ABSTRACTS

(TOXICOLOGY


Dinitrobenzol is used in the preparation of colours and explosives, and may cause acute toxic symptoms. Cases of chronic poisoning are less common. In the case here described the patient worked in a factory and for 15 years had been making dinitrochlorobenzene. Into a boiler of 4 cubic metres capacity was put a cubic metre of water, a metric ton of pig iron, and hydrochloric acid. When effervescence occurred dinitrobenzol was added, and the boiler was then closed. The rise in pressure drove the mixture through an exhaust pipe into a filter, and then into the container, which received the dinitrochlorobenzene. Two exhaust tubes were placed near the boiler to trap any fumes, but, from a mechanical defect, the workman was exposed at intervals to powder and fumes of dinitrochlorobenzene. During the year before the patient came under treatment he noticed progressive asthenia, frontal headaches at work and later after work, some confusion, paraesthesia in the limbs, pruritus, insomnia, and loss of appetite. He also had some disturbance of vision. When first seen, there was a yellowish tint of the skin and sclerotics and a bluish coloration of the hands. On two occasions he spent a short time in hospital, each time being diagnosed as suffering from infective hepatitis. He then came under the authors' care. He was very weak, had disturbance of vision, paraesthesia in the limbs, and frequent fainting fits. His general condition was poor and there was some cyanosis of the extremities and of the lips, and gingival bleeding. No special physical signs were discovered. Blood examination revealed a secondary anaemia; occult blood was found in the stools. After some weeks in hospital he gradually got better; the headaches and paraesthesia lessened and the digestion improved. Vision did not improve much, and there were signs of optic neuritis. The cyanosis noted was undoubtedly due to methemoglobinemia, and there is no doubt that wrong diagnoses had been made on several occasions previously.

The icteric tint of the conjunctive can be associated with the positive Takata-Ara reaction. Though careful radiological examination was made, no sign of a gastrointestinal lesion was noted, and it seems likely that some form of irritation, occurring in the gut as well as in the gums. The nervous and physical changes of confusional type and the changes in the optic nerve suggest direct poisoning of the central nervous system.

The authors stress the importance of protective clothing, of careful washing when work is finished, and of the particularly harmful action of alcohol, which favours methemoglobin formation, according to Issakutz and Lipschitz. As absorption may also be through the respiratory tract, ventilation is important, as well as care in the design of the plant to avoid leakage of fumes.

G. C. Pether.


Six men were engaged in the production of atebrin tablets. They worked in an atmosphere which contained clouds of very fine aterbin dust for short periods. They had no dermatitis or other discomfort. Although protective clothing, goggles, and masks were worn, the dust penetrated these barriers and stained the skin of the hands, head, neck, and conjunctiva. After working for some weeks they noticed that at night a point source of light had a blue halo around it. One yard away the halo began 2 in. from the source and was about 3 in. wide. It was dark blue at the inner edge and pale blue at the outer. At a distance of 6 yd. faint yellow, green, and reddish-brown bands appeared outside the blue ring. All the men had normal visual acuity.

Slit-lamp examination showed yellow discolouration of the conjunctiva in the interpalpebral space, and a slight dulling and yellowing of the cornea which was barely visible macroscopically. Under magnification there appeared to be an actual deposit of minute dark-brown dots at the exposed margins of the limbus. The surface of the cornea was peppered with fine dust-like particles, which appeared dark yellowish-brown by direct illumination and opaque by transmitted light. The size of the particles was estimated as between 5 and 10 μ in diameter—that is, about the size of the nucleus of a corneal epithelial cell. The corneal surface was smooth and bright, and the change was present only in the surface layer of cells. In the lower part of each cornea there was a series of wavy yellow lines composed of closely aggregated dots similar to those peppered over the cornea but closer together and bright yellow. One patient noticed the haloes after being employed for less than a year, and they disappeared within 2 months of transfer to a different job. Later he returned to work with aterbin, and the phenomenon reappeared in 6 months although not reaching its previous intensity. There was no evidence of glaucoma in any patient, and it seems reasonable to attribute the condition to a diffraction effect.

Two volunteers, who had both taken 100 mg. of aterbin by mouth for 7 months, showed a pale-yellow staining of the skin generally, but their eyes were normal and they had never seen blue haloes. Atebrin dust
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W. J. B. Riddell.


The method was developed for use in an investigation of mercury poisoning in a pharmaceutical laboratory and a chemical factory. Colorimetric estimation with dithizone (diphenylthiocarbozone) is employed, the interfering effect of copper being eliminated by the use of extremely dilute dithizone in chloroform in the presence of 0.1 N hydrochloric acid. Organic matter is removed as ammonia-sulphuric acid oxidation and the mercury separated as sulphide, using arsine as coprecipitant. The mixed sulphides are dissolved in aqua regia, and the nitric acid removed by hydroxylamine. Results for the 24-hour excretion of the factory workers and of normal persons are given.

