**Poisons in domestic fabrics in relation to trade and art : a paper read before the Society, 21st January, 1880, John Simon ... in the chair : being a sequel to the pamphlet, Our domestic poisons, from the sanitary point of view / by Henry Carr.**

### Contributors

Carr, Henry.
Royal College of Surgeons of England

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# SOCIETY OF ARTS.

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# POISONS IN DOMESTIC FABRICS

## IN RELATION TO TRADE AND ART.

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*A Paper read before the Society, 21st January, 1880, John Simon, Esq., C.B., D.C.L., F.R.S., in the chair,*

BEING A SEQUEL TO THE PAMPHLET,

## "OUR DOMESTIC POISONS,

FROM THE SANITARY POINT OF VIEW,"

BY

HENRY CARR, M.Inst.C.E.



LONDON:
WILLIAM RIDGWAY, 169, PICCADILLY, W.

*Price Sixpence,*
OR POST FREE ON RECEIPT OF SEVEN STAMPS.

## SAMPLE FABRICS.

The following articles were exhibited on the occasion of the paper being read, as illustrating the subject, and as proving that arsenic is not an essential ingredient in good pigments:—

*Wall Papers.*—In pairs of the same shade of colour, each pair being, the one arsenical, the other free from arsenic—red, olive, green, blue, white, French grey, &c., the non-arsenical colour being in all cases as good as the arsenical, except as regards one shade of blue.

*Tarlatanes.*—Two samples of light green, the one arsenical, the other free.

*Artists' Water Colours.*—Sepia, emerald green, Payne's grey, burnt sienna—all arsenical.

*Aniline Dyes.*—Gloves and stockings, each of which had been the cause of serious eruptive affections, though free from arsenic.

*Artificial Flowers, Playing Cards, Cretonnes.*—All arsenical.

*A Wall Paper.*—Arsenical, the sucking of which caused the death of an infant at Peckham.

# POISONS IN DOMESTIC FABRICS

## IN RELATION TO TRADE AND ART.*

**By Henry Carr, M.Inst.C.E.**

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The object in view in this paper is to draw attention to certain poisonous materials, heedlessly introduced into, or intentionally used for some special purpose in, our domestic fabrics.

Accidental injurious emanations arising from defective construction of houses, foul air from drains, insalubrious sites, and such causes, would naturally fall under a distinct head, though involving, no doubt, domestic poisoning, in some cases, to a very serious extent. Attention will, therefore, now be limited to poisonous materials used in the process of manufacture and allowed to remain in the finished goods. The evil effects of these "domestic poisons" have long been known to a limited number, but they are only now beginning to be recognised by the public at large.

It should be stated that the writer has simply attempted to gather such information from competent authorities on medical, chemical, and trade questions, as may be useful when put forward in a collected form. As the question has been raised by a manufacturer, it should be here further stated that neither he nor any of his personal friends have any trade interest whatever in these matters.

The subject of domestic poisons naturally divides itself into two heads:—

First, as it affects the public, to whom these deleterious compounds are supplied.

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* Mr. Carr will be glad to receive any information or communication on the subject of this paper, addressed to 21, Cedars-road, Clapham, S.W.

Secondly, as it affects the trades, manufacturing and dealing in these articles.

The principal materials by which poisonous or injurious matters are introduced into domestic use, are arsenical pigments in wall-papers; arsenical dyes in cotton fabrics, such as curtains, chintz, tarlatane, &c.; in artists' water colours, and ordinary paint; in lithographic printing, poisonous colours being sometimes dusted on. Poisonous colours are also dusted on in colouring tin plate work. Poison is also introduced in artificial flowers, lamp shades, fly papers, in cardboard boxes and labels, now so much used by drapers, stationers, and confectioners; confectioners even attaching poisonous papers to sweets.

Fatal results are reported arising from the use of arsenic in destroying the nerve in teeth, but they appear to be very rare. Paper collars and cuffs are said to be sometimes arsenical, but all attempts to follow out these reports to their origin have hitherto failed.

The aniline dyes produced from coal tar are a source of very serious irritation in some cases, when brought into contact with susceptible skins. Lead is a well-known poisonous material, affecting water supply more especially, injurious also to the white lead manufacturers, to painters, and to many susceptible persons when exposed to newly-painted rooms.

The sanitary view of the question has been dealt with in the pamphlet, "Our Domestic Poisons,"* already published by the writer of this paper. Some further illustrative cases, however, under this head will be desirable before proceeding to the trade branch, which is the principal subject for consideration at the present time.

Amongst poisonous substances, the great offender, no doubt, is arsenic in its various combinations; for though aniline dyes free from arsenic produce most serious eruptive disorders, when im-

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* "Our Domestic Poisons," Ridgway, Piccadilly.

perfectly fixed or prepared, they do not affect the general health in the same insidious manner as arsenic. Aniline dyes do not produce injurious effects unless brought into contact with a susceptible skin, whereas the arsenical poison is diffused through the air either as dust or gas, so that injury may arise without actual contact with the arsenical fabric.

Those to whom this subject is new, have at first a difficulty in realising the fact that such small quantities of arsenic, combined in the colouring matter of a wall-paper or other fabric, can possibly have any injurious effect, since nothing but a chemical test will detect its presence. The evidence, however, which ought to satisfy any candid observer, will be found simple in the extreme, such as could leave no doubt on the mind of any unprejudiced person as to the verdict to be given.

