

Inflammation of the eye and injuries to health by arsenical wall-paper poisoning / by Jabez Hogg.

Contributors

Hogg, Jabez, 1817-1899.
Royal College of Surgeons of England

Publication/Creation

London : Printed by Spottiswoode, 1879.

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INFLAMMATION OF THE EYE AND
INJURIES TO HEALTH

BY

ARSENICAL WALL-PAPER POISONING

BY

JABEZ HOGG

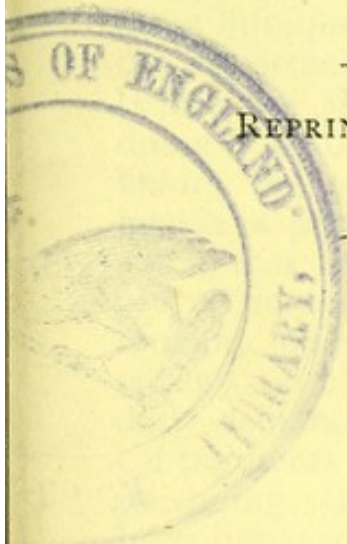
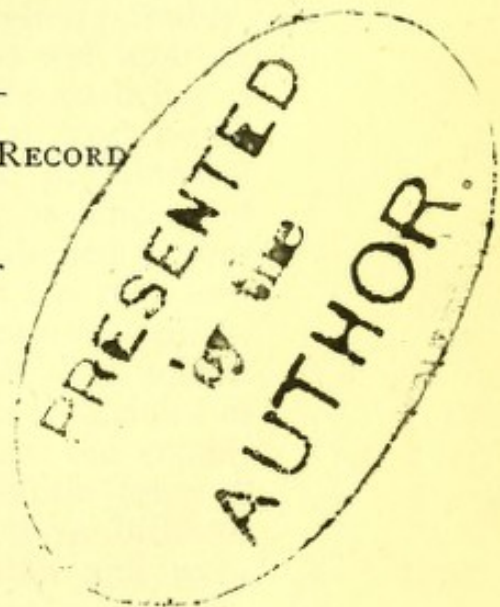
CONSULTING SURGEON TO THE ROYAL WESTMINSTER OPHTHALMIC HOSPITAL
AND TO THE NORTH WEST HOSPITAL FOR DISEASES
OF WOMEN AND CHILDREN
ETC.

REPRINTED from the SANITARY RECORD
April 25, 1879

Printed by

SPOTTISWOODE & CO., NEW-STREET SQUARE, LONDON

1879



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INFLAMMATION OF THE EYE AND

INJURIES TO HEALTH

BY

ARSENICAL WALL-PAPER POISONING

BY

JAMES HOGG

WITH AN APPENDIX ON THE EFFECTS OF THE SEVERAL VITAMINES ON THE HEALTH OF THE BODY AND ON THE HEALTH OF THE MIND

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APR 25 1873

INFLAMMATION OF THE EYE AND
INJURIES TO HEALTH BY
ARSENICAL WALL-PAPER POISONING.*

DEFECTIVE drainage, adulterated food and drinks, the septic state of the air we breathe, together with one or two other sources of zymotic disease, have almost exclusively absorbed attention in connection with hygiene. A scarcely less important matter of health, slow poisoning by means of the increased use of arsenic in domestic industries, is, I think, in some danger of being passed over, from a belief, possibly, of its infrequency. For this reason, as well as from the importance of the subject, I venture to bring it before the Medical Society of London, and by so doing hope to place it somewhat more prominently before the profession generally, and of officers of health in particular. It will not be denied, I presume, that arsenical pigments are extensively employed in the manufacture of wall-papers, paints, muslins, chintzes, calicoes, artificial flowers, and a variety of other textile and ornamental articles in daily demand. It is equally certain that the arsenical pigments employed constitute a subtle form of poisoning, the symptoms of which have hitherto been liable to be confounded with other and well-

* A paper read before the Medical Society of London, April 7, 1879.

recognised forms of disease, and must have led to errors of diagnosis.

