# *Therapeutic Mule:*

# The Use of Arsenic in the Nineteenth Century Materia Medica

**by John S. Haller, Jr.***

> If a law were passed, compelling physicians to confine themselves to two remedies only in their entire practice, arsenic would be my choice for one, opium for the other. With these two I believe one could do more than any two of the pharmacopoeia.
> (I. L. Crawcour, *Journal*, Louisiana State Medical Society, 1883).

> Some years ago one of my professional brothers exultantly informed me that he had cured several cases of diabetes with quinine arsenate. He was a careful, painstaking reliable physician; his rationale was good; his results were good; my faith in quinine arsenate was good. I induced one of my relatives who was diabetic, to try the remedy. He did so faithfully—and died on schedule time.
> (Ralph St. J. Perry, *American Journal of Clinical Medicine*, 1912).

A MAJOR DRUG of the nineteenth century materia medica, whose history went far back into the spagyric theories of the ancients, arsenic served the medical profession from the empirical age through the heroic period of medicine and into the critical and experimental era of therapeutics. Its progressive ascent from the alchemist's laboratory to the apothecary's cabinet reflected a history of medical correction of observations and hypotheses that culminated in the early years of the twentieth century in the development of highly complex and synthetic organic preparations which were far less toxic than their inorganic time-honored ancestors. The art of employing arsenic, as so many physicians learned only after trial and error, consisted of controlling the pharmacological action and making it serve therapeutic aims.

The natural sulphides of arsenic were well-known medicaments to physicians from the earliest times. Hippocrates had administered orpiment ($As_2S_3$) and realgar ($As_2S_2$) as escharotics as well as remedies for ulcers, while Dioscorides

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referred to orpiment in the first century as a valuable depilatory. In the eighth century Schabir roasted realgar to obtain white arsenic ($As_2O_3$) and gave to it the name it still bears. Centuries later Basil Valentin and Paracelsus used the mineral for medical purposes, while Jean de Gorris (1503-1577) recommended arsenic as a sudorific, Angelus Salva used it as a specific against the plague, and Lentilius (1684) and Friceius (1710) employed it in the treatment of malaria. In 1686 Donzellus reported the use of arsenic as an amulet to ward off the infectious plague. Yellow sulphuret of arsenic formed one of the principal ingredients in Lanfranc's collyrium which physicians used for nearly two centuries as a remedy for ulcers. Frere Come's paste, composed of red sulphuret of mercury, arsenious acid, the ashes of burnt shoe sole, and dragon's blood, was also applied in the external treatment of ulcers and cancer. Orpiment became known as Rousselot's arsenical powder and was one of the major ingredients in Hellmund's ointment for cancer.[1] Monsieur LeFebure of Paris recommended arsenic as a radical cure for cancers and administered it in much the same fashion as corrosive sublimate was used for venereal disease—external application and fumigation.[2]

Throughout the eighteenth century, physicians prescribed arsenic both externally and internally. While pure metallic arsenic had no therapeutic use, its arsenides and salts were employed as alteratives, antiseptics, antispasmodics, antiperiodics, caustics, cholagogues, depilatories, hematinics, sedatives, and tonics. Some sixty different preparations were tried therapeutically in the history of its use, and probably twenty or more were still in circulation by the end of the nineteenth century, including Aiken's Tonic Pills, Andrew's Tonic, Arsenauro, Gross' Neuralgia Pills, Chloro-Phosphide of Arsenic, and Sulphur Compound Lozenges. The potash solution of arsenious acid remained the most popular arsenic-based drug while preparations such as De Valagin's mineral solution (arsenious acid in dilute hydrochloric acid) and Donovan's solution (iodide of arsenic and mercury) were frequent substitutes. There were also copper arsenite, iron arsenate, quinine arsenate, sodium arsenate, strychnine arsenate, and later the cacodylates of sodium and of mercury. Taken internally in either liquid or solid form, injected hypodermically, inhaled as a vapor, administered intravenously, applied externally, and in rare occasions even given in enemas, arsenic proved to be one of the mainstays of the nineteenth century materia medica.[3]