H. M. Buckell.


A brief description of the various methods of estimating mercury vapour in the air is given, none of which is accurate for mercury salts. Mercury vapour was trapped by alkaline hypobromite in three adsorption bubblers in series; the slip from the first bubbler was approximately 10%. Two bubblers were used in full. Mercury salts in the atmosphere were sampled, using a filter paper backed by a bubbler. The filter papers were treated in a similar manner to the organic matter handled by Milton and Hoskins (Analyst, 1947, 72, 6). The hypobromite solution was acidified with hydrochloric acid, bromine removed with hydroxylamine, and the mercury estimated colorimetrically with dithizone in chloroform solution. Results of factory estimations are tabulated.

H. M. Buckell.


The physiological effects of substances which enter the body through the respiratory tract have usually been assessed in terms of the concentration to which the animals are exposed and the time of exposure in minutes. This method does not indicate the biologically active retained fraction of the inhaled substance; therefore the probable range of toxicity for man, in terms of animal experiments, has not been satisfactorily delimited. In the present investigation the lethal dose of phosgene was determined in goats, and also the percentage of inhaled agent retained: 62 normal unanesthetized goats were employed, half of them being exposed to phosgene at a concentration of 1-19 mg. per litre, and the other half to one of 6-88 mg. per litre. The former group were exposed for 4-3 to 36-4 minutes, and the latter for 0-8 to 7-2 minutes. About a third of the animals survived, and it was found that there was no increase in the toxicity of the phosgene with increase of concentration. The median lethal dose on exposure to the lower concentration was 0-86 mg. per kilo of body weight, and for the higher concentration 0-84 mg. per kilo. The mean amount of retention for the 62 goats was 63%, while in previous observations on dogs it was found to be 74%. The goats showed marked respiratory inhibition on exposure to the phosgene, occasionally for as long as 60 to 97 seconds. This was longer than the time observed in dogs.

H. M. Vernon.


The median lethal dose and percentage retention of inhaled phosgene were determined in 37 normal unanesthetized rhesus monkeys. The phosgene had a mean concentration of 1-6 mg. per litre, and the animals, being very susceptible, were exposed for only 0-4 to 3-1 minutes. 21 died 15 to 36 hours later, and the retained median lethal dose was found to be 0-2 mg. per kilo, or less than a fourth of that required for goats. The mean retention of inhaled phosgene was 79%. Respiration was to some extent affected, the mean respiratory rate under phosgene being 29 per minute as compared with 38 per minute in unexposed monkeys, while the average tidal air was 6-8 ml. per kilo as compared with 10-1 ml. per kilo. However, earlier investigators (Coon and others) found that low concentrations of phosgene (ranging from 0-45 to 0-8 mg. per litre) did not produce appreciable respiratory inhibition.

[H. M. Vernon.


Acetylene tetrachloride (C2H2Cl4) is used in many industries because of its high solvent power and non-inflammability. It is one of the most toxic of halogenated aliphatic hydrocarbons, and it is, therefore, important to determine accurately the concentration of its vapour present in the atmosphere of industrial plants using the solvent. A concentration of 10 parts per million (0-068 mg. per litre at 25°C) has been found safe for some time regarded as safe for an 8-hour working day. The simple portable apparatus devised for the rapid estimation of low concentrations involved the use of a quartz combustion tube packed with platinum foil. The chlorides formed from the combustion of the vapours were absorbed in alkaline arsenite solution and determined colorimetrically with 0-01 N hydrochloric acid solutions. Laboratory and chamber tests proved that by this method 95% or more of the acetylene tetrachloride was recovered.
The degree of protection afforded by gas masks against the tetrachloride was determined by means of an elaborate apparatus. The maximum concentration of tetrachloride found in the air of the plant was 0.176 mg. per litre, but the gas canisters of the masks were tested at a concentration of 6 mg. per litre. Four different types of U.S. Army canisters were used. They were tested 250 to 640 ml. of impregnated charcoal, and were found to offer complete protection for at least 3 hours. A commercial type of canister, containing 1,500 ml. of ordinary activated charcoal, had a life of over 20 hours.

H. M. Vernon.


In Lincolnshire lameness and cachexia occurred in cattle as a result of calcination of ironstone in the neighbourhood. The ironstone contained 1,200 parts per million (p.p.m.) of fluorine, which was reduced to about 300 p.p.m. on calcining with coal slack. The coal contained over 100 p.p.m. of fluorine. The smoke drifted on to vegetation and grass in the immediate vicinity, which showed values up to 2,200 p.p.m., and close to an adjacent farmhouse values of 68 to 487 p.p.m. Affected cattle excreted urine containing 26 to 69 p.p.m., and the fluorine content of their bones was up to 15,000 p.p.m. Water in the area contained only 0.5 p.p.m. People living in the farmhouse showed a moderate degree of dental fluorosis and excreted urine containing 1.6 and 4.2 p.p.m. at a specific gravity of 1.015. These facts may be explained by surface contamination of food in the larder. The glass in the windows of the house facing the ironstone calcination process was etched. One inhabitant had suffered from stomach pains. On the farm wheat and barley embryos did not mature, and the farmer was paid compensation based on the difference between the expected and the actual yield of grain. In 6 years 7 horses and 11 cows had died, young cattle and sheep were under weight, the sheep were lame and had nasal discharge, and much poultry had been lost. At the height of calcining the density of fumes made driving on neighbouring roads difficult.