Mistakes have probably arisen, not only from a certain scepticism (which still prevails on the subject), but also from the difficulty of seeing the connection between an inappreciable quantity of floating dust, and a distressing form of illness. Dr. Hinds, of Birmingham, was for a long time unable to conceive that his sufferings (extending over a period of months) could be solely due to 'a neat green paper,' which he had just then had put up on the walls of his study. Neither he, nor the several medical friends whom he consulted, were able to understand or explain his remarkable symptoms, and when the wall-paper was fixed upon, it was too trivial to deserve a serious thought. Dr. Alfred Taylor, the eminent toxicologist, failed in his attempt to convince a Committee of the House of Lords of the danger to health from the then greatly-increased use of arsenic in certain manufactures. The facts, however, elicited at the time (1856) had the good effect of directing attention to the subject; and Dr. Halley, who was suffering from a train of symptoms that neither he nor his friends could well understand, saw the termination of his misery when he read Dr. Hind's case in the columns of the *Medical Times and Gazette*, February and May 1857. The truth flashed across his mind that he was the victim of arsenical poisoning; and on examining the recently-hung paper—an 'emerald green'—of his study, discovered arsenic in a considerable quantity. On its removal he at once recovered his health, and had no return of the symptoms. In every particular the circumstances of Dr. Hind's and Dr. Halley's illness were very nearly alike, and thoroughly typical of wall-paper poisoning; and on the removal of the arsenical papers the distressing symptoms from which these gentlemen suffered entirely vanished.*

* See Dr. Johnson 'On Arsenical Wall-papers,' *SANITARY RECORD*, July 4, 1874.

For various reasons, then, the subject chosen for consideration to-night is one of the greatest possible importance, so much so that, did time permit, I should prefer to treat of it in its wider aspect—its bearing on the public health—rather than from an apparently special point of view. I will, therefore, as briefly as possible, extract from my note-book a few selected cases of arsenical wall-paper conjunctivitis which have come under my notice, and then proceed to the consideration of wall-paper poisoning generally; and, if time permits, inquire in what particulars the symptoms of wall-paper poisoning differ from those observed when arsenic is administered as a remedy.

Inflammation of the Eye, Conjunctivitis.—It will save the time of the Society if I first enumerate the symptoms of arsenical wall-paper conjunctivitis. The symptoms, for convenience sake, may be divided into constitutional and local. The constitutional symptoms are, a certain amount of symptomatic fever; the pulse is accelerated, often fuller. The tongue is white and furred, the mouth dry, and thirst great; the throat is sore; there is nausea or actual sickness; the digestion is deranged, the appetite impaired; the bowels irritable, so much so at times; that the poison is eliminated by a smart attack of diarrhœa.

The local symptoms are of a severe catarrhal character—as running of the eyes and nose; turgidity of the superficial vessels, chiefly of the conjunctiva; on closer inspection of the sclerotic also; as a faint zonular zone is seen, and which explains the orbital pain at night. A feeling as if some mechanical irritant were lodged between the eyelids and the eyeball, from which circumstance the cornea frequently suffers, as there is a constant desire to remove the supposed body or grit from the eye; a vesicle appears at the lower margin of the cornea, and pustular eruptions about the meibomian follicles; the discharge becomes muco-purulent, and the symptoms

pass to the chronic stage, ciliary blepharitis, the cilia fall out, nebulous opacities of the cornea appear, and the case is of an unusually obstinate character. The dimness of sight complained of depends entirely upon the viscosity of the discharge, and the haziness of the cornea thereby produced, than to any actual loss of visual perception; the other symptoms partake of a more general or constitutional character, as tension and swelling of the lids, an erythematous blush over the cheeks, irritation of the schneiderian membrane, severe fits of sneezing, and bleeding of the nose. The disease is pretty much the same whether it occurs in the child or the adult, and does not yield to ordinary remedies; stimulating local applications aggravate it; whilst warm, soothing, sedative applications give considerable relief, and change of air acts as a charm. The extremely unyielding nature of the symptoms characterises it from the conjunctivitis of arsenic given medicinally. As briefly as possible I will give a general outline of a few cases.

Case 1. Acute Arsenical Conjunctivitis.—My attention was first attracted some twelve or fourteen years ago to arsenical poisoning in the case of a friend, Mr. S., a gentleman given to natural history pursuits, who consulted me for an attack of acute conjunctivitis. It appeared that having purchased a collection of shells at a sale, he had been devoting himself for several days to the task of removing them from their old mountings, for the purpose of rearranging them. His work was, however, interrupted by what he supposed was only an ordinary cold in the head; but the pain and irritation of the eyes, together with an excessive mucous discharge from the eyes and nose, and an erysipelatous blush over the face, greatly alarmed him, and I was sent for. On becoming acquainted with the nature of his occupation, I at once gathered up a good deal of the dust, and examined it under the microscope; and finding a large amount of some crystalline particles

amongst it, I forthwith had a chemical analysis made, and it was discovered to be very largely mixed with arsenic. After change of air, the conjunctivitis slowly yielded to treatment.