Although the sulphurets of arsenic had been used for external and internal treatment, it was really not until doctors boiled arsenious acid with an alkali to make it more soluble in water, that arsenic therapeutics changed perceptibly from external to internal administration. As a result, a number of solutions such as Jacob's, Brera's, and Hein's were introduced into medical use. When Thomas Fowler, M.D., physician to the General Infirmary of the County of Stafford, England, suggested potassium arsenite for the treatment of intermittent fever in 1786, his solution soon superceded all others. Up to that time the "Tasteless Ague Drops," "Asiatic Drops," and "Asiatic Pills" (arsenic and black pepper) were popular antiperiodic remedies. In his *Medical Reports on the Effects of Arsenic in the Cure of Agues, Remittent Fevers and Periodic Headaches* (London, 1786), the Edinburgh-educated physician related how he became interested in the Tasteless Ague Drops that were prescribed in the

Stafford Hospitals in the 1780's. Having examined the drops with the help of the infirmary's apothecary, he then tried to imitate the preparation. Soon, Fowler recommended his "Solutio Mineralis" which later bore the name Fowler's Solution as a substitute for the ague drops and costly Peruvian bark; in 1809, the solution became recognized in the London Pharmacopoeia.[4]

**Solutio Mineralis**

Recipe arsenici albi in pulverem subtilissimum triti.
Salis alkalini fixi vegetabilis purificati singulorum grana sexaginta quatuor.
Aquae fontanae libram dimidiam.
Immittantur in ampullam florentinam qua in Balneo Arenae posita.
Aqua lente ebulliat. donec arsenicum perfecte solutum fuerit. Deinde solutioni frigidae adde:–
Spiritus Lavendulae compositi uniciam dimidiam.
Aquae fontanae distillatae libram dimidiam plus vel minus adeo ut solutionis mensura libra una accurata fit vel potius pondere unciae quindecium cum dimidia.

IN A SERIES of well-received articles prepared for the *Edinburgh Medical and Surgical Journal* in 1809 and 1810, surgeon G. N. Hill observed that arsenic had been too long neglected by the medical profession because of the false and mistaken belief in its deleterious effects on the human body. Yet the medical world, he argued, should be greatly indebted to Fowler and the attention he gave to the salutary effects of that Herculean remedy. As a tonic and stimulant, the new preparation became an invaluable agent in cases of intermittent fever, whose victims had formerly consumed large quantities of cinchona as well as the "minor tribe of tonic febrifuge remedies."[5] In paralytic afflictions, there was no better treatment than Asiatic Pills preceded by mild carthartics.[6] For rheumatism, arsenic in combination with electricity rendered the patient more comfortable, particularly since mixtures of mercury and opium proved so mischievous in their effects. In the difficult management of hypochondriasis, Hill prescribed the arsenical solution to counteract the morbid changes occurring in the liver and spleen.[7] In addition, he recommended arsenic for epilepsy, hysteria, melancholia, dropsy, and rachitis; arsenic in combination with digitalis for heart palpitations, and arsenic in combination with musk root for convulsions. Finally he used arsenic for syphilis, "painful affections of the head and face," ulcers, cancer, worms, and dyspepsia.[8]

Because of arsenic's tonic and stimulant properties, Hill first prepared his patients through bleeding and purging, particularly in cases of active febrile state. "In fevers then, of a periodical nature," he wrote, "arsenic is of high value; and in *all* affections of the anomalous, irregular description, whenever we detect any evidence of periodicity, we may prescribe it with strong prospect of success."[9] Doctors who preferred Fowler's Solution or arsenious acid to quinine did so in many cases in the belief that quinine only temporarily delayed the febrile paroxysm and only too often tended to "increase the susceptibility

to the action of the morbific cause," while arsenic acted quickly and permanently.