K. M. A. Perry.


Diphenyl and its amino- and nitro-derivatives are constituents of various plastics and resins. As they are used commercially, their inhalation and skin contact cannot be avoided completely. Experiments were made on animals to determine tentative standards for safe industrial environments. The compounds, dissolved or suspended in olive oil, were administered by stomach tube to rabbits and by blunt hypodermic needle to rats. In the inhalation experiments a 160-litre chamber was employed, and the animals were exposed to the dust or vapour for 7 hours a day on 5 days a week.

The lethal doses per kilo of body weight (for 50% fatalities), when administered orally to rabbits, were 2.4 g. of diphenyl, 2.0 g. of p-nitrodiphenyl, 1.6 g. of o-nitrodiphenyl, 1.0 g. of o-aminodiphenyl, 0.7 g. of p-aminodiphenyl, and 0.2 g. of dihydroxyoctachlorodiphenyl, while the corresponding doses for rats were usually larger. These doses caused an increase of respiratory rate, lacrimation, muscular weakness, unsteadiness, and death in coma after 2 hours to 18 days. With one exception the repeated application of the compounds (in olive oil) to the abdominal skin of rabbits did not induce signs of local irritation, though sufficient absorption of the compounds took place to induce varying degrees of systemic poisoning. The exception was the dihydroxy compound above mentioned, and this induced marked signs of local irritation and systemic toxicity. Experiments of 6 rats for 46 periods to diphenyl dust at a concentration of 0.04 mg. per litre of air induced irritation of the nasal mucosa and 1 fatality, while one-fifth of this concentration caused no effects in rats but a few fatalities in mice. The absorption of all the compounds mentioned induced toxic myocardiitis, hepatosis, nephrosis, and pneumonia, but the gastro-intestinal tract showed little if any evidence of local injury. Oral administration of sublethal doses of diphenyl or o-nitrodiphenyl to rabbits on 4 to 21 occasions caused no significant changes in the number of erythrocytes or leucocytes or in the concentration of haemoglobin, but p-nitro- or p-amino-diphenyl induced anaemia together with haematuria or haemoglobinuria. The ortho- and para-isomers of nitro- and amino-diphenyl are excited and hexuronic acid and organic sulphates.

It was considered that, for prolonged human exposure, concentrations of 0.005 mg. diphenyl per litre of air should be regarded as dangerous, while concentrations of 0.003 mg. of o-nitrodiphenyl seem inadvisable.

H. M. Vernon.


Various animals were exposed in chambers of 1,500 litres capacity. Methyl chloride was admitted through a rotometer, where it mixed with the air which was pumped through the chamber at a rate of 400 litres per minute. The animals were usually exposed to the vapour for 6 hours a day on 6 days a week. At a concentration of 4,000 parts per million (p.p.m.) the mean survival time of rats was 4 days, and of rabbits 13 days. At one of 2,000 p.p.m. it was 27 days for rats and 20 days for rabbits; and at one of 1,000 p.p.m. it was 59 days for rabbits while two-thirds of the rats survived. Young animals usually withstood the methyl chloride better than adults; thus, at 1,000 p.p.m. young mice survived 46 days and older mice only 11. At the low concentration of 500 p.p.m. dogs and monkeys showed a high degree of susceptibility. Of the 4 dogs exposed, 3 died after 2 to 4 weeks’ exposure, while the 2 monkeys exposed died after 16 and 17 weeks. If it is assumed that the susceptibility of human beings is comparable to that of dogs and monkeys, it follows that daily exposures to concentrations of 500 p.p.m. are extremely dangerous even for a period of 2 weeks or less. The maximum allowable concentration for exposures of relatively long duration must be well below 500 p.p.m.

H. M. Vernon.


Ketene (CH₂ : CO) is used as an acetyling agent in the laboratory and in industrial plants. Animals were exposed in a 40-litre chamber, through which air was drawn at a rate of 50 to 100 litres per minute. Ten-minute exposures were made, and the following samples of the results obtained may be quoted. At a concentration of 0.12 mg. per litre 29 out of 40 mice died in 115 to 240 minutes; at one of 0.43 mg. per litre all the 4 rats...
exposed died in 150 minutes or less: at a concentration of 0.63 mg. per litre 5 out of 8 guinea-pigs died in 8 hours to 3 days. The few tests made with ketene dimer (diketene) showed that it is much less toxic than ketene. For instance, only 1 mouse out of 20 died at a concentration of 3 mg. per litre. After death the animals appeared normal, but pressure on the thorax caused edema fluid to flow profusely from nose and mouth. The lungs were hyperemic and mottled by lobules filled with edema fluid. It is concluded that ketene is as toxic as phosphene and is comparable to it in its action.