Case 2. Ciliary Blepharitis and Nebula.—Mrs. Mary Drysdale and a daughter of ten years of age suffered from repeated attacks of acute conjunctivitis, for which she had been upwards of six months under treatment. When they came under my care the disease had already assumed the chronic form of ciliary blepharitis; the blar eyes of the child were very unsightly, and nebulæ of some size occupied both corneæ. From the history furnished, I came to the conclusion that they were the victims of arsenical wall-paper poisoning; and on making a careful examination of the wall papers they were pronounced highly arsenical.

Case 3. Ciliary Blepharitis.—Arthur Phillips, a pale-faced, blar-eyed man, twenty-six years of age, consulted me in February for ciliary blepharitis of some standing. For several days he had been unable to follow his employment from the constant orbital pain, increased vascularity, and severe lachrymation. He had sore-throat, a short dry cough, difficulty of breathing, and palpitation of the heart. ‘He had lost his appetite, and could not sleep; and had been so often under medical treatment that he despaired of ever getting well.’ He was a paper-hanger by trade, and suffered severely when he was engaged hanging green papers. He had heard that these were arsenical. He had frequently suffered from sore fingers. I requested him to bring me a specimen or two of the papers considered most dangerous, and all were found arsenical. Rest and absence from work, together with iron, brought about a great change in this patient.

Case 4. Acute Conjunctivitis and Dimness of Sight.—Mr. and Mrs. W. and an only child were simultaneously attacked by a painful irritation of the eyes, nose, and throat. These symptoms were

for some days believed to be due to an ordinary cold caught during the repapering of the bedrooms; a conjunctivitis with a severe muco-purulent discharge came on, and it was thought prudent to have a consultation. Days passed and no improvement took place; ulcers appeared about the margin of the corneæ, with swelling of the lids, together with unpleasant symptoms of general debility. It was impossible to account for the obstinate character of the disease. At length it occurred that the wall-papers of the bedrooms were suspected, but as these were French greys a doubt was expressed. However, on placing specimens in the hands of Professor Heisch, F.C.S., he reported them all more or less arsenical.

Case 5. Conjunctivitis, Skin Eruptions, &c.—Mr. G. with his family took up their abode in a newly-decorated house in the suburbs of London. Soon afterwards first one member of the family, then another, suffered from constantly-recurring colds, coughs, sore-throats, and skin eruptions. In a week or two these symptoms were succeeded in some by irritation of the eyes and lachrymation; in others, by a smart attack of conjunctivitis, which resisted all kinds of treatment. During a consultation the bright green wall-paper attracted attention, and became the subject of conversation, and it was at length determined to place specimens in Mr. Heisch's hands. Of the fifteen papers submitted to him fourteen of them contained arsenic. The family continued to suffer for some days, and it was found absolutely necessary to remove the whole of the papers before the house became fairly habitable.

Case 6. Fainting, Dimness of Sight, and Paralysis.—Mrs. S., having been engaged the greater part of the day in superintending house cleaning, made an attempt to remove some dirt stains on the wall-paper of the bedroom (a French grey). In the course of the afternoon, and while so engaged, she

became giddy and faint; these feelings were succeeded by dimness of sight, retching, cramp, and an inability to raise her arms and hands. When she was seen she appeared to be quite paralysed, and was perfectly helpless. The suddenness of the attack, and the persistency of some of the very distressing symptoms, led to a more careful inquiry. Lead-poisoning was suggested as the cause; but on passing the hand over the wall-paper of the bedroom a quantity of colouring-matter came off on the fingers. The dust removed, together with a piece of the paper, was sent to Mr. Heisch for examination. He reported that it contained an unusually large quantity of arsenic. The patient was removed for change of air, and made a perfectly good recovery.

In arsenical wall-paper conjunctivitis, the fine crystalline particles of arsenic set up, in the first instance, mechanical irritation; this is followed (as is always the case when a foreign body is allowed to remain between the lids), by redness of the eyeball, increase in the number of the conjunctival vessels, and a mucous discharge. After a time, absorption of the poison takes place, and produces an increased flow of tears and mucus from the eyes and nasal passages; the thin, watery, mucous-like flow, however, neither diminishes nor becomes very much thicker. The disease is not contagious, and this distinguishes it from catarrhal conjunctivitis, which is always characterised by a thick mucopurulent discharge and sago-like grains of a very contagious character. The general and constitutional disturbance that accompanies the disease points to the cumulative character of the poison, whilst it tends to embarrass the diagnosis, or mislead the practitioner as to the prognosis.

