebooks that such “whiggism” can be further illustrated.

“The greatest value of Starkey’s notebooks is their ability to tell us about the precise operational and methodological aspects of his laboratory practice and thereby allow us to reconstruct the thought processes that guided his laboratory work” (Newman and Principe 100-101). For example, in Starkey’s preparations for the isolation of Sulphur of antimony from other metallic or mineral components, as detailed in his “Antimoniologia”, he begins by citing and comparing the existing, published processes of Oswald Croll and Angelus Sala. But Starkey was interested more in the creation of rare and powerful arcana than in “producing a medicine cabinet of common medicaments. Thus he immediately sets about *improving* the known methods. Significantly, Starkey does not deploy merely empirical or unguided trials toward his goal but rather turns to theoretical principles to direct his practical investigations...[I]n order to use these theoretical principles practically, Starkey consistently deploys a highly formalized, sequential method for assessing, developing, and testing new processes” (Newman and Principe 101-102). Thus, while Starkey does refer to the chemical theories of his predecessors (in this regard, he was a committed Helmontian), he does not restrict his experiments to the mere whims of common-sense observations or aimless trust in the works of the ancients; in all respects, he seems to have been a serious investigator of occult (or, unknown) chemical processes.

One of Starkey’s most common methodologies, “found in page after page of the notebooks” (Newman and Principe 103), includes making formal observations on known processes or sets of facts, deriving improved processes from these and testing them in his laboratory, then returning to the original entries to record the results, “noting which parts worked and which parts did not” (Newman and Principe 111), and using the experience to improve the process further (Newman and Principe 103). In Starkey’s search for higher arcana, however, he was often faced with “the silence of authoritative authors about issues or ingredients key to the

success of their processes...Thus, Starkey [was frequently forced to] hazard a guess about the meanings of things or about the right steps to take or ingredients to use in a certain process” (Newman and Principe 109). If his guess was incorrect, Starkey “was nothing if not tenacious” (Newman and Principe 114), and by trial and error, with logical reasoning, he would endeavor to narrow down his possibilities until the correct process revealed itself through experimentation. It is important to make clear, however, that Starkey’s “experimental practice was the test of his interpretations of texts, not of the claims of the texts themselves” (Newman and Principe 186) – in other words, all of his processes began with the authority of the written source, and if experimentation led to an unsuccessful product, Starkey was forced to admit folly in his own conjectures (Newman and Principe 117).

Admittedly, this may be one major truth in henceforth distinguishing alchemy from science; for, although science also bases its conjectures on the proven theories of the past, and like Starkey aims to improve existing processes, science is willing to consider fault in the wisdom of its own ancients. There is always that consideration of which is the problematic variable in a given process – the theory itself, or the present interpretation of it? I believe that even science must face this question, but for the alchemist, it seems that when it came to knowledge of the higher arcane processes, such as development of the Philosopher’s Stone, the outcome was proven valid and the process itself was the mystery to be unraveled through study. Redgrove agrees, “[The alchemists] were wont to repeat the same operation (such as distillation, for example) on the same material over and over again...They paid much attention to any changes of colour they observed in their experiments, and many descriptions of supposed methods to achieve the *magnum opus* contain detailed directions as to the various changes of

colour which must be obtained in the material operated upon if a successful issue to the experiment is desired” (sec. 28).

The varying and inconsistent obscurity in the literature of the alchemist is well known, and has become a major point for segregating the whole of alchemy from science. “While the end products are generally clearly described...the means of attaining them is not” (Newman and Principe 186). The implication, of course, is that the practice of alchemy was that of a sort of secret society in which “code names” or elaborate storytelling were employed to describe a given chemical process, that only the spiritually pure or those with mystic training might ascertain the high truth, for the sages did not dare that this knowledge should fall into the wrong hands! Granted, this statement does hold some truth in history (as will be discussed further concerning “Philalethes’s” relationship with the dangerously verbal Boyle), but we must not neglect the viewpoint of culture in this matter. For, in our day, many “might question the reality of a thing simply because it is secret”, yet “[t]he view that real knowledge is not to be freely given away runs deep through many sorts of early modern chymical literature, not only those dealing with transmutation...[Secrecy] marked out the items of greatest value” (Newman and Principe 179-180). It was the noble quest for knowledge that fueled the intellectual’s struggle to understand the hidden and obscure; “the early modern mind took very seriously Heraclitus’s assertion that ‘nature loves to hide’” (Newman and Principe 181).