H. M. Vernon.


Arc welders' methods of working are described. The fumes from the electrode metal and its covering did not contain toxic substances. An inquiry was started on 67 arc welders, most of whom had been working for at least 5 years, and some for 15 or 20 years. No serious intoxications or pathological manifestations were found. Frequently welders suffer from the condition of "flash-eye" (coup d'arc) from exposure to ultra-violet and infra-red radiations, with characteristic symptoms and a delayed and transient kerato-conjunctivitis. Weakness of vision, especially at night, was found in 20%. Digestive disturbances occurred in 37%. Cough is fairly common (37%), and in radiographs of 1 in 10 or 12 workers there is an appearance of nodulation (granité), which is due to iron oxide, since the dust contains 51% of iron oxide and only 1-5% of silicon dioxide. These small nodules at necropsy do not show the typical connective-tissue proliferation of silicosis. There was little evidence of abnormalities in the blood or in the nervous system. The evidence that welding causes sexual dysfunction was slonder, for only 4 to 5% complained of impotence, and this could be attributed to other causes. Intoxication from lead, phosphorus, and arsenic is possible, but only because of contact with these substances and not specifically because of welding. The ocular manifestations alone seem to be directly caused by the occupation. The risks of welding have been over-emphasized. J. N. Agate.


Mental disturbances due to carbon monoxide poisoning assume in most cases the clinical form of Korsakow's syndrome, memory defects, compensatory fantasies, and lowering of the intelligence standard being the main features. The disturbances are often preceded by an interval of apparent normality lasting for from a few hours to several weeks.

In 1923, a man, aged 30, suffered severe carbon monoxide poisoning and remained in coma for 5 days. Two weeks later he was able to return to work, but 3 weeks after this apparent recovery he was admitted to hospital with grave neuromotor and mental symptoms: muscular rigidity, exaggeration of all tendon reflexes, ankle clonus, bilateral Babinski sign, abolition of the superficial abdominal reflexes, and incontinence of the sphincters; mentally there was dullness, apathy, and loss of memory. He remained in hospital for 5 months, by which time the motor signs had subsided and he had recovered the use of his limbs; his intelligence improved, although it was still impaired when he was discharged.

In 1944—21 years later—he was re-admitted to the same hospital. Only slight traces of neuromotor disturbances were found—such as drooping of the left angle of his mouth and some exaggeration of his ankle jerks, particularly of the left one—but there was an unmistakable Korsakow's syndrome, with its classical symptomatology. No evidence of syphilis in blood or cerebrospinal fluid was found. Encephalography showed a uniform enlargement of all the cerebral ventricles. The radiological diagnosis was atrophy of the brain and internal hydrocephalus.

A. Lilker.


To determine the atmospheric concentrations of onion-oil vapour (largely allyl propyl disulphide) and of xylyl mercaptan, the apparatus previously used for the estimation of halogenated hydrocarbons in air was employed. Air at the rate of 1 litre per minute is drawn through a quartz combustion tube containing a platinum catalyst, and heated to about 900°C; then through a gas absorber containing glass beads wetted with a 2% solution of sodium carbonate. The sulphur of the sulphide is converted into sulphur dioxide, which in turn forms sodium sulphate. One-hour samples were taken in the breathing zone of the workers and were analysed by titration with standard barium chloride solution, using tetrahydroxyquinone as an internal indicator for excess barium ion. The titration is made sensitive by the use of ethyl alcohol to decrease the solubility of the barium sulphate formed. The method can be used when the quantity of sulphur in the air sample is 0.1 mg. or more.

H. M. Vernon.


The author studied this symptom in several workers in a soldering workshop. He reports 8 cases occurring in his own practice. He believes that the fever is due to zinc, although it cannot be regarded as a direct acute poisoning from this metal, and it would be more correct to consider it the result of a pathogenetic effect of zinc oxide on the pulmonary epithelium. The proteins of the blood plasma, under the caustic action of zinc, vapours, are apt to form heteroproteins, the passage of which into the blood stream would, perhaps, explain the fever.

L. Roche.


Two reasons for suggesting that carbon bisulphide may enter the body through the unbroken skin are, first, that the substance is soluble in fats and could thus pass through, and secondly that, as the heavy vapour lies near the ground, absorption through the feet and legs is favoured, which would explain the greater frequency of polyneuritis in these cases. The author rejects the first assumption and does not consider that there is adequate proof that any substance absorbed by the skin must necessarily be most harmful to the tissues closest to the area of penetration. The nerves of the legs are the longest in the body. Furthermore, fatigue is most often felt in the legs. Many toxic substances which are not absorbed through the skin tend to attack the nerves of the legs.

Ten men were shut in a closed chamber except for their
faces. Fresh air was breathed from a mask. One arm was encased in cotton-wool soaked in carbon bisulphide, and on the floor of the chamber were placed pieces of cotton-wool soaked in the solution. The expired air was collected in a closed circuit from the mask and tested for carbon bisulphide. Subjects were exposed to the gas for 20 minutes. In none of the ten subjects tested was any of the gas detected in the expired air, and the author concludes that neither liquid nor gaseous carbon bisulphide is absorbed by the unbroken skin. G. C. Pether.