The symptoms of chronic poisoning by arsenic begin with what appears to be an ordinary cold and cough; dryness and irritation of the throat and frequent headache; extreme restlessness; great debility, accompanied by cold clammy sweats, cramps of the legs, griping and dysentery, convulsive twitchings, and a group of nervous symptoms, varying in each case. Inflammation or irritation and smarting of the eyes and nostrils is often the most marked symptom, lasting for days, weeks, or months, sometimes accompanied by irritation of the skin or of the whole mucous tract; sore throat, running on to diphtheritic throat, ulceration and soreness of the mouth and tongue; irritative fever, which, if persistent, exhausts the patient, and death takes place by collapse. One universal feature should be mentioned, namely, the inefficacy of all usual remedies, the presence of arsenic not being suspected.

The above-mentioned symptoms are by no means absolute indications of arsenical poisoning; they may arise from other causes, but if the usual remedies fail to give relief there is reason for suspecting some hidden source of mischief. The proof

of arsenical poisoning then depends on the patient's recovery on removal, relapse on return to the arsenical rooms, and final cure on discovery and removal of the arsenical fabric. There is no abstruse scientific investigation needed to obtain such evidence; the facts are plain, within the comprehension of the most ordinary common sense. Illness unaccounted for—failure of ordinary remedies—cure on removal—relapse on return—final cure on discovery and removal of the arsenical fabric.

Any number of cases might be produced illustrating the above position, but a few typical ones can alone be given here. The "nursery paper" now exhibited, with pictures of boys playing cricket, was the cause of the illness of four young children, relatives of the writer. Repeated illness at home, and recovery on removal from home, occurred during a length of time. One of the children died, exhibiting nearly all the symptoms above described as the results of exposure to arsenical fabrics. This occurred before the parents became aware of the injurious effects arising from this cause. After communication with the writer, the paper was taken down, and the surviving children recovered immediately.

The following is from Robert Brudenell Carter, F.R.C.S.Eng., Ophthalmic Surgeon to St. George's Hospital:—

"I have reason to believe that two children of mine died, many years ago, from an arsenical wall-paper in the nursery; but the presence of arsenic was not discovered until after the deaths had occurred."

Case of a lady residing on Sydenham-hill, as given by Rev. R. J. Simpson, who himself had previous experience in his own family:—

"In March last, Miss S—— moved into a furnished house. A few days after her arrival she was attacked with a slight cold and cough, and, being subject to bronchitis, she confined herself to her bedroom, where a large fire was continually kept up. She gradually

became worse, and more unpleasant symptoms began to show themselves. She was constantly very sick and suffered much pain. There was a good deal of irritation about the throat and chest, accompanied with difficulty of breathing. The debility was great, and fainting fits of almost daily occurrence. A friend who remarked the suspiciously bright green paper on the wall of the bedroom, advised her to move into another room. This she did, after having occupied the room with the arsenical paper for six weeks. Each day after the change found her better, and she was soon restored to her ordinary health. I may mention that a Persian cat, which was always with her during her illness, was observed to be covered with a peculiar eruption, and her hair came off in large quantities."

It may here be observed that cats are frequently affected by arsenical papers, as mentioned in this case, and so are birds.

The following cases are furnished by Mr. Edmund Spitta, L.R.C.P., M.R.C.S. :—

"Case 1 was that of a little girl who had bronchitis. Convalescence occurred at the usual time, but was attended with extraordinary relapses of a severe nature. These relapses always came on after any circumstances which raised dust in the room. The wall-paper and the dust were examined by Dr. Stenhouse, and were all found to contain arsenic. The child rapidly recovered after removal to another room.

"Case 2 was that of a gentleman, who also had bronchitis, and who, like the child, always became much worse when his children ran about the room, or when, from other causes, dust was disturbed. Paper found to be loaded with arsenic. Recovered slowly after removal to another room.

"Case 3 occurred in a lady of weak constitution, who for years has had impaired health. She was suffering from great prostration, which steadily got worse. Alarming symptoms presented themselves, the patient fainting many times daily. Sweatings, vomitings, and dryness of the mouth, with intense prostration, almost closed her career. The wall-paper of the room, being examined, was found loaded with arsenic. With change of air she has now much improved; indeed, she is almost well.

"Case 4. My concluding case was simply one of depression, with pain in the stomach of the most obstinate character. Had the bedroom paper tested, and found the old enemy, the getting rid of which effected the recovery of the patient."

The following is the case of Mr. and Mrs. Clifton, of Derby, as reported by the former:—

"In March of the present year, 1879, I had my room papered, but did not occupy it for six weeks afterwards. A few days after sleeping in the room, my wife began to fail greatly in health, and lost flesh considerably; on rising in the morning complained of extreme exhaustion, and frequently vomited; the throat assumed a dark red appearance, the tongue parched, and sometimes cramp, or severe pain in the bowels, was experienced. Many times during the night I found the heart's action extremely feeble, and the hands and feet cold, and not ntil I had applied my ear to the region of the heart was I certain it had not ceased to beat. The effect upon myself was different; although, on waking, I felt prostrate, this passed away as soon as I left the room; yet, when I returned at night, the symptoms reappeared, frequent sneezing, and watery discharge from the eyes and nose, accompanied by great exhaustion. It did not occur to me until after two months of suffering, that arsenic being present in the paper might have induced some of our ailments. An examination showed that the whole surface was covered with arsenite of copper. On sleeping in the adjoining room the following night, the symptoms referred to ceased, excepting the exhaustion, which has since disappeared, and I have every reason to believe that, had we continued to use the room with the arsenical paper remaining on the walls, no human aid could have restored the balance of health."

The paper referred to in Mr. Clifton's case is now exhibited.