> Arsenic is undoubtedly an antimalarial agent and a specific for diseases of the periodic type. Its remedial action may be slow, but it is nonetheless sure. Relapses after its use, together with abdominal engorgements and other sequelae of intermittent fever, are said by many to be much less common than after quinia. Permanency of effect is its marked attribute. The contra-stimulation incident to a long use of quinine impairs the tone of the nervous system, and begets a condition of system favorable to the action of the exciting cause of the disease for which it was originally administered. On the other hand, arsenic cautiously used is a nerve tonic, devoid of harm, and leaves no permanent bad effects.[10]

Unlike opium, alcohol, or tobacco, arsenic was considered to be a stimulant which caused no subsequent prostration, and the muscular force and general strength of the patient increased rather than diminished with its proper use. Surely, wrote one physician in the 1830's, "a medicine possessed of properties so valuable, ought not to be looked upon with that distrust with which it is commonly regarded, and be prescribed in rare and isolated cases, with a trembling hesitation."[11]

Part of the past difficulty with the use of arsenic, according to Hill, had been the sanguine wishes of practitioners "to attack violent diseases by very enormous doses of medicine, thinking to mow down, as it were, all opposition to their wishes, by a *coup de main*." The mineral solution of arsenic, however, did "not admit of loose and inattentive application." Physicians who used arsenic had the responsibility for administering it in the most exacting manner and in doses small enough to cure, careful to every precaution. In order to guard against its injudicious use, Hill advised physicians to watch carefully for symptoms of nausea, pain, thirst, "strong feelings all over the body," and contractions of the stomach—signs that the mineral had reached toxic level and must be suspended immediately.[12]

**A caricature (c.1885) by the American artist James Whistler lampoons the popularity of Fowler's solution (a potassium arsenite solution) as a cure for a wide variety of ailments. (From the collection of William H. Helfand).**

But while physicians such as Hill cautiously administered no more than a few drops of Fowler's Solution, there were those partisans of heroic therapeutics who believed that arsenic could be given in much larger doses without ill effect. One "heroic" advocate was D. Theodore Coxe, of Philadelphia who, while agreeing that doctors could administer arsenic in

moderate amounts "lest idiosyncracy, or the state of the system should cause it to disagree," nonetheless favored heroic doses continued for short periods of time as more beneficial. His idea of a brief period was somewhat open-ended, since he claimed to have given patients from fifty to one hundred and fifty drops of solution daily and continued the medication for days and even weeks without harmful effects.[13]

"It will not do to rest contented with such timid doses as might be worthy of a homeopathic quack," wrote another doctor. "It must be exhibited in increasing doses [and] persevered in until the toxic effects show themselves, in sickness, a sense of fainting, formication in the toes and fingers, dryness of the fauces, and white tongue."[14]

TWO of the more vocal supporters for the use of arsenic in the early nineteenth century were Thomas Hunt, M.D. and James Begbie, M.D., whose articles in *Lancet*, the *Edinburgh Medical Journal*, and the *Transactions* of the Provincial Medical and Surgical Association helped to support Fowler's introduction of the mineral into the pharmacopoeia. They likewise defended the solution from the attacks of homeopaths and Thomsonians whose medical theories and prejudices had caused arsenic to be repudiated without sufficient reason. While agreeing that some doctors had been reckless in its heroic use, the two physicians felt there were nonetheless sound therapeutical reasons for its proper application as a tonic, antiperiodic, febrifuge, and as a powerful alterative. In the hands of the experienced physician, arsenic became an essential drug whose abandonment was as senseless as rejecting the steam engine. "Let us use the medicine," Hunt wrote, "but use it discreetly. Let us not repudiate it; but let us beware of an overdose."[15] The most evident signs that the healing powers of arsenic were in operation were increased heat and dryness of skin, a quickened pulse, itchiness of the eyelids, conjunctivitis, and perhaps even swollen and tender gums, salivation, nausea, vomiting, diarrhea, nervous depression, faintness, and tremor. Physicians also looked for a change in skin coloring to a "dirt-brown, unwashed appearance." When these signs became evident in the patient, the observant physician knew that arsenic was in "full operation over the disease."[16]