Conditions in the artificial fibre industry, the technical methods employed, and the risks run by the workers, are described. The main risk is carbon bisulphide poisoning due to the "viscous" process. In the artificial fibre industry in France approximately 3,000 persons are exposed to carbon bisulphide poisoning. In 1942 there were 252 cases of poisoning, 69 of them serious. By 1945, there were only 62 cases, all mild. The measures taken to combat the hazard are as follows:

1. Medical. — Careful selection of personnel; regular analysis of the atmosphere, this being especially frequent where high concentrations are found (examination every four or six weeks in exposed places has considerably reduced the number of grave cases of poisoning).

2. Technical. — Individual precautions such as the wearing of a gas-mask (though this hampers the worker); and collective precautions such as purifying the atmosphere in the workshops and psychological education of the workers.


Following the work of Peters, which showed that a diithiol protected against lewisite, a related substance has been found of value in arsenic poisoning. This paper summarizes results of in vitro and in vivo experiments in which 2,3-dimercaptopropyl-ethyl-ether was found effective if given soon enough after exposure to arsenic. Other protective substances were investigated. Arsenic was generated from magnesium arsenide and water, the concentrations being estimated by a modification of the molybdenum-blue method. In vitro experiments with erythrocytes were carried out by adding 0.4 ml. of serum to 1:6 ml. of defibrinated blood. The cells were exposed to 0.2% arsenic at 37-5° C. for 2 hours. Protective substances were added 5 minutes after exposure started. Lysis was determined colorimetrically. Inhibition of tissue respiration was also measured in the Warburg apparatus, in which tissue respiration of control material remained reasonably constant for 3 hours.

The average percentage lysis produced by arsenic for 150 experiments was 33-5%. The variation in response of cells from one donor was small as compared with responses from different donors ; with 2,3-dimercaptopropyl-ethyl-ether, 4-8% lysis; with the product "BAL" effective against lewisite, 17% lysis occurred. Good protection was obtained with ascorbic acid and sodium thiosulphate in high concentrations, though at the level of concentration of the thiols in these experiments they are only 10% as effective. Of the compounds giving good protection against lysis of erythrocytes, only the dithiols gave protection to tissue-slice respiration in vitro; 2,3-dimercaptopropyl-ethyl-ether gave almost complete protection of kidney and brain and some protection of liver. BAL gave good protection of kidney and brain, but accelerated inhibition by arsenic of liver-slice respiration. BAL was found to give a small but inconstant protection to rabbits, dogs, and monkeys exposed to arsenic. In rabbits arsenic had the effect of increasing the toxicity of BAL, and thus of reducing the protective action. The authors point out that in lewisite-poisoning several lethal doses of BAL may be administered to neutralize lethal doses of lewisite.

Other compounds were found to be more potent and were given in intramuscular injections of successively smaller doses. The second was given 4 hours after the first, and the third 24 hours later. Using the more effective compounds, particularly 2,3-dimercaptopropyl-ethyl-ether, almost complete protection was afforded if treatment was started 30 minutes after exposure. Survival was reduced to 90% at 1 hour, 40% at 2, 3, and 4 hours, and 20% at 51/2 hours. 1,6-dimercaptopentane was almost as good if given within 1 hour. If used with BAL a 50% survival was maintained between 2 and 4 hours—higher than was obtained with either separately. The percutaneous route of administration was also used, being preferred to the intravenous route, which had been reported by Cattell as responsible for damage to the central nervous system in cats. No such effects were observed after intramuscular or percutaneous administration. Local application to human skin produces no irritation, and other workers have applied 2,3-dimercaptopropyl-ethyl-ether percutaneously to man in doses of 30 mg. per kilo without ill effect. R. H. D. Short.


"BAL" (British anti-lewisite) injected into rabbits by the subcutaneous, intramuscular, or intravenous route in aqueous or propylene glycol solution is effective in the treatment of acute and subacute mapharsen poisoning. A more stable BAL preparation is obtained by dissolving it in peanut oil with the aid of benzyl benzoate (2 g. for each g. of BAL). This preparation can be sterilized by heat with only slight loss in activity and is suitable for human use. It also has proved effective in the treatment of mapharsen, lewisite, and phenyl arsonic oxide poisoning in rabbits. BAL exerts an antibiotic action through its ability to remove arsenic from its combination with cells, with the excretion of the stable and relatively non-toxic thiarsenite so formed. The rate of urinary arsenic excretion is strikingly increased, in some cases by more than a hundredfold.

G. R. Cameron.


Twelve men were exposed for 6 minutes to very low concentrations of an arsenical smoke (diphencylarsine) and their urinary excretion of arsenic estimated. There was an immediate increase in the urinary arsenic with a gradual fall from an initial average of 6-8 g. per hour to an average of 3 g. per hour 72 hours after exposure. The corresponding value in a group of 6 control subjects was 2 g. per hour. Both groups were given a single intramuscular injection of "BAL" (9-5 mg.)
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per kilo) in the form of a 10% solution in peanut oil and benzyl benzoate. A significant increase in the rate of urinary excretion resulted, reaching a maximum within 2 to 4 hours, and most pronounced in the subjects exposed to the arsenical smoke. Since this effect on excretion did not persist for more than 4 hours, it is concluded that such an interval is the optimum between successive therapeutic injections of BAL.

