Report of the Committee appointed by the Westminster Medical Society, to investigate the subject of adulterating candles with arsenic; and to ascertain the probable effect of the use of such candles upon health and life ... / transcribed and reprinted by James Scott.

REPORT OF THE COMMITTEE

APPOINTED BY THE

WESTMINSTER MEDICAL SOCIETY,

TO INVESTIGATE THE SUBJECT OF

ADULTERATING CANDLES WITH ARSENIC;

AND

TO ASCERTAIN THE PROBABLE EFFECT OF THE USE OF SUCH CANDLES

UPON HEALTH AND LIFE.

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BY JAMES SCOTT, M.D.,

MEMBER OF THE SOCIETY AND OF THE COMMITTEE.

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THE

WESTMINSTER MEDICAL SOCIETY.

MEETING OF SATURDAY, THE 9th OF DECEMBER, 1837.

The Committee appointed to inquire into the truth of the statement made, respecting the presence of arsenic in certain Candles, now extensively used in this country, have agreed on making the following

REPORT.

1.—REASONS FOR THE APPOINTMENT OF THE COMMITTEE.

It will be in the recollection of the Society, that at their meeting of Saturday, the 28th of October, a member brought to the notice of the Society, the fact of an hypochondriacal patient having fancied himself injuriously affected by the use of particular candle ssupplied to him at an hotel; in consequence of which, he had forwarded a piece of one of them, for analysis, to a professor of chemistry, who had reported that the candle contained a notable quantity of arsenic, sufficient to account for the morbid symptoms described by the patient. As neither the name of the patient nor that of the chemist, was mentioned, the allegation rested solely on the responsibility of the member who represented it to the Society; and who added, that from infor-

mation he had subsequently obtained, there were reasons to apprehend that the practice of adding a large quantity of arsenic to a particular sort of candles, at present purchased in London, was by no means confined within narrow bounds. He therefore submitted to the meeting, that the question, being one which deeply concerned the public health, was deserving of the serious consideration of the Westminster Medical Society.

After a lengthened discussion—the Society, having heard on the one hand, the opinion of a high legal authority read, declaratory of their competency to investigate every part of such an allegation; and, on the other hand, having received much valuable information from an eminent chemist present, (not a member of the Society,) which went to confirm the statement of the presence of arsenic in candles, came to the resolution, on Saturday, the 4th ult., of appointing a committee, consisting of

Dr. Addison.
Dr. C. J. B. Williams.
Dr. James Johnson.
Dr. Scott.
Dr. A. Todd Thomson.
Mr. Costello.
Dr. Granville.
Mr. Golding Bird,
Lecturer on Experimental Philosophy at Guy's Hospital.
(All members of the Society,)
Mr. Everitt,
Lecturer on Chemistry at the Middlesex Hospital; and
Mr. Richard Phillips,
Lecturer on Chemistry at St. Thomas's Hospital.
(Not members of the Society,)

with instructions to make every necessary inquiry into the general question as to the presence of the poison in candles, and in what proportion:

and also as to the probable effect it might have on animal life during combustion: eschewing, at the same time, every personal reference to the manufacturers and sellers of such candles.

To these instructions your Committee have strictly adhered, and they now present to the Society the result of their labours.

II.—HISTORY OF THE NEW CANDLES.

Those who have followed the progress of analytical and organic chemistry for the last quarter of a century, need not be reminded, that CHEVREUL, one of the most distinguished French chemists of the present day,—in the course of a laborious and interesting investigation into the nature and elementary composition of animal fats—an investigation which lasted ten years, and has been characterised by Berzelius, as the most complete and most perfect that has ever been undertaken by chemists—discovered that common tallow consisted of two distinct substances; the one solid, the other of the consistence and appearance of olive oil; to the former of which he assigned the name of *Stearine* (tallow) and to the second, that of *Elaine* (oil.)

The first of these substances, the only one with which the Committee had any concern, when modified by saponification, crystallizes (in its pure state) in long, brilliant, and silky needles, arranged in large compact masses, beautifully white, almost odourless, and resembling, in a great degree, those square lumps of pure spermaceti, which may be seen exhibited in the windows of wax-

chandlers' shops, in London. With these physical advantages over ordinary tallow, and another also, namely, that of resisting a much higher temperature without melting, it might have been expected that this modified Stearine, (as it will be called for brevity's sake in the course of this Report,) or solid Stearic acid, would soon have been employed for the purpose of fabricating a superior sort of candles. Such, however, was not the case, until several years after its discovery, namely, about six or seven years ago, when Stearine candles were first manufactured in Paris; for they appeared to have formed part of the exhibition of the products of French industry which took place in that capital in 1834, and which has been described in a work in three vols. 8vo., by Baron Charles Dupin.

From authentic documents in their possession, your Committee learn, that the mode of manufacturing candles with Stearine, had at first presented difficulties which were only overcome by some process that was kept a profound secret in Paris; and a knowledge of which was sold, some time after, to a London manufacturer, who immediately introduced it into this country. The names of the parties are known to your Committee, and will be found in the minutes of their meetings, as well as among the documents laid before the Society; but the introduction into this Report of such names, or of that of any other manufacturers of Stearine candles, under whatever denominations they be sold, has been

deemed unnecessary and unadvisable.—(*Vide* Appendix, page 43.)

Although Stearine was prepared in London in considerable quantity, candles manufactured with it, were not, at first, so numerous as they have become since; owing to the secret process employed, to render them fit for sale. Your Committee have been informed, by a very intelligent manufacturer of candles, who made use of, but has since given up the process in question, that an individual in possession of the secret, went about to the candle-makers in London, to sell, for a consideration, not only the mode but the very material, with which Stearine was to be made fit to be converted into showy and attractive candles for the market.

The material in question was very soon ascertained, by some of the candle-makers, to be powdered *white arsenic;* and thus having emancipated themselves from the tax which they formerly paid, for what had now ceased to be a secret process, those persons were enabled to extend the field of their operations, whereby the practice of manufacturing Stearine candles with arsenic, became very soon almost general. Nay, such was the effect produced on the market by the appearance of this novel and extensive branch of trade, (at a price lower than that of any other candle except of common tallow,) that some of the most respectable manufacturers of wax and spermaceti candles, were compelled to resort to the making of the new Stearine candles, (according to the then well-known process, which your Committee

have learned, consisted in putting one pound of white arsenic into every hundred weight of Stein rine,) in order to retain their customers, and, a some measure, indemnify themselves for the losses sustained in consequence of the great diminution that had necessarily followed in the sale of every superior sort of candles.

As is generally the case in all matters of this kind, notwithstanding the notoriety of the practice among the trade, the public, whose welfare was likely to be affected by it, remained in ignorance of the fact, that in using the new Stearine lights, they were burning arsenicated candles, until Mr. Everitt mentioned the subject in a lecture delivered in June last, before the Medico-Botanical Society; and again, until Dr. Scott, in October, as stated in the introduction to this Report, brought it to the notice of the Westminster Medical Society, and led them to the present investigation.

III.—CHEMICAL EXPERIMENTS TO PROVE THE PRESENCE OF ARSENIC.

The admission made by the parties themselves, who employed it, that arsenic was contained in the candles in question, might have been deemed sufficient for the purpose of the present investigation; but your Committee could not rest satisfied without verifying the fact by chemical analysis; and still less without ascertaining the quantity present in each candle: as that point was held to be of great importance in determining the proba-

ble injurious effects of such candles on the human constitution.

Accordingly, a great many specimens of the candles in question were procured from several shops, under various denominations, and were submitted to accurate analysis. (Appendix, page 37.) This was confided principally to Mr. Everitt, who repeated his experiments before several of the Members of the Committee, and whose results were afterwards corroborated by some fresh experiments made by Mr. Golding Bird, supported by the testimony of Mr. Richard Phillips.

The Society, through the kindness of the first of these three chemists, had an opportunity of witnessing, at one of their ordinary meetings, the repetition of some of the experiments in question, which consisted not only in testing the water (with which the suspected Stearine had been boiled for some time) by proper re-agents, denoting the presence of the white oxyde of arsenic; but also in re-producing the metallic arsenic from the precipitate that had been obtained in the liquid, by means of sulphuretted hydrogen gas.

Through the various experiments which he made and often repeated, Mr. Everitt satisfied your Committee that the quantity of white oxyde of arsenic, or arsenious acid, contained in the candles submitted to analysis, varied in different samples, from ten to eighteen grains in the pound of four candles; and that the largest proportion of it, namely, four grains and a-half in each candle, was found in the specimen which bore the lowest price of sale. (Appendix, page 40.)

By another set of very ingenious experiments, conducted with the greatest precision, it was ascertained that this quantity of arsenious acid is only mechanically mixed with the Stearine and not dissolved in it (the saponified Stearine appearing to be scarcely capable of holding any portion of it in solution); and it is worthy of remark, that a larger quantity was found at the top of some of the candles, which in the act of moulding, forms the lower end in the mould, than at the bottom. The difference between the two ends amounted to nearly one third of the whole (Appendix, 41): so that when such a candle is first lighted, it must emit a larger quantity of arsenious acid, than when it is nearly burnt out. These several quantities of the poisonous substance, are given out during the combustion of the candle, in the form of subtle vapours of arsenious acid; a fact which was proved by the deposits obtained on the inner surface of glass vessels placed over a lighted candle, and which deposits were carefully examined.

But in order to leave no vestige of doubt on this point, Mr. Everitt contrived a little apparatus, by means of which, the vapours emitted by a suspected candle in a state of ignition, were obtained, partly in a solid form, adhering to the inside of the body of a retort, and partly dissolved in the condensed steam deposited in the horizontal tube of the same retort, which was kept, for that purpose, in a constant state of refrigeration. Under both those forms, arsenious acid was detected.—(Appendix, page 38.)