Now, with regard to the wider question of wall-paper poisoning, first traced to flock papers garlanded with posies of the brightest hues, and which (like the famous Upas tree of Java) are of so

poisonous a nature that they cannot be approached without incurring certain disease or premature death. More than a quarter of a century has passed away since Professor Alfred Taylor put the public on its guard against the dangerous character of these papers, and since then a very large amount of confirmatory evidence on the poisonous effects of the absorption of arsenical dust from wall-papers has appeared in many of the medical journals. Dr. Guy, in a valuable report to the Privy Council, 1862, mentions that in a manufactory where a hundred young women were employed in artificial leaf making, all suffered from the effects of arsenical poisoning. Scarcely one was free from some skin affection; either the fingers or flexure of the arms and axilla were in a state of ulceration. Two-thirds complained of dimness of sight; all from symptoms of chronic poisoning, as excessive thirst, nausea, loss of appetite, sickness, pains in the stomach, palpitation of the heart, shortness of breath, fever, headache, drowsiness, tremblings, nervous twitchings, and convulsions. One among the number died after eighteen months of intense suffering from convulsions, the fits occurring every five minutes, during a space of seventeen hours and a-half.

It is well known that workmen employed in the manufacture of paper-hangings continually labour under skin diseases, papular eruptions about the arms and hands, as well as eye affections. In the preparation of the pigment for painting, it is necessary to mix up the hot size with the colour; that this may be the more perfectly accomplished they stir in the colour with their hands, and frequently eruptions appear in the course of a day or two, which run on to ulceration. Dr. Vernois says the ulcers on the hands vary in size, from a split pea to a threepenny-piece, and they look as if they were punched out in the skin. The fingers are inflamed, and the nails drop off; the pulse is quickened, the eyes are constantly red and irritable, and the epi-

gastrium is tender. On abandoning their employment these symptoms gradually pass away.* Dress-makers suffer from the absorption of the dust separated from the tarlatanes (muslin) used for making ball dresses. Dr. Taylor informs us that two young women who were employed upon tarlatane muslin dresses complained of dimness of sight, irritation of the eyes and throat, difficulty of breathing, thirst, a profuse flow of saliva, cramps of the hands and legs, and other symptoms of poisoning, which lasted in one eight days, and in the other fourteen days after the dresses were finished. The chemist to whom a portion of the material was sent for analysis suffered most severely from having handled it too freely. Thirteen per cent. by weight of the tarlatane consisted of arsenic.† Professor Hoffman examined a great number of muslins, and discovered the colouring matter—Schweinfurt's arsenical green—so loosely laid on the surface with starch, that it separated at the rate of 20 or 30 grains per hour in a ball-room. It requires twenty yards of tarlatane to make a modern dress, and Professor Hoffman estimated that each dress contains about 900 grains of arsenic. 'Imagine,' writes Dr. Owen Rees, 'what the atmosphere of a ball room must be when these muslin fabrics are largely worn, and when the agitation of the skirts consequent on dancing must be constantly discharging arsenical poison.'

General Symptoms of Wall-Paper Poisoning.—The general symptoms observed in cases of wall-paper poisoning are considerably modified by constitutional susceptibilities or idiosyncracies. The earliest indication of the absorption of the poison, and that most frequently noticed, is an excessive irritation of the whole mucous tract, and which is nearly always attributed to a catarrhal attack. If improvement

* 'Principles of Forensic Medicine.' By W. A. Guy, M.B., F.R.S., &c. Third Edition.

† 'Poisons in Relation to Medical Jurisprudence and Medicine.' By Alfred Taylor, M.D., F.R.S., etc. Third Edition. Page 247. 1878.

takes place it is more of a temporary than permanent character ; but usually, as the nasal irritation subsides, a feeling of faintness, sickness, constant headache, and great prostration occurs. The person so attacked endeavours to believe that he is not so very ill, although he may be obliged to leave business and lay up. In other persons the first symptoms of the poison are dyspepsia, stomach derangement, or bilious attack. If sleeping in a room newly papered, the sufferer will awake in the morning unrefreshed, complaining of a sick headache, sore-throat, and smarting eyes. In many instances it has been noticed that after breathing the arsenical dust a peculiarly aggravated form of hay fever or spasmodic asthma, or even bronchitis, is experienced ; whilst in others fainting fits, vomiting, irritative fever, dysentery, nervous prostration, paralysis, skin eruptions, psoriasis, conjunctivitis, dimness of sight, etc., succeed each other in regular sequence.