The following is worthy of note, as coming from the trade department rather than from the medical:—

"It is an extraordinary thing that, during my 25 years' experience in the trade, I never met with a case of arsenical poisoning amongst my own circle of acquaintance until this autumn, when a slight case came

under my notice. I was at the seaside, and while there engaged apartments for an invalid friend. A few days after my friend had taken possession, a change in the weather obliged her to keep the windows shut. A marked irritation of the throat, cough, and general *malaise* was at once set up, which continued and increased day by day. I tested the paper, found it arsenical, and removed my friend into another room, the paper of which was not arsenical, when the unfavourable symptoms disappeared as if by magic."

Another case has been reported, only just in time for insertion. It is given as a striking illustration of the kind of proof to be relied upon with reference to the injurious effects of arsenical wall-papers, namely, illness produced, recovery on removal, return of symptoms on return to the arsenical paper, final recovery on the arsenical paper being taken down.

"I now forward the case of Mr. B———. The paper, since found to be arsenical, was put up in Mr. B———'s bedroom seven months ago. He was taken ill four weeks afterwards. The symptoms were remarkably complete; soreness of the eyes on waking in the morning, pain at the pit of the stomach, loss of appetite, emaciation, and general *malaise*.

"I sent Mr. B——— to Margate for change in July, and he came back, as he said, "a man again;" but, at home, the former symptoms soon returned, added to which there was intense dryness of the throat and jaws, swelling of the gums and tongue, followed by excessive irritation of the skin. The symptoms became alarming. The wall-paper was tested, and found arsenical; it has been taken down, and the patient is now rapidly recovering"

The above cases, excepting that of Mr. Brudenell Carter, are all recent, and are only a sample of the great number which have come to the knowledge of the writer within the limited circle of his own acquaintance. They, however, are sufficient to illustrate the injurious effects arising from poisonous pigments, and they alone might almost be considered as establishing a *prima facie* proof of illness arising from this cause; but, when similar

cases are multiplied to an indefinite extent, there can be no doubt remaining on any unprejudiced mind. Medical men, whose attention has not been drawn to poisoning by arsenical surroundings, raise the objection that they are in the habit of giving more arsenic as a medicine than can possibly be imbibed from arsenical fabrics. True, they do put more arsenic into the stomach than can be imbibed from a wall paper, and they do it, perhaps, with beneficial effect in some cases; the legitimate conclusion to be drawn is, not that arsenical surroundings are uninjurious, but that arsenic taken into the stomach does not act in the same manner as when breathed and received through the lungs.

Another difficulty is raised, grounded on the production of arsenic from the mines, and its use in various manufactories in large quantities. It is said that arsenical fabrics, containing comparatively small quantities of arsenic, cannot possibly have the injurious effects attributed to them, for the workpeople continually exposed in these works do not suffer. That many workpeople do not suffer is, no doubt, true, but how many do suffer it is difficult to ascertain. It must be borne in mind that the majority do not palpably suffer from exposure to arsenical fabrics in domestic use, but only a minority of susceptible subjects; nevertheless, that minority is large enough to be an important proportion of the population. Susceptible subjects, attempting to gain a livelihood by exposure to arsenic, would probably soon abandon the employment, thus leaving the work to those who are able to resist it. It is marvellous what the human frame may be inured to, not only as regards arsenic, but other deleterious matter, as, for instance, sewer gas. This gas, escaping into houses, is universally admitted to be highly injurious, producing, in many cases, a well-known class of diseases; but, on the other hand, men whose occupation it is to clear out sewers, spend their working hours breathing the very atmosphere of the sewer itself, and that with perfect freedom

from the deleterious effects produced by that same air escaping in small quantities into the house.

As before stated, it is said that workpeople continually exposed to arsenic, in great quantities, do not suffer. It is perfectly clear that great numbers can endure exposure to these arsenical works with impunity, but how many break down, and how many die under the ordeal, it is impossible to ascertain. No such investigation would be at all reliable unless carried out under Government authority, such as that made by Dr. Guy with regard to a manufactory of artificial leaves. (See Report of the Medical Officer of the Privy Council, 1862.)

The following is taken from Dr. Guy's report above mentioned:—

"In an establishment employing about one hundred young women, more or less suffering was almost universal amongst them; the symptoms were erythema, ulceration, excessive thirst, nausea, vomiting, fever, convulsions, &c."

In commenting on this report, and with particular reference to one case of extreme suffering described by Dr. Guy, Mr. Simon says:—

"The tortures which that poor girl must have endured will not have been in vain, if, as may be hoped, the public knowledge of them leads to the amendment of a system under which others are still day by day enduring in different proportions the progress of a similar fate."

Had Dr. Guy's investigation been carried into other works where arsenic is employed, further important information would no doubt have been elicited.

It is, of course, only under peculiar circumstances that instances of suffering in manufactories can be reached, and, for the purposes of this paper, any attempt at investigation would have been useless, but the cases of two men, accidentally brought under the notice of the writer, may be mentioned, whose hands and various parts of the body were covered with scars of ulceration produced by

printing papers with arsenical colours, some years ago, the employment of such colours now being abandoned in the factory where they work.

Another case may be given, as related by a connection of the writer's, who had the superintendence of the operation in question :—

"A quantity of emerald green, delivered in large packages, had to be redistributed. The work having to be done in haste, four extra hands, men not accustomed to the work, were put on. All had wet sponges over their mouths; nevertheless, these four extra men were made ill, one died soon after, and the other three were far more ill than the men usually employed in repacking colours."

This is a remarkable instance of the difference between men accustomed to such work and others not habituated.

The case of a young woman in a draper's shop, in one of our large provincial towns, is a good example of the serious but less virulent effect of arsenical fabrics in the course of trade. It is this young person's department to sell artificial flowers, and the mere production of them and exhibition to the customers makes her ill, so much so that she has been obliged to leave her work and have change. This report is from a medical man, a friend of the writer's.