It is to the interesting question of what are the productions of the combustion of arsenicated animal fats, that one of the members of your Committee, Mr. Golding Bird, chiefly directed his attention. He first experimented on arseniferous gases, and afterwards instituted some direct trials with a mass of fat, in which arsenious acid was mixed, and which by means of a wick was set on fire. In watching the operation in both cases, Mr. Bird convinced himself of the fact, that according as the combustion is impeded or free—that is, according as more or less oxygen has access to the flame—metallic arsenic—(or the so called black oxyde of arsenic)—or arsenious acid is given out and deposited under their respective characteristic forms. According to Mr. Golding Bird's experiments, there might be a point of such low combustion in the burning of arsenicated fats, as to give rise to that most deleterious and fatal gas called arsenuretted hydrogen gas.—(Appendix, page 43.)

In the course of their analytical inquiries, your Committee received specimens of candles, for examination, from clubs, institutions, and private families; some of which were found to be arsenical, while others were not. And in order not to leave any point undetermined, the analysis, in some instances, was extended to wax, spermaceti, and the old fashioned "composition" candles, in none of which the noxious material was detected.

It would be superfluous to specify more minutely or technically to the Society, the several operations gone through by your Committee, with

a view to settle the chemical question of the presence of arsenic in the above candles. It is sufficient to state, that the fact of its presence in such candles was established beyond all possible doubt, and that the quantity contained is considerable.

IV.—COMPARATIVE PHYSIOLOGICAL EXPERIMENTS ON ANIMALS WITH ARSENICATED AND ORDINARY CANDLES.

Your Committee next directed their attention to the best mode of ascertaining, as far as such an investigation can admit of demonstration, the probable effect which the respiring of the ascertained quantity of arsenical vapour, might have on animal life; and after some consideration, it was determined to expose various living animals to an atmosphere in which arsenicated or Stearine candles, were burning; at the same time that an equal number of the same species of animals, and, as nearly as possible, of the same age and strength as the first set, were placed in an atmosphere of similar limits, wherein *spermaceti* candles only were used.

The Committee being anxious to convince the Society that every measure of precaution, necessary to ensure accurate results in the physiological experiments about to be undertaken, was adopted, have directed the apparatus employed on the occasion, to be brought into the Society's apartment, at this meeting, in order that it may be examined, precisely under the circumstances

in which it was used when the experiments were performed.

DESCRIPTION OF THE APPARATUS.

The apparatus represents two sets, of two chambers each, made of deal boards; the one set measuring two feet by three, and three feet deep; and the second, two feet by two, and three feet deep. Their interior is ventilated by contrivances similar to those which are recommended for large assembly-rooms, namely, by several openings at the bottom and top; so arranged, that the whole, or only part of them, may be used. The top, or roof of the chambers, takes off to admit of the ready introduction and removal of the animals; and there is a glass-door in front, through which all that passes within can easily be observed.

These wooden chambers stood at the height of two and a-half feet from the ground, supported upon wooden uprights; and they were fixed within a spacious and lofty apartment, well lighted and well ventilated. The two largesr chambers were marked A and B; the smaller, C and D.

Into the letter A, two strong and lively linnets (*Fringilla Linaria*) were introduced, confined together in a large cage raised on a stand, and placed in the centre, with two guinea-pigs and one rabbit, in perfect health. In letter B, a similar cage was placed, containing two guinea-pigs and one rabbit. Four arsenicated candles, one in each angle of the chamber, were lighted in A; and an equal number of spermaceti, in B. In C,

two greenfinches, (*Fringilla Chloris*,) and in D, two other linnets, (the birds in C, being particularly strong and lively,) were confined within cages properly suspended, the former with three arsenicated candles lighted in the first chamber, and the latter with three spermaceti candles in the second.

The experiments in A and B began at two P. M. Monday, the 27th November; and those in C and D, at half-after three P. M. Tuesday, the 28th November; and all of them were continued, from day to day, until Saturday evening, the 2nd December; beginning each day about ten o'clock A. M. and terminating at the same hour in the evening, when the cages were taken out and all of them suspended in an ante-room; cleaned the next morning, and a fresh supply of food and water, for the day, administered, before they were again replaced in the experimental boxes.

A thermometer was suspended in each of these boxes, so as to be easily seen by the observer; and a strict watch kept by some member or other of the Committee, but especially by Dr. Scott, (at whose house the experiments were made,) respecting what was going on within the boxes in reference to the state of the animals, their movements and power of feeding, the temperature and ventilation of the chambers, and the manner of burning of the candles. All these remarks were instantly committed to writing as soon as made, and your Committee beg to lay before you this curious register, which extends over a week's time, during which, observations, almost hourly, were made for seventy-two hours. In the course of

that period, several pounds of arsenicated candles were burnt in A and C. As a general statement it may be remarked that, with the exception of the first day, when it varied from eighty to ninety degrees, the temperature of all the boxes was kept, more or less, at the standard of summer heat, as the most congenial to the animals submitted to the experiment,—that ventilation was maintained as perfect as it could be,—and that, neither in food appropriate to each, nor in drink, were the animals stinted in the course of the experiments.

RESULTS OF THE PHYSIOLOGICAL EXPERIMENTS.

In reporting the result of their observations made on the animals during those experiments, your Committee intend strictly and rigidly to adhere to a statement of the facts and phenomena observed; without venturing an opinion as to any relation which such facts or phenomena might bear to the vapours of arsenic, as a cause. Having once proved the presence of the poison in candles, and its volatilization during combustion; and having faithfully reported in the register laid before the Society, what several of the members had an opportunity of repeatedly witnessing in respect to the progressive condition of the animals experimented upon, your Committee leave it to the Society and to those who may peruse the present Report, to draw their own conclusions.

After exposure to the candles containing arsenic, for the space of three or four hours, one

of the birds in A, became visibly affected, but recovered in the night on the experiment ceasing. At the termination of the first hour, on the resumption of the experiment on the following day, (Tuesday,) the same bird became again affected, and in an hour more it died. Its death was followed by that of the second bird, half an hour later. These two birds had been in an arsenicated atmosphere for seven hours and a half altogether.

Three more linnets were immediately put into the cage of chamber A, with two arsenicated candles, instead of four. In about four hours they became dull and stupified on their perch, although, at first, they appeared particularly the reverse: they seemed much inconvenienced for the rest of that day. On Wednesday, three Stearine candles with arsenic, were lighted; and the three birds that had recovered in the course of the preceding night, were not long in exhibiting symptoms of uneasiness, They drooped their wings, breathed laboriously, and kept their beaks constantly open—they continued to do so through that day. On Thursday, two of them became much more distressed three hours after exposure to the candles; an hour later, one of them fell from its perch, as if from vertigo, and half an hour after, it died. The next day, witnessed the death of its two remaining companions, although when replaced in their chamber A, at ten o'clock that morning, (Friday), they appeared to have recovered their usual state of health.

On that day at twelve o'clock one of these latter birds had been seen to gasp for life, unable to re-

main on the perch; and the other became equally affected by one o'clock P.M. The register of observations at this part of the experiments states, "that the respiration of the two birds was difficult, and that a convulsive action of the whole body, backwards and forwards, was noticed, with the head drawn on one side, the eyes closed, and the beaks open and pointed upwards." On being stirred, one of them strove to gain another perch, but failed and fell to the bottom of the cage, where it made various struggles to fly upwards and regain its station, without success. It, at last, after various crawling attempts, reached the edge of the water-cup, on which it balanced itself in a state of evident convulsion, breathing with difficulty, its beak wide open, and the eyes closed. Its sufferings increased in the course of the next three hours, and at eleven o'clock P.M. it was dead. Its companion presented at the same time similar symptoms of distress, which terminated likewise in death, as before stated, in the course of that night.

As for the two greenfinches, exposed, sometimes to three, and at other times to two arsenicated candles only, in chamber C,—being much stronger and larger than the rest, they seemed to resist a longer time without exhibiting signs of uneasiness; but they began, at last, to do so towards the end of the third day, particularly with regard to respiration, and the presence of perpetual thirst. They also died, at length, on the night of Monday the 4th instant, having been exposed (but at intervals only) for the space of 49 hours,

to arsenical vapours. The last struggle of one of them was for water; and the position in which it expired is so striking an evidence of that fact, that your Committee have deemed it right to leave the cage undisturbed, in order that the Society may see how the little creature, having reached the cup, and by stretching its neck over the edge of it, succeeded in dipping its beak into the fluid, and expired in that very position.

GENERAL OBSERVATIONS.

With respect to these seven birds which died in the course of a week, your Committee will only offer a few general observations, in addition to the symptoms already specified. First, it was remarked that they drank, at least, four times as much water as the other birds not exposed to the arsenicated candles; that when they had taken a seed into the beak and broken the shell, they resorted to the water and immersed the bill, before they swallowed the seed; that they gradually lost their inclination for food; and, lastly, that they were affected, during the best part of the experiments, with diarrhœa accompanied by a continual propulsive and retractive action of the anus. The discharge was a greenish serous fluid, very different from the fæculent matter of birds.

The bodies of five of these animals were confided, for chemical examination, to Mr. G. Bird, who reported, that distinct though minute traces of arsenic were found in them, under circum-

stances which led him to believe that the poison had been either inhaled or swallowed. (Append. p. 55.)

Your Committee have merely to add, in respect to these experiments, that the two linnets, which had only been exposed to the burning of spermaceti candles, under equal circumstances of temperature, ventilation, space, and food, never exhibited the smallest deviation from health, and are now alive and well.

Of the larger animals, your Committee have only to report, according to the daily entries into the register, that those in the arsenicated chamber A, evinced signs of distress from the second day; the rabbit in particular, which became dull from that time, was constantly lying on its side, its flanks drawn in, and its breathing quick, accompanied with a tremulous motion. These symptoms, which were not noticed in the rabbit of chamber B, kept increasing towards the end of the week, when the experiments were put an end to; at which time, the eyes of the animal had become dull, the ears were drooping, yawning occurred frequently, and the guinea pigs as well as their companion refused corn. They would take only green food, of which, however, they partook in diminished quantities; while they accepted eagerly of water twice in one day. The same species of animals confined in B, on the contrary, invariably refused water; they seemed as lively and playful at the end of the week as when they were first put in; nor did they appear to have lost flesh like those confined in chamber A.