The following symptoms may be enumerated as having been from time to time observed in connection with wall-paper poisoning :—Violent fits of sneezing, lachrymation, sore-throat, difficulty of breathing, spasmodic asthma, bronchitis, faintings, constant headache, nausea, sickness, great thirst, eruptions and ulcerations over the skin, conjunctivitis, dimness of sight, nervous depression, general debility or great prostration, cramps, colic, palsy, paralysis, and coma, followed by death. Some of the earlier symptoms are either modified or delayed by the mode in which breathing is performed, that is, whether the person breathe wholly through the nasal passages, and with the mouth quite closed, or through the open mouth ; also by the quantity of dust moving through a given space, as, for instance, in a chromo-lithographic printing-office. The men employed at the work, when using green pigments, complain of symptoms of poisoning in from fifteen to twenty minutes after having been at work.

Thus it will be seen that the symptoms of con-

conjunctivitis are only a portion of those belonging to the several forms of disease of a very serious character due to arsenical dust. Indeed, up to this time conjunctivitis would almost seem to have occurred less frequently than it does when arsenic is administered as a remedy; for on turning to the published reports of cases in the *British Medical* and other journals, I find eye affections only quite incidentally alluded to. In the latest publication on the subject, Mr. Henry Carr's interesting *brochure* on 'Our Domestic Poisons,'* they are referred to only twice. Dr. Sedgwick mentions 'irritation of the eyes' as amongst many other distressing symptoms experienced by himself of chronic arsenical wall-paper poisoning. I am not surprised at this, nor of the difficulty said to be experienced in tracing out the connection between a homœopathic dose of dust and a long train of muscular and nervous diseases. In connection with wall-paper poisoning, many remarkable anomalies occur which are of a perplexing character, not at all to be explained by what we know of the action of arsenic given as a remedy, nor by the peculiar form in which it is taken into the system.

A somewhat instructive example of extreme susceptibility to the poisonous materials given off by an arsenical paper is afforded in Professor Osborne Reynolds's, F.R.S., case, and which is one of considerable interest. It is as follows:—'I have lived in my present house since 1868, spending a greater part of my time in my study, a small room about 14 feet square. I had always been remarkably free from headache or any sickness. During my absence in July 1876, my study was re-papered with a light blueish-green unglazed paper. In August I returned extremely well, and having work to do I spent the next fortnight almost entirely in my study. I had not been at home more than a day before I began

* W. Ridgway, Piccadilly. 1879.

to feel poorly. A set headache and a faint sick feeling were the earliest indications of illness, and towards the end of a fortnight a sore-throat came on. I then left home, and immediately recovered. In October I returned, and not having the least suspicion that my former illness had been due to the room, I inhabited it as before. The same headache came on again, and as time went on I became worse. Twice I fainted, and I seemed to be always on the point of doing so. I could not account for what was amiss with me, and I assumed it to be over-work. This view was confirmed as I worked in my study, and always seemed worse after a long spell, and noticeably better again after spending the evening with a friend or at a dinner-party. About Christmas I again left home, being very poorly, and after a fortnight's change I returned much better. I then spent two days continuously in my study, and about 12 P.M. on the second day I fainted. After a conversation with Professor Roscoe, I for the first time suspected the wall-paper, and I removed into another room, and felt no more of the headache or sickness. Dr. Roscoe removed some of the paper and dust from the study, and found arsenic in both. By way of a test, after having avoided the room for some weeks, I returned to it for a few days, and experienced all my former symptoms. The paper was not one of the worst, but there was a good deal of arsenic in its composition ; thereupon I had it removed, and avoided the room for nearly a year, since which I have again occupied it as before, and have experienced my usual health.' In Professor Reynolds' case the symptoms appeared in a mild and misleading guise, whilst in other instances the attack has assumed a dangerous and violent aspect from the outset. A case of the kind was published in the *Medical Times and Gazette*, and it appears by the report that the medical attendant was for a time deceived, and believed his patient to be labouring under Asiatic cholera. The first symp-