As a further illustration of the effect which may be produced by artificial flowers, and, as a confirmation of the above statement, it may be well to give the following report from Mr. Charles Ekin, the analytical chemist of Bath, who has kindly also sent the flowers themselves. He says :—

"The history of the French flowers is this. They were procured direct from Paris by a lady residing here with her two daughters. When the flowers arrived and were being inspected, one of the daughters, who is rather an invalid, was seized with a violent shivering fit and faintness. She was taken out of the room, and, after a time, recovered. The mother and other daughters returned to the room and put away the flowers; they remembered afterwards that they too felt the same

symptoms, only in a much less degree. The flowers were taken out of the box a day or two afterwards, and all three were at once affected just as before. The flowers were naturally suspected, and packed off to me at once."

The leaves are found to be highly arsenical, but not so the flowers.

The effect of arsenical wall-papers on men stripping them off or hanging them, is well-known; they are frequently obliged to desist from their work. It is stated by Mr. Heisch (analytical chemist and gas examiner to the City of London), who has paid much attention to this subject, that men suffer more from cutting the edges than in hanging the paper; this seems highly probable, for in the one case the dust would be shaken off dry, while in the other it would be rather retained by the damp of the paste.

A very important case has lately been investigated by Dr. Hardwicke, in an inquest on a young woman, who died from the poisonous effects of colours used in decoration and printing on tin plate. These colours contained carbonate of lead, acetate of lead, sulphide of tin, metallic copper, antimony, arsenite of copper, and chromic acid salts; the colours were used to a great extent as dry powder, dusted on to an adhesive surface; in this dusting operation, the person was so covered with colour as to be described as "not recognisable."

Dr. Bartlett was first engaged on the part of Government, to give information on the chemical question, and at a later stage Mr. Lakeman, the Inspector of Factories, was also called in. Dr. Bartlett analysed the colours, and both these gentlemen examined the works. They pointed out to the manufacturers that the process of dusting poisonous dry colours by hand was inevitably dangerous. It appeared there was no particular blame to be attached to the manufacturers, they merely carried on certain works in the ordinary manner customary in this country; that the process was destructive to the life and health of the per-

sons employed, was no peculiarity of this establishment.

The point to which it is desired now to draw particular attention, is this, namely, that Dr. Bartlett and Mr. Lakeman, having pointed out the danger arising from the use of dry colours, it was stated by the manufacturers, on the last day of the inquest, that the process of using dry poisonous colours had been then abandoned. If such a change could be so readily made, why was it requisite that this poor girl's life should be sacrificed, in order to enforce attention to these well-known facts? One girl, produced as a specimen of a healthy subject employed in these works, while giving her evidence, was requested to open her mouth, the marks of lead poisoning were at once discovered.

Many cases of suffering are given in a valuable paper by Mr. Frank Draper, of the United States, published in the *Chemical News*, July 19th, 1872, and following numbers.

The foregoing statements, with regard to both the public generally and the work people, can leave little doubt on the mind of anyone, that many lives are sacrificed, and a vast amount of illness produced, by this use of arsenic. There are no doubt many employments in which life and health are freely exposed to danger under a sense of duty. The medical man and the nurse expose themselves to infectious diseases; the soldier and sailor to great dangers; workmen in mines, and in various employments, are necessarily exposed more or less to danger; but in these cases every possible precaution ought to be taken, even though the exposure is a moral duty, and the object aimed at be such as to justify the risk. Where the object in view is a great good, not to be attained without risk, the risk is justifiable; not so, however, when it is a mere paltry question, such as whether you have one shade of green paper, or another shade a trifle brighter.

The question, therefore, arises—What is gained?

Why is arsenic thus used? Simply, *cui bono*? In considering this part of the question, it is requisite to distinguish carefully between fabrics for home consumption, and articles for exportation.

In considering home consumption, we have to deal with the interests of the trade supplying, and with the interests of the public using, these articles. As to the public, the evidence on the whole tends to show that they do gain some brighter greens at lower prices, that is to say, low-class bright green poisonous papers can be produced, brighter and cheaper than non-poisonous. Arsenic is also said to give permanency, brilliancy, and body, especially to the group of aniline colours. The cost of colour in low-class papers bears an appreciable proportion to the total price of production; but in higher-class papers the difference in cost between one green pigment and another is too small to be of material importance. It should, however, be stated that some paper-stainers assert that there is no economy or advantage in using arsenical colours.

The samples now hung on the walls will satisfy those present that arsenic is not essential in order to produce a good colour; even if it be true that more brilliant tones can be obtained with than without arsenic, the difference is certainly too slight to be appreciated, except by those specially skilled in colour.

The colours in which arsenic is an essential ingredient are Scheele's, Vienna, or emerald green (practically the same thing, no matter what name it is called by), a blue (not containing copper), orpiment (containing 60 per cent. of arsenic, an expensive colour, now seldom used), and, perhaps, some few others; but it is by emerald green, used either alone or in combination, that arsenic is principally introduced; it is, however, also used without absolute necessity in a great variety of colours—red, brown, some blues, pink, low-toned greens, French greys, black, and notably in magenta; and colours are made

arsenical where there is no occasion for it, merely by using up arsenical remnants which happen to be left on hand from other work. There is no doubt that, in any factory where arsenical colours are freely used for certain purposes, all the papers made will be more or less contaminated, thus accounting for the slight trace frequently found. Colour, therefore, cannot be taken as any guide to the public as regards freedom from arsenic. It is said that greater depth and sharper lines are obtained in black by the use of arsenic. The two samples now exhibited are from the same maker—the non-arsenical, if anything, somewhat the sharper and better of the two. These two, the black and olive-green papers, are a good sample of the carelessness with which such a virulent poison is introduced into our houses—the one arsenical, the other practically free; the one as good as the other, and both from the same maker. Permanency of colour is a matter of importance, and is one advantage stated to arise from the use of arsenic; but there is another side to this question, that is to say, if the public make use of fabrics coloured with poisonous pigments, it is a very questionable, benefit their being the longer exposed to them, and their superior average of durability is certainly very questionable, when the number of arsenical papers which it is now thought requisite to remove, is taken into the calculation.