It had been arranged that, with a view to obtain some information as to what became of the arsenical vapours when once they were dispersed through the chamber, an earthen dish should be fixed over one of the candles, at the height of two feet and a half; and, also, that shallow basins, holding distilled water, should be placed on the floor near each candle. This arrangement, however, was not made until the third day of the experiments, and was therefore in force only for thirty-six hours altogether. Notwithstanding the shortness of the period, Mr. Everitt discovered, both on the surface of the dish in question and in the distilled water, ample traces of arsenic; showing, that when arsenicated candles are burning, the poisonous particles may fly upwards, or fall on the objects, in the apartments, near the candles.

V.—HISTORICAL RECAPITULATION OF RECORDED FACTS, PROVING THE INJURIOUS EFFECTS OF ARSENICAL VAPOURS.

Such are the authentic facts observed by your Committee, to the simple narrative of which they deem it prudent to confine themselves. But although they consider this to be the most proper course, with regard to their own observations, your Committee would think that they had but imperfectly fulfilled that part of your instructions, which directed their attention to the probable effect of arsenious vapours on animal life, if they did not briefly bring under your consideration, the information they have collected upon that point.

THREE FORMS OF ARSENICAL VAPOURS.

It has been stated, that during the combustion of arsenic associated to animal fats, in which both hydrogen and oxygen are present, the three possible states in which vapours may arise, according to the degree of combustion going on, are, first, arsenuretted hydrogen gas; secondly, a vapour holding a mixture of metallic arsenic and its (so called) black oxyde; and, lastly, a vapour of white oxyde of arsenic or arsenious acid. The first is only a possible, but not a very probable occurrence. When it takes place, its effect on animal life is quickly fatal. The second can hardly take place at the temperature at which the combustion of Stearine candles goes on. But the third is a more general case, and it is to its effect on health and life, that the Society need direct their attention.

First Form of Arsenical Vapours.—Of the fatal effect of arsenuretted hydrogen gas, the annals of science present two most lamentable examples.

The first is that of the death of Gehlen, which should be read where it is most feelingly detailed. namely, in the "Annales de Chimie," vol. 95, p. 110, in an extract of a letter from M. Ruhland to M. de Guyton Morveau, relating the death of M. Gehlen.

Munich, Aug. 1st, 1815.

"My colleague, M. Gehlen, who must have been known to you from the journal that he conducted for several years, has just died in a most miserable manner.

During the last fifteen days, we had been preparing, together, arsenuretted hydrogen gas. The alkaline solution that we employed being too dilute, the gas was very slow in manifesting its peculiar odour. Whilst filling in succession several bottles, M. Gehlen attempted to judge, from its odour, the instant when the hydrogen commenced to combine with the arsenic; and it was thus he was poisoned. An hour had scarcely elapsed, ere he was attacked with incessant vomiting, rigors, and alarming depression. He died in my arms after nine days of unheard-of sufferings, (*suffrances inouies,*) a victim to his zeal for the advancement of science. During the first moments, we administered all remedies that appeared applicable; especially potass, milk, &c. but with so little success, that we must conclude that arsenic, combined with hydrogen, is more dangerous than in the metallic state, although the actual quantity of the metal inspired *may be infinitely small.* It is probable, that, if, in the metallic state, arsenic attacks chiefly, the organs of digestion; when *combined with a gaseous* body it acts more directly upon the *nervous* system."

This case appears particularly important to your Committee, from the very minute portion of poison inspired: so little of arsenuretted hydrogen gas being really present, that the gaseous mixture appeared to have been destitute of any particular odour.

A second melancholy instance of death by the inspiration of the same arsenical gas, was referred to, in Committee, by Mr. Phillips, as having, only last year, occurred as Falmouth. The statement is taken from a Cornish Paper of the 30th December, 1836, and shews, like the preceding case, how awfully dangerous is this species of arsenical

gas, although the quantity of it may be very minute :—

"On the 5th of December, 1836, Mr. J. E. Bullocke, who had resided some time with Mr. Beard, at Falmouth, delivered a lecture on the gases, at the Mechanic's Institute; and on the 19th performed a series of experiments in illustration of that lecture. Among others, he hazarded an experiment on arsenicated hydrogen gas, procured by pouring sulphuric acid on arseniate of zinc; but the gas jar not having as much water in it as he supposed (he being near-sighted), and the atmospheric air above the water diluting the gas, he inconsiderately applied his mouth to draw up the asmospheric air, while the process of generating the gas was going on; and unhappily inhaled a portion of the gas itself, which being poisonous affected his whole nervous system, and ultimately his lungs. The case baffled the skill of his medical attendant, and, although, for several days no alarming apprehensions were entertained, to the great grief of his father and sister he died on the 29th, that is, twenty-four days after the accident."

Second Form of Arsenical Vapours.—What may be the condition of the atmosphere around a vessel or a burning candle, emitting vapours holding black oxyde of arsenic, (as it has been called,) your Committee are not able to state, nor is it to their purpose to inquire. Still they find it asserted by Dr. Merat, in his voluminous work on Materia Medica, that the *poudre a mouches*, (which is the preparation of arsenic alluded to,) employed in France to destroy flies, is fatal to them if they but appoach the atmosphere around the vessel which contains its solution.

Third Form of Arsenical Vapours.—Of the deleterious effects of the vapours of arsenious acid on the human frame, which more directly bear on the present question, we find in the Annals of Modern Medicine a well-authenticated example, in the experiment made on himself and a friend of his, by Dr. Joseph Waltl, who published the results in the twenty-seventh volume of the "Reportorium fur die Pharmacie," edited by Buchner. Having imagined that arsenious vapours might be useful in curing that most obstinate disorder of the skin called ichthyosis, Dr. Waltl wished first to ascertain what effect they might have on the human constitution. He, therefore, determined to try that effect on himself. Accordingly, he projected six grains of arsenious acid on thoroughly incandescent coals, and as soon as the arsenious vapours were disengaged, he removed the chafing dish to a remote part of the room in which he was. In the course of the night he experienced extreme shortness of breath, a constriction of the windpipe, a dreadful headache; while his pulse became frequent and irregular. Similar symptoms, but much severer, occurred in the person of his friend, who chose to try the same experiment on himself afterwards; and Dr. Waltl concludes, from these experiments, that arsenious vapours affect, as diluted poison, by their immediate contact with the aerial vessels of the lungs.

It may not be out of place here to observe, that during the experiments which were carrying on at Dr. Scott's, that gentleman, who watched them with perseverance, experienced smarting and un-

easiness of the eyes, which, on one occasion, compelled him to resort to the application of cold water to relieve it. After the experiments were concluded, he had no such sensation.

VI.—GENERAL EVIDENCE OF THE EFFECTS OF ARSENICAL VAPOURS.

Thus far, the evidence of the dangerous effects of arsenicated vapours or gases, on the human constitution, is direct, and supported by personal facts. That which is supported by facts of a more general nature, is equally conclusive; and your Committee have only to refer the Society to what takes place at Joachimsthal in Bohemia; and in the mines of arsenicated iron called *mispickel*, and of arsenicated cobalt at *Maremberg* in Saxony, where, it is said, that owing to the danger of the operation of parting the two metals by fire, only criminals condemned to the galleys are employed in it. It is notorious, that at all those mines, the workmen are either short-lived, or retire early from their occupation in a state of the most wretched health, which has rendered necessary the institution of benevolent funds for their support during the remainder of their lives.

The same remarks apply to workmen engaged in similar operations in other parts of Europe; particularly Siberia, Silesia, the Hartz, and France; in all of which places, the conviction of the deleterious effects of arsenical vapours on the constitution of man, is such, that prizes have been

founded for those that shall discover the best method of obviating them. Ebers of Breslau has distinctly stated the very injurious effects produced by such vapours on workmen in the mines of arsenical ores at Reichenstein. On looking nearer home, we find the evidence equally conclusive with regard to the injurious effect of arsenical vapours on animal, as well as vegetable life, in the mining districts of Cornwall. The testimony of Dr. Paris, on this point, given in his first volume of Medical Jurisprudence, is incontrovertible.

If the Committee turn to by-gone professional writers, touching this part of their subject, they meet, in their pages, with general corroborative statements of the positive mischief produced by arsenicated vapours. Tachenious has related his own case of sufferings from the vapours of arsenic undergoing sublimation, to which he had been for some time exposed. Timæus, in his medical histories, reports a similar instance of an apothecary at Colberg, who in subliming arsenic, inhaled part of the vapours, was seized with faintness and tightness of the chest, profuse perspiration, and palsy. In more modern times, Mahon, in his "*Medicine Legale*," has enumerated the morbid symptoms known to be produced by arsenical vapour, among which are to be found those observed by your Committee, in the birds alluded to in this Report.

Such being the case, is it too much to assume, that, whenever a large number of candles of arsenicated Stearine are lighted in a room, a club-house, an assembly, a theatre, or a church, filled

with people who remain for some hours exposed to the vapours arising from the combustion of those candles, mischief to the health of some, at least, of the parties, may be expected? Let us suppose that the interior of Drury-Lane Theatre, whose brilliant lustres hold exactly one hundred and fifty-two tapers, were to be lighted with Stearine candles for cheapness sake, and under the impression that such are better-looking than other composition candles, burn better, last longer, and give a clearer light (all which has been promised by their manufacturers, but which your Committee have found from experience not to be quite correct ;) in that case 608 grains of arsenious acid would be vaporized and floating in the air during the time of the performance. Is any one prepared to assert, that not one of the individuals present on such occasions would receive the slightest injury from an arrangement of this kind, and from the subtle particles of the arsenic wafted to and fro through the atmosphere of the house, by the system of ventilation employed in it?

Nor is it surprising that minute particles of so violent a poison as arsenic, when applied to the mucous membranes of the mouth and bronchi, during inspiration, should give rise to injurious effects, when we know, from experience, how small a quantity of that substance will produce death, if applied even to a small portion of the human body denuded of its skin. The Society cannot but recollect, on hearing this part of the Report, the striking case so candidly published by

Roux, in his new edition of "Operative Surgery," of a young woman who died in three days, poisoned, in consequence of the application of the arsenical paste, which Mons. Roux had ordered, instead of the common caustic, to a very small ulcer occurring after the cicatrization of a large wound.