It is clear then, from Starkey’s example, that there was “a laboratory practice guided by the methodical approach of theoretical principles and direct observation...in the laboratory work of...one who has been called the seventeenth century’s ‘last great philosophical alchemist’” (Newman and Principe 111-114). It is also clear, through his adamant trust in the authority of the ancient texts – and through “the perennial nagging question of how and why...the painstaking

laboratory worker claimed success under the guise of Philalethes in transmutational alchemy even though the notebooks (not to mention the limits of physical possibility) indicate that he had not achieved this desideratum” (Newman and Principe 155) – that Starkey was nonetheless a product of his times. And, with this statement then, it is additionally clear that there *is* some distinction between ancient alchemy and modern science after all, though perhaps it is not really as large a distinction as historians have made it out to be.

In 1698, an anonymous author wrote a “cautionary anecdote about the seventeenth century’s most celebrated adept, the great Eirenaeus Philalethes” (Newman and Principe 1), detailing an incident when Philalethes aimed to “impart the Art to the Honorable Mr. *B.*”, but upon realizing that Mr. *B.* was “too communicative, and his house was so disposed, that nothing was done in it could be Secret” (Newman and Principe 1), he decided against sharing his knowledge. Newman and Principe state in regard to this anecdote, “There can be no doubt that the unfortunate Mr. *B.*...is none other than Robert Boyle...Indeed, Boyle was extremely keen to contact alchemical masters in the hope of sharing in their special knowledge” (Newman and Principe 1-2). This may be a portion of history found near the heart of the distinction and emergence of chemistry.

For, although it is plain that Boyle was inspired by his communication with the adept Starkey, he offered very limited acknowledgement of his sources, in part because of Boyle’s early “interest in asserting his own independence and originality and enhancing his own status” (Newman and Principe 272). However, especially as his “acerbic character...became even more corrosive through the late 1650s and early 1660s”, undoubtedly Boyle wished to avoid being publicly associated with Starkey (Newman and Principe 272). Furthermore, Newman and Principe add, “a casual reading of Boyle brings to light criticisms of his predecessors’ theories

but not the origins of his own, nor the degree to which he continues to adopt other notions from the thinkers he criticizes” (Newman and Principe 289). Assuming the previous anecdote held some amount of truth, we find that Boyle would have kept the meticulous laboratory knowledge of the alchemists as his own, apart from their secrecy and mysticism which we might suppose had never really been imparted to him, giving us a sort of watered-down alchemy. Even so, as historians look back on Boyle to find the beginnings of “science”, the chemist’s “silence about his sources has made it seem that he had none, and has consequently given the impression of a greater discontinuity in the history of chemistry at Boyle’s period than is really the case” (Newman and Principe 272).

This impression has remained a strong influence on how we see our past and present, nonetheless. Taylor offers this viewpoint: “[A]lchemy is distinguished from chemistry first by its purpose and secondly by its method. The purpose of alchemy is the perfection of all things in their kind and most especially of metals; that of chemistry is the gaining of knowledge concerning different kinds of matter and the use of this knowledge for all manner of ends” (Newman and Principe 190). It should by now be clear, however, that his distinction is somewhat hazy, for we have seen that Starkey’s purpose and methods resemble very closely what we see in modern science; even science may be said to seek out manipulation of nature for the perfection of all things, especially the perfection of humans and their livelihoods on this planet.