It may be safely asserted that paper-stainers would suffer no injury, in the home trade, from an Act of Parliament entirely prohibiting the use of arsenic, except as regards the stocks in hand; this, however, would, in many cases, be a serious matter, very large stocks of arsenical papers being held by some makers. Were an Act suddenly passed, prohibiting the sale of arsenical papers, either the manufacturers must be compensated or they must sustain a heavy loss; the only alternative being that time must be given to sell the stocks in hand, the public being allowed to imbibe so much more poison, in order that the paper-stainers may be

secured from loss. Continued additions to their stocks of arsenical papers will, however, for the future, be a matter for their own consideration, at their own estimate of the risk.

Some paper-stainers have abandoned the use of arsenical pigments for a length of time, others are now ceasing to use them, and are supplying papers guaranteed free from arsenic, stating that this change is made on account of the public feeling in the matter. It is, therefore, to be hoped that all may soon follow the same course, for it will be to the makers of non-arsenical papers that, at all events, the intelligent portion of the community will look for their decorations.

The foreign trade, however, is a more difficult question, for it is well known that a shade of colour, or a very small per-centage of extra cost, will turn the balance of the market. It seems clear that papers cannot be made of the particular shade of Scheele's green without arsenic; and though the precise colour is of no real value, the colour, together with the merest trifle in cost, may turn the balance in competition with foreign manufacturers who do use it. Therefore, as regards foreign trade, the real point will come to this—Shall the English manufacturer continue to export poisonous papers for the benefit of the trade of this country, irrespective of the effects on the foreign purchaser? This question seems to be settled in the affirmative, if we may judge by the course taken with regard to the opium trade. For the sake of £6,000,000 of Indian revenue, we continue to export that which is well known to be most deleterious to the Chinese nation. But, as regards home regulations, the opposite course is being followed to such an extent as to have become a settled principle of government. The Sale of Poisons Act and the Adulteration of Food Act establish the principle that the purchasing public shall be defended by the Government from the careless or nefarious vendor. If our Government thinks well to protect the public from water being added to their milk, is it too much to ask

that our houses may be defended from arsenic? If druggists selling poisons are obliged to label them as such, is it unreasonable to require that arsenical fabrics shall be marked "arsenical?" Is there any reason against their being so marked, except that they would not sell? If there be no other reason, it proves that, in the opinion of the vendors, a large portion of the public are sufficiently alive to this question not to use these papers if aware of their nature.

Some paper-stainers state, with the most perfect confidence, that they do not use arsenic at all on their works, which is perfectly true as regards "crude arsenic;" in that condition, arsenic is not used by paper-stainers. The manufacture of colours is a distinct trade, and it is the colour-manufacturers who introduce the compounds of arsenic, passing them on to the paper-stainers in the form of arsenical pigments, which the paper-stainer may not know to be arsenical if not inquired into. Some paper-stainers, who desire to avoid arsenic altogether, report that they find considerable difficulty in procuring pigments free from it, and find it requisite not only to contract for colours free from arsenic, but also to watch and test the colours delivered. On this question, however, the following statement from a paper-stainer is satisfactory:—"Since the question of arsenic has arisen, the attention of the colour-manufacturers, mostly abroad, has been given to the subject, and they have produced colours, guaranteed free from arsenic, so nearly equal in brilliancy that the general public could not detect the difference, except by such a close inspection as they are not likely to give. These non-arsenical colours do not add to the cost ."Another paper-stainer would rather say, "Not to any serious extent." The ceasing to use arsenical colours would not involve any expense in alteration of plant; this is a matter of some importance.

The samples now exhibited prove that there is no difficulty in producing the most satisfactory colours

free from arsenic; and, as regards the home trade, the question of cost is decided by several firms having entirely abandoned the use of arsenical colours, and still holding their ground satisfactorily in the open market. In fact, it is now stated by them that, with the present feeling of the public on the subject, it is more advantageous to abandon the use of arsenical pigments, and to issue the goods guaranteed free from arsenic. The only real difficulty, therefore, as regards the home trade, is that arising from the stocks on hand. Some paper-stainers give it as their opinion that the present movement is altogether a mistake, and that injury does not arise from this cause; but, even amongst these, some have already abandoned the use of arsenical colours, others use emerald green and such pigments as cannot be produced without arsenic, avoiding them wherever, in their opinion, it is feasible.

One paper-stainer writes:—

"We may state that we have not used any emerald green for a long time, and we take every precaution to purchase such other colours as are guaranteed to us free from arsenic."

Another writes—

"I exclude all arsenical colours most carefully. 9-10ths of the colours I use are made in Germany and Belgium, and are guaranteed free from arsenic, nevertheless I also have them tested by a public analyst in this country."

A third has for some years abandoned the use of arsenical colours. Another says—

"There is difficulty in obtaining colours free. We do our best to avoid arsenic."

Another has issued the following circular:—

"The subject of arsenic in wall-paper having been so prominently brought before the public in the last few months, we have repeatedly been asked whether those manufactured by ourselves contain it. We have always been able to prove to the satisfaction of inquirers that there is no arsenic in wall-papers of our manufacture,

but with a wish to completely satisfy our customers that such is the case, we invited a chemist, who had previously devoted much time to the subject of arsenic in wall-papers, to thoroughly examine our manufactures and the materials used for the same. We have now pleasure in sending you a copy of his report."