Your Committee are, almost, afraid of being taxed with unnecessary prolixity, in the adducing of evidence to prove what might be considered almost as a truism; when however they reflect, that in the very Society to which this Report is to be presented, the question as to whether arsenical vapours generally would be injurious or not to the human frame, was deemed and declared by some few members to be a problem, and, that consequently, if arsenious acid were shown to exist in candles in general use, it was not easy to demonstrate that its vapours would be injurious to the consumer of such candles, they felt that they could not do otherwise than endeavour to make their case complete.

VII.—CORROBORATIVE EVIDENCE OF THE EFFECT OF ARSENICAL VAPOURS.

But whatever doubt the Society may choose to entertain on this point, the case is certainly far different with regard to the public authorities of other countries, who, we find, have adopted the sounder conclusion, that all arsenical mixture with such a common article of consumption as candles, must be detrimental to public health, and ought strictly to be forbidden.

On this important part of their investigation, your Committee have obtained great assistance from one of its members, who, immediately after the Committee was appointed, addressed letters on the subject of the inquiry to Dr. Pariset, secretary general of the Royal Academy of Medicine of Paris; to Mons. Chevreul, the discoverer of Stearine; and to one of the chiefs of division in the Prefecture of Police in Paris, in whose department the *Conseil de Salubrite*, is placed.

The immediate replies obtained by the member alluded to, from the several parties just mentioned, give an additional interest to the present investigation; and invests it with a degree of importance which the Society must be glad to see connected with what may be considered as the first inquiry into a great question, practically affecting the public health, in which the Westminster Medical Society has embarked, with the view of interposing their effectual efforts between probable danger and the public; and thus protect (in the total absence of a better and more authoritative protection in this country) the latter from the former.

The documents alluded to, will be laid before the Society, in the original; and will be read, should the meeting require it; but they will best form an Appendix to the Report, where they may be referred to by those who may wish for farther information.

For the present purpose of your Committee, it will be sufficient to state briefly, that Monsieur Chevreul's communication deprecates, as perfectly unnecessary, the admixture of arsenic in Stearine

candles; and contradicts the assertion of the manufacturers in England, that without arsenic such candles cannot be made fit for sale. He considers that the knowledge of the fact that arsenic is present in Stearine candles, will prove ultimately fatal to the propagation of an otherwise neat, useful, and cheap mode of domestic light; and he urges his correspondent in this country, (who had been his pupil, and had been present at the discovery of Stearine, and Elaine in Paris, twenty-two years ago,) to oppose with all his energies so disastrous a practice as the mixture of arsenic in Stearine candles.—(Appen p. 57.)

The official communication from the Prefecture of the Police, (Appendix, page 60) which was transmitted with a readiness and dispatch that reflect credit on the liberality of that department of the French government, to the member of your Committee already alluded to, in the present inquiry, is of paramount interest. It first states, that in consequence of having ascertained that certain candles, manufactured by two persons, whose names are given at full length, contained arsenic, and during their combustion, gave out arsenious vapours, producing "serious disturbance to health," the Prefect of Police had directed the Council of Salubrity, to institute, immediately, an inquiry into the matter. The result of the inquiry is then given as an historical narrative; and a certified copy of the Report itself, is also sent in corroboration of that narrative. It will be sufficient to mention the names of the persons appointed to examine the question and to draw up the Report, to be satisfied of the

manner in which the business has been conducted. The names of Deyeux, Barruel, Gauthier de Claubry, Chevallier, and Cadet de Gassicourt, are sufficient to stamp that document with great value. The Report mentions, that arsenic was found in the candles examined; that in the opinion of the members of the commission, a slow but repeated action of the vapours arising from such candles, cannot fail to take place on the animal economy, in a certain degree, especially on such persons as are weak, very susceptible, or in bad health; and that the government ought not only to forbid the use of such candles as then manufactured, but also to watch, with a jealous eye, in order to prevent any such manufacture for the future. It is needless to add, that the conclusions of the Report were adopted by the Prefect, and that every trace of arsenicated candles was obliterated from the capital of France.

The Prussian Government had, in accordance with the same spirit, but a long time before, forbidden, by a special edict, the use of the yellow orpiment or sulphuret of arsenic with which wax candles were generally coloured in Prussia, and this is found stated in Roemer's *Police Judiciaire.*†

VIII.—PRACTICAL REMARKS ON STEARINE CANDLES.

In spite of the length to which their Report has already extended, your Committee deem it

† It is currently reported in the Austrian States, that young Napoleon died from the effects of arsenicated candles.—*Note by the Transcriber.*

essential to the completion of their inquiry, to conclude with some useful and practical remarks.

The various specimens of candles examined by your Committee, were either procured at different shops, or were given to them under the following several appellations:—Stearine candles—German wax—Imperial wax candles—French candles—Pressed tallow—Tropical candles—Moulded wax—and Venetian wax. The Committee have been told (but of this they have no personal knowledge,) that candles of the same description were sold some time ago under other denominations, such as adamantine candles, pearl candles, &c. In fact, each candle-maker thinks it essential to give a different name as well as to affix a different price to his own candles made of one and the same material; namely, Stearine. This substance, when in its saponified and crystallised form, being brittle, arsenic is added to harden it as well as give it more adhesion. The committee had two Stearine candles made without arsenic; and certainly the difference in appearance and feel of the candle, was in favour of those containing arsenic. The effect, however, sought to be produced by arsenic, your Committee are led to believe, may be produced also by a very small proportion of wax, as in the case of spermaceti candles, which cannot be made, for the same reason, without using a 30th part at least of wax with it—for *Cetine*, the principle of spermaceti (likewise discovered by Chevreul) possesses, equally with pure Stearine, the particular brittle grain complained of.

Your Committee have learned from an experi-

enced manufacturer, that for ten dozen of pounds of candles of Stearine, one pound of arsenic is employed. In order to make it intimately mix with Stearine and produce the desired effect, the temperature of the latter must be kept at 200 degrees of Farenheit. The wick, also, which is platted, is dipt in diluted sulphuric acid, till it is nearly rotted,—and a little gamboge is added to the mass, to colour it yellow, in imitation of wax. This imitation is further strengthened by the opacity which the arsenic seems to impart to Stearic acid. But the public need not be deceived in the purchase of such candles—first, because the lowness of their price is in itself sufficient to shew that real wax or anything approaching to it, cannot form the least part of such a candle; and secondly, because there are characteristic features in the Stearine arsenicated candles, which happily distinguish them from all others. With regard to the price, however, that is not always a sufficient guarantee; for it has come to the knowledge of your Committee, that one of its members, upon sending for a genuine wax candle at a shop, got one as like to wax in appearance as it was in price, but which proved to be an arsenicated Stearine candle! The latter may in a moment be distinguished from wax by the platted wick, which has never been yet used in wax candles; and from spermaceti candles, first by the transparency of the latter; and secondly by this general character, that when the surface of either a spermaceti or a wax candle is rubbed backwards and forwards three or four times, with the edge of an ivory knife, the polish

or lustre is much heightened; whereas, the surface of the Stearine candle, treated in a similar manner, loses the slight polish it naturally has, becomes dull, and no effort can restore the lustre equal to that of the other parts of the candle.

The fractured surface too of the Stearine candle suddenly snapped in two, presents a very different aspect from that of the fractured surface of either spermaceti or wax candles: the latter, or the wax-candle, exhibits regular concentric circles or circular laminæ, around the wick; the other, or the spermaceti candle, looks like a broken piece of camphor or a broken watery turnip; whereas the fractured surface of the Stearine arsenicated candles, looks spongy, is easily rubbed into a white powder by the finger nail, and, seen through a magnifying-glass, presents minute shining particles.

The presence of the arsenious acid, however, for immediate and practical purposes, may be detected, first by the garlic-like smell, which is perceivable while part of the wick is red-hot when the candle is extinguished; and secondly, by placing for a quarter of an hour or twenty minutes over a suspected candle, (the flame of which should be all the time perfectly steady,) a small bell-glass or shade, on the inside of which, if arsenic be present in the candle, a white powdery deposit will take place. This last experiment, however, is not of easy execution.

With respect to the *alliaceous* smell, every writer and experimentalist seems to have agreed upon its being an excellent popular test for warning people, that arsenic is present. Your Com-

mittee, therefore, recommend, that it should be assumed, where it exists in candles, as a sufficient reason for at once discarding them. There are those who imagine that if zinc were used in the Stearine candles instead of arsenic, the smell, on extinguishing them, would be the same. (Append. p. 45.) In order to settle this question, your Committee, on two different occasions, made some direct experiments, by burning a wick in Stearine in which white oxide of zinc had been abundantly mixed; but they could not perceive the smallest trace of the peculiar alliaceous or garlick-like odour in question.

IX.—CONCLUSIONS.

From all that your Committee have had an opportunity of learning and ascertaining, whether by direct experiments, personal inquiry, or authentic information, respecting this important question confided to their consideration, they can safely deduce the following conclusions:—

First, that a practice has been introduced into this country, within the last two or three years, of manufacturing candles in imitation of wax, in which a considerable quantity of arsenic is mixed; and that this practice is daily extending throughout England.

Secondly, that the exposure of persons to the vapours arising from such candles, is likely to be detrimental to their health.

Your Committee having now brought to an end all that they have deemed it their duty, in compliance with your instructions, to offer to your consideration, might naturally feel inclined to

propose to your notice some recommendation likely to render the Report useful in the cause of the public. But this they forbear from doing; they prefer leaving it entirely in the hands of the Society to determine, whether, as this country is still without a competent tribunal or board where questions of such magnitude as this, trenching on public health and safety, might be referred for immediate attention, (in which deficiency England stands alone in the list of European nations,) the WESTMINSTER MEDICAL SOCIETY, which has stepped forward on the present occasion, to rescue their fellow-creatures from a probable danger, ought not to complete its work by some ulterior measure.

Signed.