While Begbie and Hunt admitted that in certain cases the curative effects of arsenic could be achieved without producing the prickling eyelid or the silvered tongue, nonetheless, in most situations diseases could not be cured unless the system came completely under the influence of the mineral "for days and weeks together." In those instances where the morbid action of the diseases was feeble, the alterative and tonic effects of arsenic could be obtained without the development of any physiological signs; but graver ills could "not be subjugated till those [effects] are not only evoked but persistently maintained." Furthermore, in obstinate diseases where the constitution succumbed to morbid effects, "the rule is more imperative; and a longer season is requisite during which it is necessary to continue its daily administration."[17] In cases where arsenic was employed for its alterative effect, particularly in chronic diseases, it was "necessary to push the medicine to the full development of the phenomena which first indicate its peculiar action on the system." Too many

physicians suspended the use of the drug at the very moment when its curative powers acted on the body. Alarmed by signs of conjunctivitis, doctors decided to discontinue its use by declaring that the medicine disagreed with the patient. With the prescription thus changed, "another case is added to the many in which arsenic is said to have failed after a fair trial of its efficacy."[18]

But in a questionnaire sent to various physicians throughout England in 1849, Hunt discovered that doctors were by no means united on the correct administration of arsenic. There was general disagreement as to whether it should be given in increasing, uniform, or decreasing doses, and there was also dissension as to whether arsenic should be given on a full or empty stomach.[19] Golding Bird, M.D., of Downham, Norfolk, wrote that the decision to administer arsenic on a full or empty stomach depended on whether one wished the metal to be absorbed into the "general" circulation, or to enter the "portal" circulation. Arsenic taken after a meal would mix with the food and be absorbed by the lacteals, not by the veins. On the other hand, if arsenic were administered on an empty stomach, the medicine would be absorbed by the venous capillaries and enter the portal circulation.[20] Physicians also divided on whether to administer arsenic alone or in combination with other substances. Many preferred combinations of arsenic with laudanum, quinine, decoction of dulcamara, or with common salines, valerian, quassia, liquor potassae, cinchona, elm bark, sarsaparilla, mercury, antimony, paregoric, bitters and aromatics.[21] "It appears, from the united experience of many practitioners," wrote Hunt, "that in ague, of whatsoever type, quinine will rarely fail alone, and arsenic alone will rarely fail; but, when one fails the other will often succeed; and a combination of both remedies in full doses, has never been known to fail."[22]

In addition to skin diseases, neuralgia, intermittent fever and malarious disorders, uterine affections, chorea, chronic rheumatism, and syphilis, both Hunt and Begbie recommended arsenic for lumbago, dyspepsia, hypochondriasis, carcinoma, scrofula, remittent fevers, cachexia, epilepsy, anemia, hysteria, ulcerations, and hemicrania.[23] During the 1830's and 1840's, Hunt along with physicians working in the Ohio and Mississippi Valleys, announced that arsenic had relieved problems of menorrhagia, leucorrhea, and dysmenorrhea.[24] Soon afterwards, doctors were prescribing arsenic for threatened abortion, post-delivery hemorrhage, spermatorrhea, and functional impotency.[25] And although the exact *modus operandi* remained a puzzle, physicians also advocated arsenic for advanced stages of rheumatism, but warned against its use in the milder stages. "We must be content to know the fact," wrote John Jenkinson, M.D., of England, "and sit down with a conviction of our inability to solve the enigma."[26]

IN MID-CENTURY, the medical world was surprised to learn that peasants living in the areas of Lower Austria and Styria were not only habitually eating arsenic, but were actually thriving on it. It was said that itinerant peddlers procured the mineral from the chimneys of lead and copper smelting furnaces and sold it under the name "hidri," a corruption of the word "hütten-rauch," meaning smelt-house smoke. According to Dr. Von Tschudi whose original

discussion of the habit became popularized in James F. W. Johnston's *The Chemistry of Common Life* (1855), Styrian peasant women consumed from one-half to five or six grains of arsenic daily in order to obtain a "fresh healthy aspect" which, when defined in peasant language, meant a certain degree of obesity. The habit, particularly popular among young women, tended to favor them with a blooming rosy-cheeked complexion and a "strikingly healthy exterior," which on the whole was quite agreeable to the male population.[27] It was Johnston's opinion that the peasant girl saw in arsenic-eating a "love-maker," a "harbinger of happiness," which through its effects upon her weight and complexion, soothed her "ardent longings" and bestowed "contentment and peace" upon both her and her lover. "Stirred by an unconsciously growing attachment," wrote Johnston, "confiding scarcely to herself her secret feelings, and taking counsel of her inherited wisdom only—really adds, by the use of *hidri*, to the natural graces of her filling and rounding form, paints with brighter hues her blushing cheeks and tempting lips, and imparts a new and winning lustre to her sparkling eye." Beauty which lay dormant under the oppressive peasant life flourished with the use of arsenic, and brought to her feet young men who sang her praises and became supplicants for her charms.[28]