In reply to the question, "What disadvantage does a manufacturer who does not use arsenic suffer under?" the following reply has been received from a firm manufacturing on a large scale: "None whatever, but the contrary, as long as the present feeling exists. We have found it desirable to issue our price lists this year with a printed label to the effect 'that the patterns are made from colours guaranteed from the manufacturers free from arsenic.' It never has been any advantage to use arsenical colours, and as soon as others were produced we discontinued them."

The above quotations may be taken to a certain extent as expressions on the part of the trade, and from them it may be fairly gathered, that there would be no difficulty whatever in the total abandonment of arsenical pigments as regards wall papers.

A caution should, however, be given that the assurance of a manufacturer that a paper is free from arsenic cannot always be relied upon. A paper selected by the writer, marked "non-arsenical," was, after being hung, pronounced highly arsenical by Dr. Stenhouse, and this from a first-class London firm, of the highest respectability. A specimen of this paper is now exhibited.

The fact is, that many paper-stainers do not appear to be well informed as to whether their colours are arsenical or not, and it may be safely assumed that the retail dealers know very little indeed about the matter—that is, judging from the erroneous assurances so constantly given.

On the whole, it may safely be said that there is a general apprehension amongst manufacturers of wall-papers, even amongst those who do not admit the injurious effect of arsenical colours, that the

public are getting too much alive to the question to allow of arsenical pigments being employed as heretofore, with profit to themselves.

It has been suggested that it may be well to turn to distemper as a security against arsenical papers; this, however, is no security, for arsenical colours are used in distemper.

In dyeing and calico printing, arsenic is used, as well as in wall-papers, but not to the same extent as regards arsenic remaining in the fabric when finished; and there cannot, it may be presumed, be any objection to the use of arsenic in certain processes where it is thoroughly washed out in the after stages, or where the trace left is so small as to be practically of no consequence. There are, however, some processes included in dyeing in which the pigment, to which the colour is due, is itself an arsenical compound, as for instance the arsenical compounds of copper producing bright green dyes, or rather pigments, the colour being due to the arsenical compound, attached superficially, rather than entering into the body of the material as a true dye. In this condition the poisonous material would of course be less firmly fixed, and would be liable to produce the symptoms described by Dr. George Owen Rees, in a letter to the *Times*, as occurring from bed curtains and green muslin coloured with Scheele's green, a square yard of which was found to contain upwards of 60 grains of the colouring matter. Chromic and ferric arseniates, which form brown and green colours, were found by Mr. Foster (Professor of Chemistry, Middlesex Hospital) to the amount of 45 grains per square yard, and 120 grains in the lining.

Arsenic is also used in dyeing in the process still called "dunging," though the material formerly used, cow-dung, has ceased to be employed. The object of this process is to remove superfluous mordants, which arise from an unavoidable excess put on in the previous stage. Instead of cow-dung, solutions of phosphate, silicate, or arseniate

of soda are used; of late years, principally the latter. Here the arsenic is of use only as an intermediate agent; it forms no part or ingredient of the final colour, and it is, or should be, removed in the subsequent stages.

There is, however, another method of producing printed fabrics, in which a much larger quantity of arsenic is used. This is in fixing the aniline colours, and it consists in printing upon the cloth a thickened mixture of red liquor (alumina acetate), a solution of arsenious acid in glycerine and a solution of the aniline colour. This printing mixture may sometimes contain as much as 8 oz. or 10 oz. arsenious acid per gallon, and a piece of 25 yards might hold upon its surface, immediately after printing, as much as 2 oz. of arsenious acid. After printing, the goods are steamed, by which means an insoluble alumina arsenite is precipitated on the fibre, and this acts as a mordant, retaining the colouring matter, and fixing it on the cloth in such a way that the colours will resist soaping. This is a most objectionable process, but is not so much in favour with printers as it was some years ago; the chief advantages of the process are, that by it the colours produced are very pure and brilliant; for fastness it cannot be much recommended. Even in this case, if the goods have been well washed and soaped, the whole of the arsenic remains in combination with the alumina, and is, therefore, firmly attached to the material. But when, to avoid expense, the calico printers send their goods into the market without the subsequent soaping and washing, they may contain considerable quantities of arsenic in a loose, and therefore most injurious, condition. There are several other methods in use for fixing these aniline colours, which are free from this objectionable use of arsenic.

The two processes, that of colouring with an arsenical pigment, such as Scheele's green, and that of removal of excess of mordant, by means of arseniate of soda, may be pointed out as

examples of two entirely different operations. The one in which an arsenical compound constitutes the permanent colouring, is decidedly to be condemned, for the arsenic remains an essential ingredient in the finished fabric. In the other process, the arsenic is not an essential part of the finished goods; it is, or ought to be, removed in the after stages, if so removed, no injurious effect could arise from it, and the ordinary processes of manufacture ought not to be interfered with. The question, therefore, as regards dyeing, is not quite so simple as in the matter of wall-papers; in them, if used at all, the arsenic must remain in the finished material, and such processes undoubtedly ought to be condemned; whereas in dyeing, temporary use may be made of arsenic without injury, provided it be thoroughly washed out in the following stages. A direct prohibition of the use of arsenic might therefore not be desirable as regards dyeing.

There is high authority for saying that, as Scheele's green and other arsenical pigments are not now produced on cloth by first-class calico printers, arsenic is not a necessary compound of any pigment or dye used by them, unless it be in the aniline colours; these colours, however, if properly prepared, ought not to contain arsenic in their final condition, or, if they do, it should only occur as a mere trace. English manufacturers generally extract the arsenic entirely, it being essential to the process that they do so, but foreign manufacturers adopt a different, and not so efficient a process.