J. Johnson, M.D.
A. T. Thompson, M.D.
C. J. B. Williams, M.D. F.R.S.
W. B. Costello, M.D.
James Scott, M.D.
R. Phillips, F.R.S.
Golding Bird, F.L.S.
Thomas Everitt, Lect. on Chem.
A. B. Granville, M.D.F.R.S. (Reporter, &c.)

Dated the 8th of December, 1837.

APPENDIX.

Minutes of the Committee appointed by the Westminster Medical Society, to investigate the Subject of Stearine Candles, (sold in London,) said to contain Arsenic.

FIRST MEETING, WEDNESDAY, 8TH NOVEMBER, 1837.

The following Members of the Committee met at 8 P.M. in the Laboratory of the Middlesex Hospital.

Dr. Scott. Mr. Costello.
Dr. C. J. Williams. Dr. Granville.

Mr. Everitt, Lecturer on Chemistry at the Middlesex Hospital, had made several experiments, which were afterwards repeated in the presence of the Committee, on various specimens of the candles in question, procured at different shops, and known under the several names of German Wax Candles, Moulded Wax, Imperial Wax, Venetian Wax, Pressed Tallow, and Stearine Candles.

These experiments convinced the members, that arsenic, in the form of arsenious acid, was present in all the samples examined—and that it was also given out, in that form, while the candles were burning.

As a general character of all these particular candles, it was remarked that, if the flame of them were blown out, a very marked alliaceous odour was emitted, while the wick was in a state of perfect incandescence.

EXPERIMEMT A.

Three hundred grains of the materials of which one of the candles was composed, were boiled with a large quantity of water in a Florence flask over sand. The mixed fluid being poured out into a shallow basin, it was suffered to cool. The cake of Stearine which

formed on cooling, was afterwards removed, and the clear liquid tested in separate quantities as follows :—

1st, By nitrate of silver, to which a drop of ammonia was afterwards added.

Precip., Whitish yellow, being arsenite of silver.

2nd, By hypersulphate of copper, treated afterwards with a minute quantity of ammonia.

Precip., Green, or arsenite of copper.

3rd, By sulphuretted hydrogen, which instantly threw down a

Precip., Of a light orange or canary colour, being sulphuret of arsenic or orpiment.

Although these several experiments sufficiently indicated the presence of the poisonous oxide or arsenious acid—the Committee, being anxious to obtain the strongest evidence possible on the subject, expect that at a future meeting some one of the precipitates (that obtained by the last mentioned test for instance) will be reduced in the usual way, so as to produce the metallic arsenic.

Mr. Everitt reported, that by means of such experiments, more than once repeated by himself, he had ascertained that the quantity of arsenious acid, which the boiling water took from the candles he had subjected to trial, varied in different samples, from two and a half to four and a half grains in each candle,—and that the largest proportion of it, was found in the specimen which bore the lowest price of sale.

EXPERIMENT B.

Simultaneously with these experiments, another was made to ascertain the effect of combustion in such candles, and the produce therefrom.

A small glass retort properly suspended, and the bottom of which had been cut off, was placed over one of the lighted candles, so that the flame burned principally within the body of the retort, steadily and without smoke. The tubular end of the retort termi-

nated in an horizontal glass tube, slightly curved, one inch in diameter, and sixteen inches long, which was covered with a rag kept constantly moist. The body of the retort was not long in becoming indued with a whitish coating or deposit, which became denser the longer the combustion lasted, while within the horizontal tube, when its vapours became condensed, some water was found. These two products being afterwards tested in the usual manner, were ascertained to be, the one solid arsenious acid—the other a solution of the same acid.

EXPERIMENT C.

In order to ascertain whether water, when boiled in contact with the Stearine of the candles, (as in Experiment A,) took up all the arsenic present with it; some of the coagulated cake of that substance, obtained after boiling, was burned with a wick under a similar apparatus, as in Experiment B, but no distinct traces of arsenious acid could be detected during or after the combustion.

The Committee afterwards resolved to make some comparative experiments on the probable effect of the combustion of arsenicated candles on birds confined within a given quantity of air—contrasting it, at the same time, with the effect produced on them by the combustion of other candles of an ordinary composition; and a series of experiments was devised accordingly, to begin on Saturday, the 11th instant, at the Laboratory: Dr. Scott undertaking to procure by that time the necessary materials.

It was agreed that the several members should, in the mean while, search for evidence of the effects of arsenious vapours on the human frame, in the several authors within their reach, to be used afterwards in the report.

The Meeting adjourned to Friday, the 17th, at the same place and hour.

(Signed.) CHAS. J. B. WILLIAMS.

Minutes of the Second Meeting of the Committee, held in the Laboratory of the Middlesex Hospital, 17th Nov. 1837.

Present,

Dr. Charles Williams.	Dr. Granville.
Dr. A. T. Thomson.	Mr. Phillips.
Mr. Golding Bird.	Mr. Everitt.

The Minutes of the previous Meeting were read and approved.

Mr. Everitt proceeded to confirm the presence of arsenious acid in the candles examined, by reducing a given quantity of the orpiment obtained in the course of one of the experiments made at the previous meeting, and thus produced metallic arsenic.

From this and other experiments, Mr. Everitt was enabled to calculate the total quantity of the arsenious acid found in one pound of the candles subjected to examination : and which quantity he ascertained to vary in various specimens from ten to eighteen grains in the pound.

Another series of experiments was made to ascertain whether the arsenious acid present in the candles was intimately combined, either wholly or in part, with the Stearine or purified tallow, or was simply mixed with it. When pure Stearine was melted with a quantity of arsenious acid and filtered, the fat which passed through the hot filter, did not yield more than nine-tenths of a grain of arsenious acid in the pound. It is difficult to say, even with regard to this minute quantity, whether it might not have been drawn down mechanically through the filter in a state of mixture only, and not in solution. At any rate, it seems evident that the acid is sparingly soluble in fat or Stearine—that the largest proportion of it found in the candles is in a simple state of mechanical mixture,—and that therefore it is possible that at one part of the candle there may be a very large quantity of arsenious acid,

while at another scarcely any or very little of it may be present.

To prove this further, three hundred grains taken from the top of a candle (which in the act of moulding the candle, is at the bottom) were examined, and found to yield 95 parts of a grain of orpiment; while three hundred grains of the same candle, taken from the bottom, (which in the cast of moulding is at the top,) 65 parts of a grain of orpiment only were obtained; showing a difference, between the two ends of the same candle, of nearly one-third of the whole.

Mr. Golding Bird next communicated to the Committee the result of his experiments on arsenicated fats, in a paper which he read and delivered in, and in the general conclusions of which Mr. Phillips coincided, as being similar to those he had come to from his own experiments.

Mr. Golding Bird directed his attention chiefly to the question of what are the productions of the combustion of arseniferous, (as he calls them,) or arsenicated fats. He first experimented on arseniferous gases, and afterwards instituted some direct trials with a mass of fat, in which arsenious acid was mixed, and which, by means of a wick, was set in combustion. In watching the operation in both cases, Mr. Bird convinced himself of the fact, that according as the combustion is impeded or free, that is, according as more or less oxygen has access to the flame, metallic arsenic, or black oxyde of arsenic, or arsenious acid, is given out and deposited under their several characteristic forms. According to Mr. Golding Bird, there would be a point of such low combustion possible in the burning of arseniferous fats, as to give rise to that most deleterious and fatal gas called arsenuretted hydrogen gas, to which Gehlen, an eminent German chemist, fell a sacrifice. With regard to the emission of metallic arsenic, or of the sub-oxide, and lastly of arsenious acid, as the successive productions of arseniferous fats

in a state of combustion, which Mr. Bird had ascertained by simple and ingenious experiments, coinciding with some of those previously shown to the Committee by Mr. Everitt,—not a shadow of doubt remained on the mind of the Committee. The conclusions drawn by Mr. Bird from his various experiments, a detailed statement of which was given by him, appeared to the Committee of importance, and are as follows :—

"1. That arsenious acid, when mixed with fats, becomes dissolved by the nascent hydrogen, having been previously reduced by it to the metallic state at the instant prior to actual combustion, and carried into the flame under the form of a compound gas; it then undergoes combustion, and if a sufficiently free access of air is allowed, as in the usual manner of burning candles and lamps on our table and in our rooms, *arsenious acid is always found* in an exceedingly finely divided state; it is carried up by the ascending currents of heated air, and unless intercepted by a bell-glass, is deposited in the state of a fine sublimate on the walls of the apartment.

2. That arseniferous fats and gases, when inflamed, never deposit metallic arsenic, unless their combustion is very considerably checked by cutting off a sufficiently free access of the oxygen of the air.

3. That when under the last mentioned state of things metallic arsenic is set free, it must not be supposed that no ultimately injurious effects are to be expected; for if the metallic deposit is exposed to the air for a few hours, it absorbs oxygen, and passes to the state of suboxide, the celebrated and fatal fly-powder of the French.

4. That as under some circumstances, especially when burnt with a glass chimney, some portions of arsenuretted hydrogen are liable to escape through the pillars of flame without undergoing combustion, we have to apprehend danger from this eminently poisonous gas mixing with the air of our apartments; the

danger resulting from which is illustrated by the unpleasant effects, and even dangerous symptoms, experienced by chemists who have devoted their time to the investigation of arseniferous gases, and by the lamented death of Gehlen, before alluded to."

The extract of a letter from Paris, dated the 10th of November, giving an account of an inquiry which had taken place by order of the Police, two years before, in that capital, on the very subject of these candles as manufactured in Paris, and which led to a decree absolutely forbidding the said manufacture, was delivered in by Dr. Scott, and read to the Committee. Dr. Granville stated that he had himself seen the original letter from which the extract was taken, and that the signature to it was that of one of the most respectable firms of wax and spermaceti candle manufacturers settled in Paris. * * * (*)

Dr. Granville also reported that he was in daily expectation of answers to some letters he had addressed to Monsieur Arago, Perpetual Secretary of the Institute of France, to Monsieur Chevreul, the discoverer of Stearine and Margaric acid, and Dr. Pariset, the Secretary General to the Royal Academy of Medicine of Paris, which he would communicate to the Committee as soon as received.