Peasant men, on the other hand, consumed arsenic for its tonic effects which according to them, improved their appetite, invigorated digestion, gave them a strong sexual desire, excited muscular and nervous functions, and even facilitated respiration. After placing a crumb of arsenic in their mouths and allowing it to dissolve, they were soon able to ascend mountains "which previously they could only climb with great difficulty in breathing."[29] The reason for this phenomenon, according to Johnston, lay in the power of arsenic to arrest the metamorphosis of tissues, and in so doing lessen the waste of the body and diminish the quantity of carbonic acid discharged from the lungs. This meant that inhalation demanded less oxygen and allowed for "greater ease in breathing under all circumstances." Furthermore, food which otherwise would have been used to supply carbonic acid to be given off by the lungs, was deposited in the cellular tissues beneath the skin.[30] What worked with men also worked with horses. Arsenic mixed into stable feed enabled peasants to obtain a greater amount of labor from those animals used to perform heavy work. On the other hand, those horses which did not toil as much and who also consumed arsenic, tended (like the peasant woman) to improve in appearance and gain weight. In Vienna and other parts of Europe, grooms and coachmen fed small doses of arsenic to their carriage horses to produce a fuller look, a glossier coat, and a foaming mouth.[31]

There were those too who ate arsenic in order to build up an immunity to its poisonous effects. Charles Boner, M.D., writing in *Chambers' Journal* in 1856, related how Napoleon had himself become an arsenic-eater from fear of being poisoned.

> A circumstance has come to the author's knowledge lately, which is interesting to him, inasmuch as it shows that the fact of arsenic being taken otherwise than medicinally, is known more generally than at first seemed the case. He was told by a person, of whom he made inquiries concerning the use of the poison in stable-economy, that he remembered long ago to have read that Napoleon was in

> the habit of taking it, to insure himself against being poisoned. It being the first time the author had heard this report, he inquired of other persons in quite another sphere of life, and of them, too, he learned that the tale was not new. Now whether true or not that Napoleon did take arsenic—though his known inclination to stoutness, later in life, might seem to lend additional probability to the story—it is sufficient that such report was *current* to show that arsenic-eating not only existed, *but was generally known to exist.*

But arsenic eating, according to Tschudi, became a necessity after continued use. Like the Indian opium-eater, the Polynesian betel-chewer, or the Peruvian coca-chewer, the arsenic-eater found it difficult to abstain once his system became accustomed to the habit. Indeed, those who omitted their daily dose frequently showed symptoms of illness which closely resembled that of arsenical poisoning. The only means of relieving the symptoms of arsenic poisoning, he wrote, consisted of returning to the practice.[32]

There were a number of reported arsenic-eaters in the late nineteenth century. The superintendent of the arsenic factory near Salzburg was actually advised by M. Boüsch, professor of chemistry and mineralogy at Eislenben, to take arsenic in order to prevent poisoning from factory fumes. "I advise you, nay, it is absolutely necessary," wrote Boüsch, "that besides strictly abstaining from spiritous liquors, you should learn to take arsenic; but do not forget when you have attained the age of fifty years, gradually to decrease the dose till, from the dose of which you have been accustomed, you return to that which you began or even less." Taking the professor's remarks at face value, the superintendent began by eating three grains of arsenic daily and gradually increasing his dosage until by the age of forty-five, he was consuming twenty-three grains of pure white arsenic daily![33] Similarly, in a paper read before the Medical Society of Quebec and subsequently published in the *Boston Medical and Surgical Journal* in 1866, physician F. A. H. LaRue, professor of legal medicine and toxicology at Laval University, discussed the case of a man who for years consumed eight grains of arsenious acid as a preventive against consumption. According to LaRue, the man began using arsenic for fear of dying of the same dread illness as his parents; in addition to swallowing the arsenic, he also smoked a grain or two mixed with tobacco in his pipe.[34] This practice, it appears, was not unusual since it was generally understood that the Chinese smoked arsenic in combination with tobacco with the result that "their lungs acted like smith's bellows; and they were as red as cherubs."[35] There was also an English physician who believed that arsenic diffused in the air merited further investigation since in those areas near the smelting of copper, the vaporized arsenic had provided an immunity for the people from fevers. While it was true that cattle in the same area were known to become crippled and to lose their hooves, he nonetheless believed that the arsenical influence was in most instances beneficial.[36]