G. R. Cameron.


The toxic effects of skin application or intramuscular injection of "BAL" to healthy volunteers is discussed. Approximately 0.3 g. BAL applied to the skin in the form of BAL 10% in K-Y jelly or BAL 10% in petrolatum gave no unusual effects in 5 males except for transient local erythema, whealing, and itching at the site of application. Approximately 1-7 g. of BAL applied to large areas of the skin in the form of a 5% concentration in K-Y jelly produced no conclusive phenomena, blood changes, kidney damage, or other forms of systemic poisoning in any of 5 healthy males. With intramuscular injection, toxic manifestations appeared at a dose of 3-6 to 5-5 mg. per kilo body weight, and included nausea, vomiting, headache, burning sensation of lips, mouth, and throat, feeling of constriction and sometimes pain in throat and chest, burning and tingling of extremities, conjunctivitis, lacrimation, rhinorrhea, salivation, sweating of forehead and hands, abdominal pain, and general agitation. Local pain at the site of injection and muscle spasm of the leg were also common. An elevation of the systolic and diastolic blood pressures occurred within half an hour of the injection. When the first two doses were given with an interval of only 2 hours cumulative toxic effects were observed, but 4 doses each of about 5 mg. per kilo at 4-hour intervals produced no severe or lasting damage in the average normal individual.

G. R. Cameron.


Small amounts of "BAL" preparations were rubbed into the forearm of human volunteers on 14 consecutive days. When applied in the form of 5% BAL in grease ointment and 5% BAL in carboxyl ointment and 5% BAL in ethylene glycol, all gave sensitization dermatitis in 16 out of 88 subjects (19% of exposed subjects). Application to damaged skin gave sensitization in 35 of 53 subjects (65%). Sensitization reactions included erythema, edema, and papules, the exposed area being more strongly sensitive than other parts of the body. Repeated intramuscular injection of BAL also produced skin sensitization as demonstrated by positive patch tests in 5 of 18 subjects.

G. R. Cameron.


Seven patients with an intractable localized dermatitis caused by diphenylamine chlorarsine improved within a few days after the injection of "BAL" (1 to 10%) ointment, starting with daily applications of 100 mg. and increasing to 500 mg. Fifteen cases of generalized exfoliative dermatitis following the use of antisyphilitic arsenicals showed symptomatic and objective improvement after intravenous or intramuscular administration of BAL. The duration of the dermatitis in over half the patients so treated was shorter than in a comparable group not treated with BAL. A mild recurrence of the dermatitis was frequent when treatment was not continued for at least a week, but 6 such relapses cleared quickly when therapy was re-instituted. BAL ointment was quite painful when applied to inflamed skin, but intramuscular injections were much less disturbing.

G. R. Cameron.


Further support is given for the contention that "BAL" increases urinary excretion of arsenic. Of 24 courses of BAL to 16 patients with arsenical intoxication and 2 patients receiving arsenical treatment without reaction, 16 were followed by a definite increase in arsenic excretion, 4 by a possible increase, and 4 by no increase. The increase appeared to be more consistent in patients with the arsenical dermatitis than in hepatitis, suggesting a correlation with the greater efficacy of BAL in the treatment of arsenical dermatitis.

G. R. Cameron.


A single instillation of 5% "BAL" solution or ointment within 2 to 5 minutes after exposure to Lewisite droplets or vapour effectively prevents the development of serious ocular lesions in the rabbit. BAL penetrates the cornea rapidly and withdraws toxic arsenical material from the tissues before irreversible damage has developed.

G. R. Cameron.


This is an experimental study of the value of "BAL," BAL glucoside and 1-thiosorbitol in the treatment of acute mercurial poisoning in rabbits and dogs. Rabbits receiving 3 mg. of HgCl2 per kilo—a dose giving 96% of deaths—intravenously were completely protected by doses of 0.1 mM. per kilo of any of the above compounds, provided therapy was initiated within 5 minutes. BAL glucoside was the most potent, 1-thiosorbitol the least. Dogs given 4 mg. of HgCl2 per kilo intravenously—a fatal dose—were completely protected from the renal effects of the metal by 3 equal doses of BAL totalling 0.15 mM. per kilo when treatment was delayed for 30 minutes. Even when treatment with BAL glucoside or BAL was delayed for 2 hours protection was striking. Of 44 dogs receiving 30 mg. of HgCl2 per kilo orally—a fatal dose—in which treatment with a total dose of 0.15 mM. of BAL or BAL glucoside per kilo was delayed for 2 to 5 hours, 28 survived, and only 1 animal died in uremia.