Large quantities of arsenic are undoubtedly used in the production of magenta, which is the foundation of all other aniline dyes, but this arsenic ought to be abstracted in the subsequent processes, and it is so abstracted by first-class manufacturers; how far it is left in, in consequence of inferior manipulation, in some dye-works, it is difficult to say. No aniline dye tested for the purpose of this paper has been found to contain arsenic, though several

samples have been examined which have produced violent irritation in the hands and feet. There seems, therefore, no reason why arsenic should not be eliminated from all dyed goods and from all cotton prints, as finally sent out for the use of the public. A sample of a stocking, which has produced very serious irritation, was received from Dr. Routh, and forwarded to Dr. Alfred Taylor. His remarks are as follows:—

"I find no arsenic in the enclosed sample. I believe the colouring is due to a mixture of coal-tar dyes, all of which are more or less irritating to the skin, more especially to an irritable skin. This is obviously a bad and unsafe dye, for the colour is not properly fixed by any mordant in the stuff. The cutaneous perspiration would suffice to draw it out, as water easily dissolves it."

The bright green arsenite of copper is a favourite colour for the cardboard boxes, now so generally used, and for labels of all kinds. Though these boxes and labels are not intended to be eaten, nevertheless, after the case of the death of a child at Peckham from sucking a piece of arsenical wall-paper, it seems undesirable to have such a poison scattered widely in our houses, no real object being gained thereby. It is reported by Dr. Wallace, of Glasgow, that on the back of a single pack of playing cards, there was found no less than 83 grains of arsenious acid. This poison, as Dr. Wallace suggests, is liable to be carried to the mouth by uneducated persons, who wet their thumbs to deal.

The impropriety of colouring confectionery and sweets with poisonous pigments needs no comment; nevertheless, it is to be feared that there is still a necessity for its prohibition, more especially as regards aniline colours, which may be arsenical, and which, if not arsenical, are, nevertheless, not desirable to be eaten. A case of a number of children being poisoned, and having a very narrow escape of their lives, is reported by Dr. Russell, of Glasgow, as having occurred in October last. Some toy

sweetie watches were made with a ring of sugar, and a paper back of Scheele's green. A single piece of paper contained 0·18 grains of arsenic; the arsenical pigment was, more or less, eaten with the sugar. In fact, an hour or two amongst the cheaper sweetie shops, and the expenditure of a few shillings, would secure a large number of samples dangerous to children.

The reports of injury from arsenical paper collars are so numerous from America, from Germany, and in England, that it seems reasonable to suppose there is some truth in these statements; but, hitherto, there has been no result in the search for definite facts, vouched for by responsible parties, nor have any samples tested for the purpose of this paper proved arsenical. It is very undesirable that needless prejudice should be raised against these useful articles. At the same time, if some are arsenical and injurious, the makers ought to be known.

In the *Scientific American* of March 1st, 1879, there is a detailed report of the death of a young lady from the use of arsenical starch, but this, like the arsenical paper collars, does not appear to be confirmed by any experience in this country.

Size is used by paper-stainers, also by builders, in the preparation of walls for papering. One correspondent states that he has met with arsenic as an antiseptic in size used for these purposes. Another has found it in large quantities in size used for stiffening veils, tulle, and other articles of millinery. Fortunately, this most dangerous use of arsenic as an antiseptic in size is not general, nly these two instances having been met with.

As a sample of the objectionable use of size, it may be well to draw attention to tapestry carpets, which are imitation Brussels, the wool surface of which is so superficial and so slightly secured in weaving as to require size at the back to keep it in place and to give substance or body to the fabric. The size in these carpets is often most offensive, the bad smell lasting as long as the carpet. Drains

&c., are suspected, when the mischief is really in the carpet.

The production of arsenic in this country is on a scale that will surprise most people; when it is borne in mind that two or three grains will destroy the life of a healthy man, an output of 4,809 tons, value £30,420, in one year, does indeed seem a large quantity to be dealt with. This quantity of arsenic is produced from twenty mines in Cornwall and Devonshire; it is an ingredient of copper and tin ores, and has to be separated from the metals in the process of smelting. The arsenic sublimed in the furnaces is deposited in a crystalline form in long galleries, through which the fumes are made to pass. The crude arsenic thus deposited is collected at long intervals, and passed on to the refiners. There are but six firms of refiners; from these information has been sought as to the quantity of arsenic used for colour manufacture and for dyeing, but no replies have been received. A reply to the inquiry as to how much of a virulent poison is sent out annually for use in our domestic fabrics, was, perhaps, hardly to be looked for. The withholding such information is certainly no ground for complaint, at the same time, it may be gathered that the less the public know about this matter the better for the trade.

As the arsenic must be separated from the metal, the expense of collection probably is small, and the bulk of the £30,420 per annum may be looked upon as profit.

Large quantities of arsenic are used for sheep-wash, for poisoning seed grain, in the manufacture of glass, for killing vermin, for preserving anatomical specimens, &c., as well as in pigments and dyes; but what the proportions used for the different purposes are, or how the 4,809 tons are distributed, there is no information to show.

This subject, "Our Domestic Poisons," arsenic in particular, has been considered of such importance, that the Medical Society of London has thought well to appoint a special committee to

investigate the subject, with a view to bringing the matter under the consideration of the Local Government Board. A paper has already been read before that society, on the medical view of the question, by Mr. Jabez Hogg, M.R.C.S.