NEWS of arsenic-eating spread quickly through Victorian culture. Tschudi's remarks were reported in the major English journals and were also discussed in over thirty-two French, German, Italian, and Swiss newspapers and magazines.[37] Following the example of the Styrian arsenic-eaters, Victorians began to "doctor" themselves with arsenic for everything from venereal disease

to tapeworms. Women not only drank Fowler's Solution for their complexions, but employed it as a cosmetic wash; others rubbed arsenic into their hair and scalp to destroy vermin, and there were those who actually purchased white arsenic as a hair-powder.[38] Doctors Daniel G. Brinton and George H. Napheys in their *Laws of Health in Relation to the Human Form* (1870) accepted moderate arsenic-eating ("pour rajeunissante") as a means for women to obtain a healthy appearance without the use of cosmetics, but hoped that they might eventually substitute flowers of sulphur in milk or wash solutions of cucumber juice or horseradish root, which were far less troublesome.[39]

While the claims of the Styrian arsenic-eaters were subjected to much criticism, many physicians accepted the practice and reflected upon the virtues of minute doses of the acid on the human organism. While A. Gattinger, M.D., of Nashville did not accept the claims that arsenic had increased the appetite and aided in digestion, he did believe that it effected a "more economical use of the disposable material." "If the arsenious acid, introduced in minute doses impedes the process of oxidation in the animal organism, in a manner that supplies either more mechanical power or more material about the body," he wrote, then it necessarily followed "that this saving in the animal economy cannot take place otherwise than at the expense of some other production of power, and points at once to the production of caloric."[40] Writing in the *Provincial Medical Journal* in 1893, physician C. F. Brown suggested to the medical profession that they consider administering arsenic to healthy persons during epidemics in order that they might remain immune from disease. He mentioned case histories of individuals who had taken arsenic during epidemics of scarlet fever, influenza and diphtheria, and who remained unaffected. Drawing upon the experiences and claims of the Styrian peasants, he suggested that moderate doses might be most efficacious in building up an immunity in the system. He also thought that surgeons might prepare their patients a few days before their operations with small doses of arsenic, believing it would render them immune from post-operative complications.[41]

The arsenic-eating habits of the Styrian peasants provided a new rationale for doctors who substituted pure arsenic acid for quinine in periodical fevers. According to A. P. Merrill of Memphis, many individuals could not tolerate the toxic effects of quinine, which often impaired the tone of the nervous system and at times even produced partial paralysis. But arsenic was a nerve tonic as well as an antiperiodic and in its action upon the blood vessels and the bronchial tubes it induced an "expansion, by which the circulation is facilitated, and congestion, hypertrophy, and hemorrhage (were) relieved." With the expansion of the bronchi, their capacity for inspiration also increased and there was consequently "a greater supply of oxygen, and a freer decarbonization of the venous blood." Reflecting on the habits of the Styrian peasants who consumed arsenic to increase lung capacity, Merrill suggested that the effects upon the tubular vessels induced similar phenomena "to all structures of that kind in the human body (and caused) an increase of animal heat and of muscular power and endurance, enabling men to encounter fatigue, withstand the tenuity of the air and cold on lofty mountains, and accomplish in every way an increase of physical exertion." In its ability to invigorate circulation and respiration without precipitating undue excitability, arsenic became a superb remedial agent in

scrofulous and tuberculous persons, guarding the system from pulmonary diseases which so frequently led to consumption. Rejecting earlier fears of arsenic acting as a catalyst in consumption, Merrill argued that arsenical medication should become "the main reliance of persons in any way predisposed to consumption." While arsenic had suffered under the same prejudices as had cinchona, opium, mercury and other strong remedies, he nonetheless believed that it deserved a higher estimation than the critics afforded. But like others who advocated the use of the drug, he warned that its correct application required that doctors be allowed to "produce its full physiological effects" which were the only indication of its impression on the constitution. When taken in full dose, arsenic diminished febrile disturbances, prevented nocturnal sweats, lessened general excitement, and retarded the development of the tubercles by arresting their evolution and "softening the old (tubercles), rendering them above abortive and latent, and not allowing them to pass beyond crudity."[42]