G. R. Cameron.

This paper reports the successful treatment of acute mercurial poisoning in humans with intramuscular injections of "BAL." Eight patients swallowed not more than 0.5 g. of mercury bichloride. Treatment with BAL was started from 20 minutes to 3½ hours later. All recovered promptly. Six patients swallowed 1 g. Five were treated within 1 to 3½ hours, and all recovered within 2 to 8 days. One patient who was treated initially with small amounts of BAL 13 hours after taking 1 g. of mercury bichloride died on the ninth hospital day. Nine patients took from 1-5 to 20 g. of mercury bichloride, 5 of the 9 having swallowed more than 1-3 g. Eight were treated with BAL from 1½ to 3½ hours after taking the poison, and one was first treated 19 hours after having swallowed at least 1-5 g. This patient was well in 3 weeks, and the other 8 in 2½ to 7 days. The initial amount of BAL used for the first intramuscular injection in 21 patients was 300 mg. (3 ml. of 10% solution). Two patients, including the one who died, received an initial dose of only 150 mg. Twenty-one patients received from 450 to 750 mg. in the first 12 hours, and a total of 900 to 2,870 mg. in a period of 3 to 4 days. Toxic features attributable to BAL were observed in a few patients after the intramuscular injections of 300 mg. or, in some instances, of 150 mg. of BAL. The authors emphasize prompt treatment by BAL in an initial intramuscular injection of 300 mg., followed within the first 12 hours by 2 or even 3 further injections of 150 mg. each.

G. R. Cameron.


Lewisite was applied to the skin of human volunteers in amounts sufficient to produce erythema and vesication. A micropipette delivering multiples of 0.05 c.mm. of lewisite was employed. The contaminated area was treated with the new dithiol after 40 minutes. Adequate controls using BAL or leaving the lewisite area untreated were instituted. The authors agree with other investigators that the vesicant action of small amounts of lewisite can be prevented by BAL, and they believe that BAL is still the most effective decontaminant against lewisite. They show that effectiveness is dependent largely upon (1) the dose of lewisite used, (2) the interval between contamination and decontamination, (3) the concentration of the dithiol in the vehicle, and especially (4) the temperature and relative humidity of the immediate environment of the test subject. Water-soluble derivatives of BAL have advantages, since they are less toxic and have a less objectionable odour, but they are not so effective as BAL. BAL retains its pre-eminence as a treatment for lewisite, not only because of its superior local effects, but also because it is effective against systemic effects and is a potent agent in the treatment of eye damage by lewisite.

G. R. Cameron.


The subcutaneous administration of BAL (30 mg. per kilo of body weight of a 5% solution in peanut oil) was found to increase the rate of excretion of arsenic in the urine of rabbits to which arsenoxides (phenylarsenoxide and mapharsen) had been administered intravenously in doses of 0.42 to 3.4 mg. of arsenic per kilo of body weight. The rate of excretion of arsenic in the feces was not altered.

R. H. D. Short.

INDUSTRIAL PHYSIOLOGY


Pathological effects occur with pneumatic tools working at an intensity of 12,000 or more vibrations per minute. Three types of disease have been described; the type affecting bones and joints; the neuritic type; and the vasoplastic type. Combinations may exist of any of these. The elbow- and shoulder-joints are those most frequently involved, and there seems at times to be a degeneration of the small bones of the hand. Tenosynovitis may occur. The peripheral nerves most involved are the median, ulnar, and radial. The incidence varies from 30 to 80%. Exposure to cold causes whiteness, numbness, and pain, mostly in the left hand. Warm air changes the colour and causes severe pain. Biopsies have shown normal vessels, with no evidence of Buerger's or Raynaud's disease. The mechanism of the condition is not known. The hand involved gets the most vibration, and the position of the tool may be significant. Cold air is an important factor. There seems to be an alteration in the chemistry of the tissues.

Treatment is mostly preventive, usually reduction of exposure. Mechanical means of holding tools have also been devised, and other tools have been substituted at times. Care should be maintained in the selection of employees for this intermittent operation. Massage and other modalities are not effective. Sympathetic block has been tried with some promise. [From the official report.]


This paper deals with investigations at the U.S. Army Air Force School of Aviation Medicine during 1942 and 1943, and catalogues the various types of symptoms experienced in the decompression chamber during 2,920 man-flights of 2 to 4 hours at simulated altitudes of 35,000 to 38,000 ft. (10,500 to 11,500 m.) while breathing 100% oxygen. The frequency of the various symptoms of decompression sickness is given, also their degrees of intensity and duration, the time interval at 38,000 ft. before they occurred, and the altitude at which relief was experienced on descending. The subjects of these investigations were chiefly flying cadets and pilots aged between 18 and 30 years.

The commonest symptoms necessitating forced descent were bends in 73% of cases, and chokes in 17%. A classification of the symptoms present at the time of descent is given.