The members having individually examined some of the comparative experiments then going on in the Laboratory, on birds exposed to the vapours of arsenicated and ordinary candles, and having agreed to pursue them further, adjourned *sine die*. (†)

(Signed.) C. J. B. WILLIAMS.

*In this and another letter received from the same firm, the name of the person who bought in Paris, and afterwards imported into this country, the secret process of manufacturing arsenicated Stearine candles, is given, but is here omitted for the present; as is also the name of the firm.

† It having been found after a day's trial at the Laboratory, that the experiments could not be fairly conducted in it;

Minutes of the Third Meeting of the Committee, Nov. 24, at Dr. Scott's

Present,

Dr. C. B. Williams. Dr. Scott,
Dr. James Johnson. Mr. Costello,
Dr. Granville.

The Minutes of the previous Meeting of the 17th inst. were read and approved.

Dr. Granville communicated letters from Dr. Pariset, Perpetual Secretary of the Royal Academy of Medicine in Paris, and from Mons. Chevreul, member of the Institute in France, and the discoverer of Stearine, in answer to letters addressed to them respectively by Dr. Granville, on the subject of the Stearine arsenicated candles

Resolved—That they be entered in the Minutes, and be used in drawing up the Report.

Several experiments were then made by the members present, by holding a common piece of flat window glass, as suggested by Dr. Granville, over the suspected candle, at the height of fourteen or sixteen inches, when an arsenious deposit was obtained. The same experiment having been made with common tallow and spermaceti candles, no deposit appeared on the glass.

Pure Stearine was melted, and white oxide of zinc was mixed with it in considerable quantity. A cotton wick was set fire to in the centre, and more oxide of zinc projected into the flame. The wick burnt with a large white and brilliant flame; but no smell in the

first, because of their interruptions on account of the lectures delivered there; and secondly, on account of the various emanations that are constantly floating in its atmosphere; the two chambers C and D employed there were carried to Dr. Scott, and the experiments enlarged by the addition of A and B. No account has been taken of the few hours' experiment at the Laboratory.

slightest or most remote degree approaching to the alliaceous odour of arsenic was perceivable on extinguishing the flame.*

A portion of a suspected spermaceti candle, which was said by one or two of the persons present to give out the peculiar alliaceous odour on being extinguished, was submitted to the test of the glass: but no deposit appearing on its surface, it was resolved to submit the candle to chemical analysis, which was confided to Mr. Golding Bird, a Member of the Committee.

The members having in the course of the evening watched the progress of the several experiments on the action of arsenicated candles on certain animals, confined in appropriate wooden chambers, the atmospheric ventilation and thermometrical temperature of which they ascertained to be properly regulated, the observations made were ordered to be registered as they occurred, *de hora in hora*, and *de die in die*, in a book, by the members who made them, in order that they might serve in the drawing up of the Report. †

Adjourned to Tuesday, the 5th of December, at eight o'clock.

(Signed) JAMES SCOTT.

Minutes of the Fourth Meeting of the Committee held Tuesday, the 5th of December, 1837, *at Dr. Scott's*, 8 P.M.

Present,

Dr. James Johnson. Mr. Everitt.
Dr. A. Todd Thomson. Mr. Golding Bird.
Dr. Scott. Mr. R. Phillips.
Dr. Granville.

*On the following day Mr. Everitt repeated the same experiment in the Laboratory of the Middlesex Hospital, with the same result.

† This resolution was only carried into full effect afterwards, during the experiments made at Dr. Scott's, beginning the 27th of Nov., and concluding on Saturday the 2nd of Dec.

The Minutes of the preceding Meeting were read and confirmed.

The Register of the Daily Observations made during the physiological experiments, which were reported to have closed on Saturday evening, the 1st instant, was read and found correct.

Dr. Scott reported that the two last surviving birds, of those that had been exposed to arsenicated candles in the course of the preceding week, had died the previous night. The committee saw the bodies of these birds, one of which expired in the act of sipping water out of the cup.

Dr. Granville reported that he had received an official answer from the Prefecture of Police in Paris, to the application he had made to that department, for a copy of the Report drawn up at the desire of the law authorities, respecting the fabrication of Stearine candles with arsenic; and that the documents in question had been furnished to him. These documents were produced and read.

The Committee next took into consideration a programme or outline of a Report of their proceedings and observations to be drawn up for the Society, which Dr. Granville had prepared; and after a few observations and suggestions, the programme was approved and adopted, and Dr. Granville appointed to draw up the Report, to be read at a Meeting of the Committee on Friday the 8th inst, for the purpose of its being finally discussed and signed by the Members present.

A very instructive conference next took place between the Committee and an intelligent manufacturer of candles, who had much personal experience in regard to Stearine arsenicated candles, although he did not manufacture them himself at present; and at this conference most valuable information was obtained, some of which is to be embodied in the Report.

Mr. Bird's Report of the examination of the two dead birds, in which he found traces of arsenic by

sulphuretted hydrogen, and by reducing the arsenic, was received.

Resolved, that three other dead birds be submitted to analysis by Mr. Bird, and that he examine particularly the external parts by washing them with distilled water.

The Meeting adjourned at 11 o'clock.

(Signed,) JAMES JOHNSON.

Minutes of the Fifth and last Meeting of the Committee, held at Dr. Scott's, December the 8th, 1837, 8 o'clock, P. M.

Present,

Dr. James Johnson.

Dr. Scott. Mr. Everitt.

Mr. Costello. Dr. Granville.

The Minutes of the preceding Meeting were read and approved.

A paper from Mr. Bird, giving the result of analysis of several candles procured from known manufacturers and shops, and others sent from private families, which had been confided to him under certain designatory letters, was delivered in by Dr. Granville. It included the analysis of the suspected spermaceti candle mentioned in the preceding minute, from which it appeared that no arsenic was present in that candle.

A letter was next read from Dr. A. T. Thomson, regretting that he was unable to attend, and expressing his readiness to sign the Report before it was laid before the Society, as not doubting but the document would be properly drawn up, and he would have an opportunity of seeing it next day, before the Meeting, at the Society's apartments.

Dr. Granville then proceeded to read his Report *seriatim*, requesting members to take their notes in pencil, and suggest them after the complete reading of the document.

This plan having been adopted and the Report examined and discussed, it was signed by the members present, and ordered to be submitted to Mr. Bird and Mr. Phillips for their approbation and signature. On the question being considered as to the best means of giving publicity to the Report,—and the circumstance of the Westminster Medical Society having no funds at its disposal for purposes of this kind, being taken into consideration also: Dr. James Johnson expressed his readiness to give it insertion into his Quarterly Journal, which is to appear at Christmas, and to supply gratuitously to the Society, 500 or 1000 copies, to be distributed in whatever manner should be thought best.

The Meeting then adjourned at 11 o'clock.

(Signed) JAMES JOHNSON.

DAILY REGISTER

OF THE

EXPERIMENTS ON BIRDS AND ANIMALS.

MONDAY, NOVEMBER 27TH, 1837.

The Box marked A, contains 2 guinea pigs, 1 Rabbit, and 2 linnets; with 4 arsenicated candles.

The Box marked B, contains 1 rabbit, and 2 guinea pigs; with 4 spermaceti candles.

Observations.

The candles in both boxes were lighted at 2 o'clock P.M., the thermometers standing at 64°.

Three o'clock; the temperature has risen to 75°—removed two plugs in A. 3½, thermometers at 85° in A, and 80° in B. Removed two more plugs in A, and two in B.

Four o'clock. The thermometer in A at 90°; removed two more plugs: the temperature in B only 84°.

Five o'clock, Dr. Granville here: the temperature in both cases increased; lowered it to 79°, by opening the doors: the birds in A slightly distressed.

Six o'clock. A, the temperature 90°, the birds lively, but breathe quickly. B, temperature 85°.

Eight o'clock. Temperature of A 90°, the birds more distressed: temperature of B 90°, plugs having been closed.

Ten o'clock. Thermometer in both boxes at 92° the animals appear unaffected, but one of the birds, in a very morbid state, having fallen from the perch, which it is unable to regain. The cages removed from the boxes, and the experiment discontinued.

Remarks.—Through the day the box A has continued at a higher temperature than B, showing that a greater heat is generated by the arsenicated candles than by the spermacetic—the light, also, in the box A is of a redder hue than that of B. Nine ounces of the arsenicated candles, and eight ounces of the spermacetic, have been consumed.

TUESDAY, NOVEMBER 28TH.

Half-past ten A.M. Experiments resumed as before: the animals appear in perfect health, and the birds have quite recovered. Temperature 64°.

Half-past eleven. One of the birds in A becoming affected as last night. Thermometer 80°.

Half-past twelve. The disordered bird in A has just died, and the other is much distressed.

One o'clock. The second bird expired, and three others put into the cage.

Two o'clock. Thermometer in A at 82°, in B 80°. The animals and new birds appear comfortable.

Half-past two. Thermometer in A 82°, in B 80°. The cages supplied with food; the inmates of B feed more heartily than those in A.

Three P.M. Thermometer 82° in both boxes.

Additional Experiments.

Half-past three, P.M. Two birds and three arsenicated candles placed in box C; and two birds and three sperm. candles in D.

Half-past four. Observations by Dr. Granville. I find the temperature at 80° in both A and B; opened the doors to admit air, having determined to keep the temperature to 76°, or very little more. Two birds in A are dead; rabbit lying on its side, its flanks drawn in, breathing quick and with a tremulous motion, evidently distressed. The three new birds dull and stupified on their perch. In B, the guinea pigs and the rabbit appear in the same health as I observed them last night. I propose to place an inverted glazed dish over each candle, fastened to the ceiling of A and B, to ascertain the nature of the deposit that might take place on them from the volatilisation of the candles. Experiments C and D, yet too recent to judge of any effect. I agree with the remarks as to the difference of colour, appearance, and intensity of light, made by Dr. Scott, in regard to the two species of candles, and which remarks I had already made during the few hours' experiments, at the Middlesex Hospital.

Twenty minutes to five. A, temperature 80°. After leaving the door open some time, I determined on putting out two candles, and shut the door. B, temperature $77\frac{1}{2}°$: four candles burning; closed doors of both at twenty minutes to five: every other circumstance of ventilation being equal in both A and B.