toms—diarrhœa and intense thirst—quickly passed into those of a graver nature, as vomiting, cramps, sweating, extreme prostration and collapse. As cholera was not then epidemic in the locality, a more careful inquiry was subsequently made into the origin of the attack, when it appeared that the patient had on the day before been busily engaged in stripping off an old wall-paper from a room. The surface of the paper had been, as is usual, previously well moistened, and it came off quite easily. This paper was of a purplish colour, but beneath it was another of a bright green colour, which had been there for several years. In his desire to complete the work he commenced tearing this down, and in so doing raised a considerable cloud of dust. This so much affected his eyes, nose, and throat that he was compelled to desist, and before the lapse of many minutes diarrhœa and the more alarming symptoms of cholera set in. The dust was collected, and, together with portions of the paper, subjected to an analysis, and found to be largely impregnated with arsenic.

Many lives, I find, have been sacrificed to the absorption of arsenical wall-paper poison. In a family consisting of six persons—the father, mother, and four children—the latter were poisoned within a short period of each other. Three of the children had died from what was supposed to be diphtheria, when Dr. Orton, of Stepney, was called in to the fourth child of about ten years of age, who was then in the last stage of illness from what was believed to be the same form of disease. Not many hours elapsed before this gentleman's attention was attracted to a bright green wall-paper on the bedroom walls in which the child lay. He passed his hand over it, and found that a quantity of the colour came off, which he at once suspected to be Scheele's green. On submitting it to the late Dr. Letheby, his suspicions were confirmed, but too late to save the child's life. On inquiry it appeared that the rooms

had been re-papered about Christmas, and very soon afterwards parents and children complained of great irritation of the eyes and nose, of headache, thirst, sore-throat, and pains over the abdomen. The inflammation of the throat increased, and ended in sloughing of the fauces, and from which cause the four children actually died within three or four months from the time the first symptoms of ill-health were noticed.

On the 6th inst., a child of six months old died from the effects of sucking a small piece of green wall-paper. It appeared from what transpired at the inquest, that the mother of the child, Eleanor Smith, left it sitting on a chair at the table playing with a piece of green wall-paper, and on going into the room a few minutes afterwards she found him sucking the colour off. She took the paper out of the child's hands, and threw it away, and wiped the colour from his mouth. When her husband came home, he noticed that the child looked ill, and a dose of castor oil was administered with effect. The child gradually grew worse, and died the next day. On examination after death, a quantity of lead and arsenic were found in the stomach, enough to cause death; and on examining the wall-paper the same poisonous pigments were discovered.* Such cases I hope we may venture to place amongst exceptional instances of wall-paper poisoning. The more constantly recurring kind of cases are the following, which have been most obligingly placed in my hands for publication by Mr. Edmund Spitta, of Clapham, and all presenting some point of interest in connection with wall-paper poisoning.

Case 1. Relapsing Bronchitis.—B. A., a little girl who had bronchitis of the small and medium-sized bronchi, became convalescent about the usual time, but this was attended with extraordinary relapses of

* A piece of the same wall-paper placed in my hands for examination yielded a quantity of arsenious acid.

such a severe nature that I was sent for during the night to see the patient. The relapses always came on after her little playmates had been running about the room and jumping on the bed. At last I became suspicious of the paper, and found it loaded with arsenic. I collected also the dust on the top of the wardrobe, on the top of the bed and on the floor, and found all contained arsenic. After removal to another room the child rapidly recovered.

Case 2. Chronic Bronchitis.—D. E., a gentleman who had also had bronchitis, and who like the child became much worse when his children jumped on his bed, or ran about the room, and thus setting the dust in motion. The wall-paper was found loaded with arsenic. He also recovered on his removal to another room.

Case 3. General Debility and Fainting Fits.—F. E., a lady of weakly health and constitution, extending over several years. I was sent for on account of her increased prostration. She was passing a considerable amount of urea and some sugar, which yielded to treatment. Not so, however, the prostration, as it steadily grew worse. Alarming symptoms now presented themselves, the patient fainting as many as ten times daily, and not recovering for upwards of half-an-hour from each attack. Sweatings, vomitings, and dryness of the mouth, together with intense prostration, almost closed her career, when I thought of the wall-paper, and found it loaded with arsenic. I immediately removed the patient, and sent her away for change of air, and she so much improved that I may say she is now well. A curious incident occurred in connection with this case. The children, owing to the upset in the house, were placed in the old room my patient had formerly occupied, and they were almost immediately seized with violent headache, vomiting, and other symptoms of poisoning; these subsided on their removal.