While considering how historians interpret transitions through the past, I came across the following passage in my textbook for PSY 210, *Brain, Mind, and Behavior*: “Western thought in the Middle Ages perpetuated the view that the mentally ill, being possessed of evil spirits, could be treated by exorcism, beating, and burning. Throughout the Inquisition and the era of witchcraft in the fifteenth and sixteenth centuries, madness and delusions were viewed as

epidemics that could be spread by contact with the ill” (364). This passage struck me, as I read it only a short time after discussing Clark’s text on witchcraft and demonology in HST 421, “History of the Scientific Revolution”; for in *Thinking with Demons*, I recalled that Clark had gone to great lengths to dispel the mystic stigma that has shrouded this whole situation, asserting that demonology was a normal aspect of natural philosophy, just as alchemy was, studied and debated heavily by the intellects of the time, and deserving of some amount of historiographic respect as a part of the grand transformation to modern science. Yet, the above passage reminded me that, to the psychologist nonetheless, mental illness was at the root of this strange moment in history, and, still further, according to my geology teacher in my GSC 350 “Natural Disasters” course this summer, an outbreak of fungus caused the mental illness! Now, granted, perhaps there is some truth to these assumptions (for who am I to question the scholars?). Perhaps there were some who were delusional in their demonic associations; there were scholars of the day who suggested it themselves. But this scenario points out that any major transformation from past to present is inherently complex and due to a great number of factors. And much of how the historian may interpret these facts and construe the order of things depends on his or her personal walk of life, on his or her individual slant on things. It seems that history, like science, is a vast team effort.

In conclusion, all can agree that, while alchemy was far more complex and (dare we say) advanced than it is often given credit for, it has eventually taken a back seat to what we now call science. But, did the alchemists invent “recipes which they thought would work, but had not fully tested” (Taylor 116) and pass these on to their protégées haphazardly? Did alchemy hand down the worth of its laboratory practices to chemistry, only to disappear in the wake of a science that was based on accurate premises and could therefore accurately predict physical

phenomena? In answer to these questions, first, an accepted site on the University of Bristol School of Chemistry offers the suggestion that “[r]adioactivity is the key to today's alchemy...Uranium is transmuted into plutonium, cesium, strontium, barium, iodine, krypton and xenon, to name but a few elements. These often decay to other stable elements through various radioactive processes” (“Modern Alchemy”); Redgrove concurs, “[S]ince it appears that all matter is radioactive...we here have evidence of a process of evolution at work among the chemical elements. The chemical elements are not permanent; they are all undergoing change; and the common elements merely mark those points where the rate of the evolutionary process is at its slowest...Thus, the essential truth in the old alchemistic doctrine of the growth of metals is vindicated, for the metals do grow in the womb of Nature, although the process may be far slower than appears to have been imagined by certain of the alchemists” (sec. 96).

Secondly, we must acknowledge that alchemy is still alive and well, albeit along the fringes of our present society. A wealth of information can be found at “Alchemy Web Sites”, <<http://www.alchemylab.com/websites.htm>>, a Table of Categories for alchemy online – although, what makes the common man uncomfortable and distrustful around modern alchemists found at such websites is the enormous weight of mysticism, secrecy, and New Age-ness that accompanies the otherwise “scientific” practicality. Possibly, the reason historians began making their own broad distinction between alchemy and science is in response to the transformation of our culture; somehow, we no longer trust that which is mystical, religious, and arcane, and deem it less real than the plain methods of science, much in the same way that our culture has set art aside as a sort of special activity and not as an integrated part of our everyday life. The ancients were comfortable with both art and mysticism, whereas such things are now alien to our modern culture. Perhaps, it is a matter of control as well, for mysticism allows for and depends on a

certain lack of control and a certain amount of trust on the part of humans, whereas science does not believe without ample proof and seeks to explain and harness everything.

In Starkey, as with the majority of his contemporaries, we found not a rational chemist one day and a religious alchemist another day; rather, “endeavors in transmutation, chymical medicine, or the more efficient isolation of essential oils were all part of the same project of ‘uncovering Nature’s secrets.’ All of these projects were party to the same methodological approach and scrutiny...[and] he did not exclude the possibility of divine enlightenment when carrying out the most mundane and repetitive of laboratory tasks” (Newman and Principe 316-317). It is a small wonder, then, that uncovering a real separation between alchemy and science has proved difficult and, further, allows the historian’s personal culture to influence and broaden the distinction, helping him or her to sense a greater security in the present.

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