With a view to the investigation of the action of arsenical fabrics, experiments have been made to test the presence of arsenic in air, exposed to arsenical papers. Mr. Phillips, in the second report of the Commissioners of Inland Revenue, 1858, gives the result of his attempts. He failed to detect arsenic in gaseous combination, and goes on to say:—"It is probable that persons have been affected by inhabiting rooms papered with arsenical hangings, not because the arsenious acid has been volatilised, but from minute particles of arsenite of copper dispersed in the air;" thus upholding the dust as against the gaseous theory. Dr. Alfred Taylor also considers the arsenical dust as the principal cause of mischief, though in some cases, arseniuretted hydrogen might be evolved.

Professor Abel made experiments on the presence of arsenic in gaseous combination, but failed tc discover it.

Dr. Fleck, of Dresden, did obtain arseniuretted hydrogen from a wall paper and paste, in the experiments he carried out. Professors Roscoe and Schorlemmer also obtained arseniuretted hydrogen from an arsenical wall-paper and paste, at the same time, however, they attributed injurious effects to dust as well as gas.

Professor Bamberg, of Stockholm,* observes, that "the injurious effects of arsenical pigments, as applied to the walls of apartments, have been observed by physicians in almost every civilised country." He made a very important and successful experiment himself, detecting arsenic in a gaseous form in the atmosphere of a room that had been papered for 25 or 30 years.

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* The *Pharmaceutical Journal*, August 1, 1874, where a very full description of this experiment will be found.

The following is from a manufacturer of wall-papers :—

"It appears to me that the 'dust' theory is much more tenable generally than the 'gaseous,' and much more likely to be the cause of mischief. This was especially noticeable in the case of our own men when we used arsenical colours. The printers, who work on several thicknesses of felt, called blankets, which become charged with dust, were much more affected than other workmen, having charge of different processes where the dust did not so much accumulate. Bearing this theory in mind, it is also to be remarked that the greater number of cases of arsenical wall-paper poisoning of late years may reasonably be attributed to the more extended use of machine papers, in which the colours are notably less firmly fixed by the sizing material than in the older block-printed papers."

That arsenical dust is productive of serious injury, there can be no doubt, and, in certain cases, it is clearly proved that some volatile compound is given off; but whether the injurious effects arise from dust or gas, the public look to be protected from a poison, the results of which they know well by experience, though they may know nothing of its mode of action.

The information gathered whilst pursuing this subject leads to the following conclusion :—

That many persons suffer in an extreme degree from exposure to arsenical fabrics—not a few to the extent of loss of life. That, judging from the number of cases brought under notice in a private circle of friends and acquaintances during this investigation, there can be no doubt that great injury to health is produced in a vast number of persons throughout the country. There is every reason to believe that a serious amount of deterioration of the constitution is going on all around, though each individual case might not appear severe; this remark will apply more especially to children.

Great irritation is also frequently produced by articles of dress dyed with aniline colours being

brought into contact with the skin. These aniline dyes produce this irritation when free from arsenic, though the injurious effect would be increased by arsenic being present also. The irritating effect of aniline dyes probably arises from unskilful management in the process of dyeing, the free dye being insufficiently washed out.

The remedy suggested would be, a law prohibiting the use of arsenic in the manufacture of all fabrics for domestic use, that is, in all those processes which leave the arsenic in the finished goods. The laws of France and Germany might be taken as a guide. The retail vendor to be liable to punishment, whether ill effects be produced or not. Such liability, however, might in many cases fall unfairly and unjustly on a retail vendor, who had taken all reasonable care to avoid arsenical articles; it is, therefore, further suggested that facilities should be given to enable the retail dealer to throw the responsibility on to the wholesale manufacturer; as, for instance, with regard to paper-hangings, the colour-maker is the real culprit, but the public have no means whatever of getting at him. If, however, the retail dealer be made responsible in the first instance, and facilities be given him, enabling him to throw the blame on the paper-stainer, and the paper-stainer again on the colour-manufacturer, each offender being only allowed to escape on his substituting another, the real culprit would be reached. Otherwise, the manufacturer of arsenical colours would practically be safe from liability. It would be the paper-stainer's duty to note his purchases of colour, so as to be able to trace them, otherwise the responsibility would rest with himself.

Finally, it is maintained that the whole subject of "Our Domestic Poisons" is a matter of such importance as to demand Government investigation.

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The reading of the paper was followed by a discussion, in which the views expressed were

supported, first, by Mr. Jabez Hogg, followed by Dr. Bartlett, Mr. Hale, Mr. W. Botly, Dr. Alfred Swaine Taylor, F.R.S., Dr. Lauder Brunton, F.R.S., Mr. Aumonier, and, finally, by Dr. Mann, who had taken the chair, Mr. Simon being obliged to leave.

The limited time remaining for discussion, after the reading of the paper, unfortunately precluded some present connected with manufactures from stating their views on the trade side of the question.

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## SOCIETY OF ARTS.

A Special Committee has been appointed by the Society of Arts to follow up the subject of this paper, and to co-operate with the Committee appointed by the Medical Society of London.

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## GOVERNMENT ACTION.

With reference to the case of the death of a young woman, as stated on pp. 13-14, it is satisfactory to find that, by a *Gazette* order, dated 30th January, 1880, workpeople employed on "*Lithograph printing, playing card making, fancy box making, paper staining, almanack making, artificial flower making, paper colouring and enamelling, colour making,*" are no longer to be allowed to take their meals in the rooms where these processes are carried on. There is at present, it will be observed, no prohibition of the use of poisonous colours, but an effort is made to prevent the various poisons being carried into the stomach of the workpeople together with their food. It is very questionable, however, whether the most serious evil is not still left untouched

whether the breathing an atmosphere, charged with poisonous dust, is not in practice a far greater evil than the amount of poison which has hitherto been taken with the food.

This order was not issued till ten days after the reading of the paper at the Society of Arts, or it would have been mentioned at the time.

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