Case 4. Cramps and Depression.—H. G., a lady, suffered from extreme depression and pains about

the abdomen of a most obstinate character. Having been placed on my guard by the effects produced by these poisonous wall-papers in my previous cases, I at once set to work and had the wall-paper tested, and found an explanation of my patient's symptoms in the old enemy, and the precautions taken at once had the effect of restoring her to health.

Before I quit the subject, says Mr. Spitta, allow me to point out two important facts observed during my attendance upon these patients. 1. That the symptoms, although of a very alarming character, were always accompanied by a fairly good pulse; and 2. The attacks were usually of a spasmodic nature, by which I mean were not persistent in their duration, and thus helping the diagnosis, which is sometimes, as in Case 3, surrounded with all manner of perplexities; 3. That during the intervals between the attacks the patients seemed, considering their severity, singularly well, and thus I think indicating that the poison must have a cumulative effect, which varies in intensity, duration, and exhibition in the different constitutions and subjects attacked.

It is generally believed that green papers only are coloured with arsenical pigments. This is a lamentable error into which many persons have fallen, and which cannot be too speedily and entirely removed. A variety of other papers besides greens are quite as dangerous; blues, mauves, reds, browns, and even white papers. Retailers of wall-papers, and even manufacturers of papers, may be and probably are ignorant of this; for cobalt blue, a colour much used in paper-printing, contains at least ten per cent. of arsenic in its composition. Aniline dyes, Professor Roscoe says, are seldom free from it. The magentas are no better, and consequently arsenic is found in red papers; for magenta reds are largely employed in wall-paper manufactories. I have on the table numerous specimens of red arsenical papers. A member of my own family, who occupied a bedroom decorated with a handsome red

and fawn Japanese paper, suffered for months from symptoms of arsenical poisoning, and which were in no wise ameliorated before the removal of the paper. The paper when purchased was warranted free from arsenic.

The colouring matter is very unevenly distributed over the surface of the printed wall-papers, and in a short space of time after a paper has been hung and become thoroughly dry, it begins to crack, and either peels off or is separated by very slight friction.

A piece of a perfectly dry paper placed under a power of 50 diameters exhibits a rough uneven surface of coarse powder, amongst which, in green papers, numerous minute crystals are interspersed. But it appears that arsenical pigments are not actually necessary; for colours quite as brilliant and equally pleasing to the eye can be produced without a particle of arsenic. I have placed on the table a sample book of Messrs. Cook's wall-papers, all of which are perfectly free from arsenic. Indeed, it is asserted by chemists that there is no need whatever to use a colour which necessitates the introduction of arsenic in the production of wall-papers.

The Pigments Employed.—Of the various arsenical pigments employed by manufacturers in wall-paper printing, the trioxide of arsenic is certainly the most dangerous as well as the most extensively used. This is the principal ingredient in Scheele's green, a fine colour composed of one part of arsenic trioxide and two of cupric oxide. Schweinfurt green, Vienna, Brunswick, or emerald green, is an acetoarsenate of copper. This colour, used both unmixed and mixed with zinc oxide in various proportions, imparts a variety of delicate tints of green. Another pigment is composed of chromic and ferric arseniate, whilst arsenious acid is employed on a large scale in the preparation of aniline dyes, and of red anilines in particular. Sodium arsenite is almost exclusively used in calico printing, and alumina arseniate for fixing. In every case, whether of paper

or calico printing, the arsenical pigment is obliged to be mixed with size or some organic matter, otherwise it would not adhere to the surface of the paper or fibres of calico and muslin ; but withal as it dries it shrinks and crumbles away by handling, heat, and the friction of a current of air.

It is by no means an unimportant fact that most arsenical pigments are volatile. At a tolerably moderate heat arsenious acid passes from the solid to the gaseous state, and may be detected by its alliaceous odour or by its faint yellow colour. Although the colour and odour will not on all occasions attract the notice of every observer, it is, nevertheless, a fact that an appreciable quantity of gaseous and solid particles of arsenic will be separated by the heated air of an ordinary sitting-room in summer time. It may be thought that if the quantity is so small as to be inappreciable, it can scarcely give rise to symptoms of poisoning. But this is by far too hasty a conclusion to draw. Numerous careful analyses convinced Professor Taylor that each square foot of an arsenical paper could be made to yield from 14 to 17 grains of arsenic, and that certain papers printed with a peculiar pigment will yield as much as 59 per cent. of arsenious acid. It is thus that grim death is made to surround the domestic hearth, and hover over the easy chair.