THE EFFECTS of external applications of arsenic on patients with cutaneous diseases was often quite severe. C. V. Barnett, M.D., of New York sharply criticized its use and accused so-called "cancer doctors" with the disastrous results that sometimes followed their liberally swabbing patients suffering from tumors and breast cancer with mixtures of arsenic and nitric acid.[43] One of the oldest "cancer cures" consisted of a plaster paste made of arsenic, soot, and serpentary.[44] Yet those practitioners disposed to its use on external cancers, eruptions, etc., maintained that cure with arsenical medication was almost always effective, despite its side effects.

> J. G.–age 69, consulted me as to a troublesome eruption on the back of the head. He stated that it had been there for many years, and under medical care he had tried various applications without benefit. It was very itchy, and occasionally a watery discharge came from it.
>
> On examination I found a patch of eruption about the size of a half-crown piece on the left side of the back of the head, beginning where the hair ends and extending upwards to a line on a level with the occipital protuberance. It was indurated and slightly elevated above the surrounding healthy skin. The surface was cracked, and there oozed out a little serous fluid. I advised that it should be painted with liquor arsenicalis.
>
> On July 19th he took a piece of lint wet in the preparation and rubbed the affected part, using altogether not more than half a drachm. The effect of this was that the part inflamed, and became covered with vesicles. There was a good deal of swelling around, and the neighbouring glands were enlarged. At the same time, his stomach was deranged, though he was not sick, and he felt very much out of sorts.
>
> On the 27th . . . the itching eruption continued to spread, and was most troublesome on the buttocks, elbows, and forearms.
>
> On the 31st, after a restless night from intolerable itching, the face, ears, and neck were swelled and red, as if eryspelatous. We could not button his shirt round the neck. The hands, too, were swelled and red; and the fingers, to him, feel as if they were raw. There is some eruption on the knees.
>
> 5th—He has improved. The eruption has faded. The skin of the face and hands, he says, has a raw feeling. On the front of the middle finger on the left hand the skin is distended by serous fluid.

8th—He has had a restless night owing to the excessive itching. A second crop of eruption has appeared on the forearms. The skin over the whole body is scurfing.

11th—Along the back of the forearms the skin is red and raw-looking; the redness disappears on pressure. The skin is peeling off the finger where the serous affusion was. The skin continues scurfing. He feels very weak. The eyes are sore; the conjunctiva is red, and he can hardly look at anything.

12th—His eyes are still sore; he can hardly keep them open, and complains of waterbrash.

24th—He has continued to be troubled with the itching more or less. Today he has a fresh outbreak on the thighs and knees, and over his hands there appeared red blotches like thumb marks.

30th—He felt stronger, though still there was a good deal of itching. The hands are red over the backs and tender to the touch.

On September 4th he went to Blackpool and had a few salt baths. He returned on the 11th looking much better, though the itching occasionally troubled him. It continued to annoy him until November, and he noticed that toward the last the redness did not accompany the heat and itching. After this no trace of the eruption for which the liquor arsenicalis was applied could be detected, and his health never was better.[45]

There was a general confusion as to just what quantity of arsenic destroyed life. According to Samuel Hahnemann, the founder of homeopathy, only two grains of arsenic sufficed while Sir Robert Christison in his *Treatise on Poisons* (2nd ed., 1832) thought that the smallest dose would have to amount to at least twenty grains of arsenic powder.[46] In general, the medical profession divided on the distinction between a "heroic" or therapeutic dose and one which they considered "criminal." This difficulty, complicated by a number of variations, brought chaos to the courtroom and dissension in medical circles.[47] Hiram Cole of Ohio was put on trial for the death of his wife after she swallowed a drachm and a half of laudanum saturated with three to eight grains of arsenic acid. Hiram claimed that his wife mistakenly confused the preparation which he gave to his horses for worms with the one she took to prevent conception.[48] Then too, a Mrs. Maybrick was charged in 1889 with the poisoning of her husband with arsenic acid. Though found guilty, she was later released when it was learned that her husband had been in the habit of taking an arsenic mixture for his health.[49]