Twenty minutes to five. C. and D. Ventilation similar in both; doors closed; temperature 75° in each. C, two arsenicated candles. D, three spermaceti candles. Height of them alike. Birds lively in both.—A. B. G.

Half-past five. A 82°.—B 82°, withdrew one candle.

" C 76°.—D 76°.

Half-past six. A 80°.—B 80°.—C 78°.—D 78°.
Eight, P. M. A 80°.—B 80°.—C 78°.—D 79°.
Nine — A 80°.—B 80°.—C 78°.—D 80°.

Placed another candle in C, which in a quarter of an hour carried up the temperature 2° degrees.

Half-past nine. C at 84°, removed the third candle; the other boxes all at 80°.

Ten o'Clock. All the boxes at 80°. The birds in A much inconvenienced: all the rest apparently as they were five hours ago.

WEDNESDAY, NOVEMBER 29TH.

Ten o'clock A. M. Experiments resumed as follow:

A. The rabbit, guinea pigs, and three birds, as yesterday; with three arsenicated candles. Thermometer 56°.

B. The rabbit and two guinea pigs, as yesterday; with four spermaceti candles.

C. The two birds, as yesterday; with three arsenicated candles.

D. The two birds, as yesterday; with three spermaceti candles.

Eleven o'clock. A 78°—B 78°—C 75°—D 72°.
Twelve o'clock. Temperature of all the boxes 76°.
One P. M. A and C at 78°—B and D at 76°.
Two o'clock. No change in the thermometers.
Three o'clock. A and C at 80°—B and D at 78°.
Five o'clock. Mr. Costello here.
Half-past six. A 80°—B 80°—C 80°—D 80°.
Half-past seven. All the boxes reduced to 77°.
Eight o'clock. Dr. Granville and Mr. Bird, present.
Nine o'clock. A 80°—B 80°—C 80—D 80°.

One candle extinguished in C.

Ten o'clock. The temperature of A has been kept at 80° during the last hour *by setting the door ajar.* The temperature of C has remained at 80°, *although with only two candles;* whilst B and D have had their temperature restrained to 80°, by the *slightest* ventila-

tion. The experiments discontinued: the birds in A droop their wings, and breathe laboriously with open beaks: the animals not so lively as those in B. The rabbit in A lying in a constrained posture, with his ears flagging.

Remarks.—It appears that the heating power of the arsenicated candles is, generally, as three to four compared with the spermaceti; but when the boxes have become equally heated through the substance of their walls, then two arsenicated candles are capable of preserving the temperature equal with another box containing three spermaceti; but, *perhaps*, only for a limited time—such has been the case for the last hour.

THURSDAY, 30TH NOVEMBER.

Ten A. M. The experiments resumed. Thermometer at 64°; the birds and animals appear in good health:

Eleven. Thermometer 70° in all the boxes.
Twelve. ditto 75° ditto.
One P. M. ditto 77° ditto.

Two of the birds in A distressed.

Two o'clock. One of the birds in A has fallen but is not dead.

Half-past two. The Bird in A is dead.

Three o'clock. Dr. Williams here, and examined the boxes; the thermometer at 80°.

Half-past three P. M. It is observed that the birds confined in A and C, drink at least four times as much as those in the other box, and keep their beaks wide open. The temperature in all the boxes is below 80°—the ventilation equal, and free.

Shallow basins were placed, at Dr. Granville's suggestion, in the arsenicated boxes, filled with distilled water, to ascertain whether any of the sublimed arsenic falls to the floor, as well as on the surrounding objects.

Five P. M. The birds in A and C very dull.

Ten o'clock. In box C the birds exhibit great dis-

tress: they have drank two ounces of water during the day: the birds in A are also suffering—they have drank about an ounce of fluid in the course of the day: the birds in D have not drank, apparently, a drachm. The birds in C are much larger than those in A. Experiments suspended.

FRIDAY, 1ST DECEMBER.

Ten o'Clock, A. M. The boxes prepared as usual, and the candles lighted, with the thermometers at 60°. The birds have recovered during the night, and appear in perfect health this morning.

Eleven o'clock. Therm. equal in all the boxes, 69°.

Twelve meridian. Thermometer 78°. One of the birds in A gasping for life; unable to remain on the perch.

One P. M. The bird still alive, but suffering.

Two o'clock. The bird in A has regained the perch; the other is now much affected.

Five o'clock. The suffering bird remains feebly balancing himself on the perch; his companion also seems much distressed. W. B. C.

Half-past five o'clock. I find the above observation written by Mr. Costello, and agree in its correctness. The bird has its respiration difficult, and there is a convulsive action of the whole body forward and backward; the head is drawn on one side, the eyes closed. The other bird holds its beak constantly open, and frequently applies it to the water. Temperature 80° on opening the door, and being left open. The bird on being stirred up, strove to gain another perch, but could not, and fell; and though it made several struggles to regain its station it did not succeed, and remains at the bottom of the cage. After various attempts he climbed on the perch next to the water, and in an instant was again in the same position of struggle and convulsive breathing, eyes closed, and the beak pointed upwards.—A. B. G.

Seven o'clock. The sick bird is still alive, but

pears almost at the last extremity: his companion is not much better.

Eight o'clock. All the boxes at the same temperature, viz. 80°. The two birds in A sinking: the other birds and animals appear to be the same as when last noticed.

Ten o'clock. Experiments discontinued. The moribund bird alive, but unable to remain perched: the other nods and staggers on the roost.

Eleven o'clock. Examined the cages, and find one bird dead in A, and the other unable to clutch the perch.

Remarks. During the last two days, the birds in A and C have been affected with diarrhœa: the discharge is a greenish serous fluid, very different from the fæculent matter of birds; they have, also, a continual propulsive and retractive action of the anus. The quantity of water drank to day, has been equal to yesterday. The birds in D do not drink a perceptible quantum, nor have they diarrhœa.

SATURDAY, 2ND OF DECEMBER.

Ten o'clock, A. M. Experiments resumed as usual. The last bird in A was found dead at six o'clock this morning.

Half-past eleven. Mr. Everitt here and examined the boxes: thermometers at 74°: nothing remarkable in the appearance of the birds and animals.

One o'clock, P. M. The thermometers got up to 78°.

Two o'clock. Temperature steady.

Three o'clock. Dr. Granville attended and examined the boxes: temperature under 80°.

Five o'clock. The animals in A are very dull: the rabbit lies a great deal, breathing quickly: its eyes are sunken: its flanks drawn in: its ears drooping. The guinea-pigs move about but little, appearing to prefer the recumbent posture: they yawn frequently. The animals in B are very lively and playful: the rabbit's eyes bright, its ears erect and it rarely lies down.

The appetite of the two sets of animals is remarkably different; in B, they eat copiously of green vegetables and oats: in A, they have almost refused corn altogether for the last two days, preferring succulent food, of which, however, they take a much less quantity than the animals in the other box. The animals in both boxes have been offered water both yesterday and to-day: it has been accepted in A, but refused in B. All the animals in A have drunk twice to-day. The birds in C have been supplied twice with water to-day, one ounce at each time: they are observed to go almost every minute to the water-vessel; and a remarkable circumstance attends their eating which is, that when they have taken a seed into the mouth and broken the shell, they resort to the water and immerse the bill before they swallow the seed. Although I have paid as much attention to the box D as to C, I have not seen the birds (in D) drink more than twice in any one day, and they have had no fresh supply of water these four days. It is necessary to remark that the water in C is contained in an *open* vessel; whilst in D, it is in a glass with a dome top, which may, perhaps, account in some degree for evaporation not having proceeded so far as in the box C. The birds in C are still affected with diarrhœa: their beak is open, and they appear distressed. The birds in D evince no symptoms of disquietude or inconvenience.

REMARKS SUBSEQUENT TO THE CLOSE OF THE EXPERIMENTS.

The two birds which have remained, (December 5th,) in C, died in the course of the night.

Analytic Examination of the Dead Birds.

The written report on five of the dead birds examined by Mr. Golding Bird, the 16th December, was on the following evening communicated by that gen-

tleman to the society at large. Mr. Bird's report is as follows:—

Result of Analytic Examination of the Bodies of the Birds that died after exposure to the exhalation of arseniferous candles with a view to detect the presence of arsenious acid.

1. Two birds first given me for analysis, (their wings and tail feathers being removed,) were divided longitudinally by one incision, across which several tranverse incisions were made with a strong and sharp scalpel, so as to divide repeatedly the thoracic and abdominal viscera. They were then examined by a process analogous to that used in the examination of stomachs suspected to contain arsenic, and minute although distinct traces of that metal were detected. As this investigation only served to demonstrate the presence of arsenic on the persons of the birds without proving its existence in the interior or exterior of the body alone, three other birds who had died in a similar manner to the two first, were submitted to examination.

2. For this purpose the birds were suspended by pieces of thread in a glass vessel, and their external surface repeatedly washed and digested with boiling distilled water containing small portions of caustic potass; but on a subsequent and careful examination of this fluid, not a trace of arsenic could be detected.

As from the first analysis, arsenic was detected on the *persons* of the birds; and as, in the second, none was detected on their external surface, may we not admit that the poison existed in their interior, having either been inhaled, or swallowed with the water in which it has been already proved to have been deposited?

GOLDING BIRD, F. L. S., &c.

Dec. 15, 1837.

CORRESPONDENCE WITH OFFICIAL PERSONS IN PARIS.

Letter from the Perpetual Secretary of the Royal Academy of Medicine.

Royal Academy of Medicine, Paris, Oct. 16th, 1837.

The affair you mention has not been agitated in the Academy.

The subject has been twice introduced to the Council of Health.

They have there made two reports against a fabrication of candles, called candles "de l'Etoile," because they were manufactured at the extremity of the Champs Elysee.

The arsenic was not blended with the wax; but with the wick, in order to render it more combustible.

This acid respired has caused many accidents, headaches, vomitings, &c. It was complained of. The candles were examined, and the mixture discovered. They were very severely prohibited.

These two reports are in the archives of the Council (of Health), and have not been made public.