The dangers to health from arsenical wall-papers are by no means of an imaginary kind ; they are, in every sense, real and urgent. The more immediate or special dangers may be described as twofold—first, there is the danger to be apprehended from the minute crystals of arsenious acid which separate as the paper dries, float about, and are inhaled and absorbed, and produce irritation of the mucous membranes, etc ; secondly, there is the danger from gaseous products—arseniuretted hydrogen, evolved by the decomposition of the organic matter, mixed with the arsenic, and which is also

inhaled and absorbed into the system by the air passages, vascular surface of the lungs, as well as the whole cutaneous surface. The dust, as I have said, is detached from the surface of the paper by the attrition of the air and heat, whilst the gaseous element is an almost invariable outcome of the combination of an arsenical pigment with some organic substance, as size, glue, starch, gelatine, etc., used in the preparation of the colouring matters. Any appreciable amount of moisture, whether of the air or remaining in the paste usually employed for papering, will materially assist the process of decomposition or chemical change. Notwithstanding, then, that arsenic exerts an antiseptic action over animal substances, it does not arrest the formation and growth of moulds or fungi. On the contrary, these lowly organised bodies flourish in the presence of strong arsenical compounds, which, during the process of growth, give off arseniuretted hydrogen gas.* Drs. Humberg and Fleck (two eminent German chemists) were for some time sceptical on this point, but after making a series of experiments they collected the gas, and this placed the fact beyond a doubt. It is highly probable, therefore, that a considerable quantity of gas is evolved by arsenical wall-papers.

* M. Pasteur instituted quite lately a series of experiments to explain a certain set of facts in connection with fermentation, and he became convinced that a group of living organisms should be divided into two classes, which he designated *aërobies* and *anærobies*. The first require for their growth the presence of oxygen; the second can dispense with it entirely, provided they are brought into contact with a fermentable substance, from which they can obtain the amount of oxygen they require. The latter are the ferments. Septic vibiones are killed by the presence of free oxygen, and these come under the designation of *anærobies*. Under certain conditions, however, even these act as ferments. Another group forms an exception. Moulds or fungi are capable of living in either state, and on this account are of considerable physiological interest. They possess the power of separating oxygen from every substance, whether of a poisonous or innocuous nature, and to enable them to do this they do not require even the influence of light. From these facts we seem to catch a glimpse of the peculiar action of moulds in combination with arsenical wall-papers.

inch Arseniuretted hydrogen contains one grain of arsenic in each cubic ~~foot~~ of gas. Several cases of poisoning have been traced to the inhalation of this gas. The late Dr. Elliotson attended the several members of a family, all of whom were poisoned by breathing the gas evolved by the decomposition of organic matter and arsenite of copper. The principal symptoms observed during the illness of the family were nausea, vomiting, great thirst, watering of the eyes and nose, foul tongue, rapid pulse, varying from 120 to 160, and after apparent recovery long-continued pains of the limbs. The poison was eliminated by the kidneys, in which organs it gave rise to great irritation. Other similar instances have been published by Christison and Vogel, who also mention kidney irritation and hæmaturia (Guy).

We have, then, I venture to think, arrived at two facts in connection with the subject of arsenical wall-paper poisoning—first, that dust is separated in sufficient quantities to give rise to a peculiar train of symptoms; and, secondly, that under certain conditions arseniuretted hydrogen is evolved, and which it is believed by chemists materially adds to the virulency of the poisonous dust.

I have been compelled to restrict my remarks tonight to wall-paper poisoning. The subject is, however, of a widespread nature, and could be extended to almost any length, for it is well known that arsenical pigments are most extensively employed in the preparation of wall-paints, distemper colours, in calico printing, in dyeing, and in a great variety of textile manufactures. If, then, you are convinced with me that arsenical poisoning is a danger to the public of even a worse form than the adulteration of food and drinks, you will also agree that it should be placed under some kind of restriction. It is most important that the air we breathe should not be saturated with poison by the carelessness or cupidity of manufacturers of papers or pigments. Manufactures

in which poisons are employed should certainly come under the eye of the officer of health ; in the interest and for the sake of those who cannot protect themselves, it is imperatively necessary that some prohibitory steps should be taken to prevent the sale of arsenical wall-papers.

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LONDON: PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
AND PARLIAMENT STREET