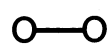
Aside from problems stemming from the directly intended internal and external application of arsenic for medicinal purposes, there were a number of industrial accidents. During the 1830's and 1840's, for example, a number of poisoning cases resulted from the use of bottles—formerly arsenic containers—in the manufacture of ginger-beer and wine. The bottles, purchased from peddlers, had been poorly cleaned and sometimes contained hard crusts of arsenic on the bottom.[50] In 1900, a virtual epidemic of peripheral neuritis afflicted the beer drinkers of the city of Manchester. Many of the victims, a number of whom died, complained of paralysis, swelling extremities, furred tongues, vomiting, husky voices, running noses, as well as a dirty unwashed skin color. Investigators found that the sulphuric acid used in the manufacture of glucose had been contaminated with arsenic.[51]

One of the more deadly commercial uses of arsenic was found in the wallpaper colored with Scheele's or Paris green. Individuals who had their

rooms covered with the attractive paper frequently complained of conjunctivitis as well as headache, hoarseness, nausea, ulceration of gums, diarrhea, prostration, cutaneous eruptions, convulsions, and even coma and death. Examinations of the green paper revealed that "no less than one-third of its whole weight consisted of arsenite of copper."[52] In one instance bakery bread became contaminated after having been placed on shelves papered with the bright arsenite of copper. There were literally dozens of physicians who themselves had become innocent victims after having their offices or homes papered with Scheele's green or Prussian blue, which contained chromate of lead in addition to arsenite of copper. In time, the carpets, curtains, tables and chair covers became loaded with the poison. Aside from the use of arsenite of copper in wallpaper, manufacturers used arsenical papers in the wrappings of food, tobacco, snuff, as well as in the construction of children's toys. Most destructive were the reckless applications of arsenite of copper, red lead, vermilion, orpiment, iodide of mercury, blue verditer, and chromate of lead in the coloring of confectionary sweets. The arsenite of copper was also used in the manufacture of artificial flowers, playing cards, dress fabrics, ladies' hosiery, textiles, cosmetics, candles, and thread.[53]

As late as 1912 physicians were recommending combinations of strychnine and arsenic for all forms of chronic diseases. As one doctor wrote, these two drugs were his "therapeutic mules" which performed "the hardest kind of work under the most adverse conditions, with the least amount of exertion." He used them as a tonic, hematinic, alterative, anti-periodic, and anti-tuberculous remedy with the utmost faith. Administrating them hypodermically dissolved in paraffin oil, as well as orally, he claimed to have used the two drugs "with an almost indiscriminate routineness," having no cause for regrets.[54] Physicians administered another popular drug, Arsenauro, a combination of arsenic and gold, in the treatment of paraplegia and hemiplegia.[55] While some employed arsenic as a depilatory, others administered it to syphilitic mothers as a curative influence upon syphilis in the nursing child.[56] *Abbott's Alkaloidal Digest* of 1906 listed 198 different diseases of which 51 called for the clinical application of arsenic.[57] Doctors began using the less toxic organic preparations of arsenic—cacodylate of sodium and atoxl—for the treatment of pellagra in the South, as well as for malaria and sleeping sickness. In 1909, Ehrlich's experiments with arsenic led to the widespread use of Salvarsan (arsphenamine), often called "606" which, until its replacement by penicillin, was the principal drug in the treatment of syphilis for nearly forty years.[58]

Arsenic earned its nickname "The Mule" not only because of its dependability in a variety of therapeutic regimes but also from the stubborn persistency with which the drug was employed and the capricious nature of its toxic powers. Together with opium, mercury and antimony, arsenic remained one of the mainstays of the nineteenth century materia medica and only reluctantly yielded its therapeutic claims to the new drug formulae of the twentieth century.



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