A thousand thanks for your kind remembrance.

Ever yours obediently,

E. PARISET.

To Doctor Granville, London.

Letter from M. Chevreul, the discoverer of Stearine.

Paris, 12th Nov. 1837.

My dear Friend,

The presence of arsenious acid in "Margarique" or Stearine candles, is not novel. It is three or four years since some portions of this poison were first introduced into our candles at Paris; but as soon as the poliee were informed of it, they absolutely prohibited its use. Since this prohibition it has been no longer necessary to counteract the crystallization of "Mar-

garique" or Stearine acids by arsenious acid. If your candle manufacturers think this process indispensable to the good quality of their productions, they are evidently in error. As father of the new candles, I raise myself against the addition of arsenious acid in the fatty substance of which they consist; it can only effectively restrain the use of this new mode of lighting in England, as it was on the point of compromising the success of that of Paris. Since our candles no longer diffuse an alliaceous odour when extinguished, they are more and more sought for; and I do not doubt that from the moment that the manufacturers prepare at the same time soaps with the acid liquid oil separated by pressure from the solid acids, the candles will be reduced in price, which will extend the use of them still further.

Oppose yourself then, my dear friend, as much as possible to the introduction of arsenicus acid into Stearine and "Margarique" candles, and since you remember to have assisted at the birth of Stearine and Margarique acids, change the epithet of German into that of French, supposing at the same time that this epithet be not in your country a proscribed title.

Your devoted friend,

E. Chevreul.

To Dr. Granville, London.

Letter from Dr. Granville to M. Rieublanc Chief of the First Division in the Department of Police at Paris.

London, 20th Nov. 1837.

Sir,

I hope you will permit me to address you in an affair which interests the public good; and in which, by assisting me with your good offices, you may be of great service; as I shall have the honour to explain.

For some time past, our manufacturers of candles

have adopted the practice of making some with Stearine, in which, the garlick-like smell led to a suspicion that arsenic was contained.

This fact having been stated at the Westminster Medical Society, a Committee was appointed to inquire into it, of which I am the secretary. We have, already, made several chemical experiments which establish the fact, that arsenic, in more or less large doses, is present in, almost, all the so called German candle, Stearine candle, &c.; and we are, at this moment, engaged in making experiments on the probable injurious effect which the burning of such candles may produce in the animal constitution.

Wishing to make my Report as perfect as possible, and having learned that the French, with the usual vigilance of the official authorities in matters of public salubrity, had already preceded us in an inquiry of this kind; and being informed by Dr. Pariset, in a letter addressed to me under date of the 16th instant, that there exist documents proving the reality of the inquiry alluded to, which has terminated in an order of the Prefect of Police, forbidding the manufacture and sale of the candles in question, I have to request you will be kind enough to communicate to me the documents and history of the said inquiry, in order that I may use them to give weight to my Report, in which I shall take care to do ample justice to the wisdom and caution of the French government in a question of such high importance.

Time presses—if, therefore, you could furnish me with the Report against the arsenical candles (among which are those called "de l'Etoile") which have produced inconvenience and injury, you would confer a benefit on society in this country, and serve the cause of humanity in general. For it is not probable that after the expressed opinion of two such enlightened nations as the French and the English, any other

country will venture on the manufacture of candles of the same description.

Be pleased to accept the assurance of my esteem, &c. &c.

Reply from Monsieur Rieublanc.

Paris, 29th Nov., 1837.

Sir,

I hasten to reply to the letter which you have done me the honour of sending to me to ask from me some documents of the interference of government, of which the fabrication of the candles "de l'Etoile" has been the object, you will find these documents in the two enclosures. I trust they will fulfil the end which you desire.

Please to accept, Sir, the assurance, &c., &c,

D. Rieublanc.

Doctor Granville, London.

OFFICIAL DOCUMENTS, TRANSMTTED BY THE PREFECT OF POLICE OF PARIS.

Note concerning the "Etoile" Candles.

Various circumstances having caused the Administration to believe, that the candles called "*de l'Etoile*", manufactured by Messrs. ——— * contained Arsenic, which, during combustion, disengaged itself in vapours highly deleterious to health, the "Conseil de Salubrite" was directed, in the month of March, 1834, to verify the fact.

The Council obtained specimens of these candles, and the result of their experiments shewed, that each of them furnished a sulphuret of arsenic, the weight of which was ascertained to be more than $\frac{3}{4}$ of a grain. The declaration made with regard to this, by the manufac-

* It has been thought expedient to suppress the names, as the above document has never been published in France; and for equal reasons the name of the individual who introduced the practice into this country, is also withheld.

turers, proved, that in order to render their saponified fats more combustible, they employed an ounce of arsenic per quintal; and that they had formerly used even more! The manufacturers were sensible, to the utmost, of the importance of the observations made to them by the council, on the danger which their mode of fabrication might produce to public health; particularly to weak, suffering and nervous persons; and they formally pledged themselves, no longer to put arsenic into their composition. In fact, they forwarded to the council, a short time afterwards, a sample of their candles, which burnt well, without containing the smallest portion of arsenic!

In consequence of the report (of which the accompanying is a copy) made on this subject, by the "Conseil de Solabrite," the prefect of police prohibited Messrs. ——— from employing arsenic in the manufacture of their candles. The last reports made by the council, respecting this establishment, shew, that Messrs. ———— have conformed to this injunction; and that their candles no longer contain any substance which can render their use dangerous or inconvenient.

Candles, under the name of "*du Soleil,*" had also been pointed out to the Prefect of Police, as containing arsenic: but the experiments made by the Conseil de Salubrite, shewed that these representations were unfounded.

Report of the Council of Health to the Prefect of Police.

Conseil de Salubrite
Paris, 16th May, 1834,

Sir,

On the 24th of March last, you submitted, for examination, to the Council of Health, specimens of candles called, "de l' Etoile," obtained at the manufactory of Messrs. ———— and from their various depots in Paris.

Messieurs Deyeux, Barreul, Gauthier de Claubry, Chevallier, and Cadet de Gassicourt were appointed to make a report on this subject,

The result of the experiments, made in the Laboratory of the School of Medicine, by the members of the Commission, was, that each of the "Etoile" candles, such as Messrs. ———— now supply to the trade, yields, when properly treated by boiling distilled water and hydro-sulphuric acid, a sulphuret of arsenic, from the weight of which, it is estimated, that the quantity of arsenic, in each, is more than three quarters of a grain. Messrs. ———— after some denials, at length admitted, that in order to render their saponified fats more combustible, they employed an ounce of arsenic per quintal, and that formerly they made use of it in a larger proportion.

The presence of a sufficiently appreciable quantity of arsenic in the Etoile candles being verified, it became necessary to ascertain the probable noxious effects, (of whatever nature they might be) which it might occasion—whether as regards the slow and repeated action which arsenical vapour arising from combustion, must exercise, to a certain degree, upon the animal economy, especially in weak, suffering, and nervous persons: or the danger of putting into the hands of the public an article in common use, containing a violent instrument of destruction, to which despair and malevolence frequently resort.* Whatever impression may have been made, by the opinion of the Commission of the

* In England every body is at liberty to purchase as much arsenic as he pleases; whereas in France, the sale of it is confined to Medical Men, Artificers, or Manufacturers. But even in this country, the consideration whether the means of easily procuring a fatal dose of arsenic, (through the mere acquisition of a couple of Stearine Candles) shall be placed in the hands of the evil minded, is one of no trifling moment.—*Note of the Reporter.*

council, and by your decision, Sir, the mere discovery of the fact, that arsenic is introduced into an article of domestic use, must certainly tend to destroy the confidence which has been so generally reposed in the productions of l'Etoile.

The manufacturers before mentioned, were sensible of this fact; and as they engaged forthwith to produce candles, of the same kind, without arsenic, the Commission, notwithstanding the evidence of the analytical results, conceived they ought to defer coming to any conclusions.

According to their promise, Messrs. ———— forwarded to you, about the middle of last month, a new sample of candles. The Commission having examined it, again discovered traces of arsenic. Messrs. ————, without hesitation, explained the disagreeable circumstance—they acknowledged, that notwithstanding their desire that their new specimen should contain no arsenic, they had neglected to order the vessels and moulds previously employed, to be properly cleaned; but they pledged themselves to present, in a few days, a sample entirely free from the same reproach. They kept their word:—at the end of last week they forwarded to the Commission a last specimen of the Etoile candle, which burnt well without containing a particle of arsenic.

It only now remains, Sir, for the Delegates of the Council to propose to you, to authorise Messrs. ————, to continue their manufacture, *under the express condition of renouncing entirely and for ever, the use of arsenic!*

Further, the Commission consider it their duty to beg to observe, that this proviso claims the guarantee of a rigid inspection (*surveillance.*) In fact, Sir, it is difficult to believe, that on this occasion, the vigilance of authority has so powerfully excited the zeal and

scientific activity of the manufacturers as to have enabled them suddenly to discover an advantageous process, in the research after which they, at first declare to us, they had fruitlessly sacrificed much time and considerable capital. The Commission dare not flatter themselves that they have obtained so favourable a result—they do not even think that Messrs. ———— have had time to profit by the suggestion which was communicated to them by one of the members of the Council, to make trial of some other volatile metal in lieu of arsenic.

The Delegates no longer think it absolutely impossible to make candles of saponified fats, which will burn perfectly well without the addition of any metallic substance. According to all appearance, the last candles which Messrs. ————, sent to us, are of this description. But whether their manner of operating in this case be an old or new process, it is presumable that it requires an especial care and precaution the adoption of which, in large manufactories, may be attended with some difficulties, but by means of which they may be able to dispense with the aid of arsenic. The Commission, also, are desirous of expressing an apprehension that the manufacturers, although they have now yielded to the commands of authority, may hereafter, influenced by interest, return to a dangerous, because more convenient and expeditious practice.

In consequence, the Delegates of the Council of Health, have the honour to propose to you, Sir, not only to grant to the Etoile Establishment a conditional authority, conformable to the one which we have above set forth, but also to order, that the candles there fabricated, shall be submitted, from time to time, to a new examination by the Council of Health.

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