Gut distension causing colicky pain occurred in the majority of subjects, usually in the first half-hour at 35,000 to 38,000 ft., and was generally of a transient nature passing off in 60% of the cases without any descent. Where descent was necessary it had to be made on an average within 11 minutes of the beginning of pain, but only in about 4% of the total subjects tested was it essential to ascend beyond the ground level because of abdominal colic. Circulatory disturbances of the nature of shock accompanied 26% of the cases of bends...
or chokes, the great majority being of the secondary type. Symptoms usually took several hours to disappear after return to ground and rest. Neurological symptoms were rare and chiefly affected the vision—scotomata; they usually cleared up within an hour or so of descent. Skin rashes and oedema of the soft tissues of chest and abdominal wall were noted and occurred in about 0.6% of the total personnel tested. At times a profuse flow of mucus from the head sinuses accompanied the expansion of gases at higher altitudes, and so interfered with breathing as to necessitate descent. Toothache so severe as to warrant descent occurred in about 0.34% of the subjects tested.

[Chokes or subternal distress with burning sensation, lung cough made worse by deep breathing, dyspnea, and apprehension appear to be far commoner in the U.S.A. than in the U.K., where they are rarely seen; whether this is a climatic or racial peculiarity is undetermined.]

H. E. Whittingham.


The rate of uptake of carbon monoxide has been shown to be constant with respect to blood concentration of COHb [carboxyhemoglobin], up to values of one-third the equilibrium level, when air containing CO in the range 1 part to 20 parts per 10,000 is breathed by men at rest or engaged in moderate physical activity. An equation has been derived which serves as a means of estimating in man the degree of blood saturation with CO as a result of exposure to air containing this gas as follows:

\[
\Delta \text{per cent. COHb} = \frac{\text{Parts CO} \times \text{minute volume} \times \text{exposure time}}{\text{46.5} \times \text{blood volume}}
\]

The equation is valid for values of per cent. COHb up to one-third the equilibrium value for the air concentration of CO under consideration. Within this range \( \Delta \) per cent. COHb may be estimated within a degree of error whose standard deviation is \( \pm 23\% \) COHb.

The fraction of CO removed from the inspired air by the blood was found to be constant as uptake progressed, and of a group of 12 men the average was 41.2% with a standard deviation of \( \pm 4.4\% \). This value is somewhat lower than that observed by previous investigators.

—[From the authors’ summary.]


In 21 years the author saw over 200 cases of Dupuytren’s contracture, and he recently observed a group of workers exhibiting a high incidence. One, a vigorous man of 48, had a palmar contracture affecting the fourth and fifth fingers of the right hand. The left hand was normal. This workman was required to lay electric wires of varying diameters, stripping these of the protective lead, paper, or pitch when it was necessary to cut them. A considerable muscular effort was needed to close the scissors provided, which had a leverage of 1 : 1, and when the author attempted to do the work he was unable to cut the thicker wires. He observes that a strong man can exert a gripping force of 50 kg. as measured with the dynamometer in the hand. To cut some of the wires a force of 75 kg. was needed, and this fell chiefly on the palmar fascia leading to the fourth and fifth fingers, as they worked against the thenar side of the palm. He did not exclude the possibility of some specific irritation of the palm by the pitch used as an insulator.

The incidence of palmar contracture in cable workers was very high. It generally appeared about the age of 34 to 40 after from 3 to 7 years’ employment. In the area 9 out of 32 employees exhibited the lesion, and these were mostly men working on thick wires. The author feels that the badly-designed and blunt scissors now in use should be replaced by a new pattern giving a leverage of 1 : 3 or 1 : 4.

G. C. Fether.


Forty-five soldiers (average age 20-5 years; surface area 1.79 sq. metres) in excellent physical condition served as subjects. Each was tested to 2 or 5 tests in a particular environment after a light breakfast 2 to 3 hours before entering the cold room. Half-an-hour before exposure the men donned thermocouple harnesses and their underwear and lay quietly in the control room at 22° C., 50% humidity, for the measurement of basal skin and rectal temperatures. This data, they dressed in their outer clothing and sat quietly in the particular environment for 3 hours. At 22° C. the metabolic rate increased by approximately 5%. Exposure to cold environments at temperatures of 1-1°, -17-8°, -23-3°, -25-1°, -28-9°, -34-4°, and -40-0° C. was accompanied by increased metabolic rate, which was greatest in the third hour and least in the first. Although no correlation between environmental temperature and metabolic response was noted, at -40° C. the metabolic rate averaged 74% of the basal value in the third hour. Mean skin temperatures calculated from five areas (thigh, toe, arm, calf, and chest) fell particularly in the first hour, the rate decreasing in the third hour. Rectal temperatures fell during the first hour but remained relatively constant in the final 2 hours except at -26-1° and -34-4° C.; the colder the ambient air the steeper the fall observed in mean skin temperature. Isolated observations are of little value, as an individual may begin with a high initial value but end the period of exposure with one of the lowest values recorded in a group of individuals examined simultaneously. At -28-9° C., less than 10% of the subjects suffered in the first hour, 50% suffered before 120 minutes, and 75% under 151 minutes. The greatest temperature changes were exhibited in the hands and feet, toe temperatures below 0° C. being encountered at -23-3° to -40-0° C.

C. C. N. Vass.


The local tissue injury in the extremities caused by various forms of exposure to cold has been studied in more than 100 cases. Material has not been examined during exposure or during the pre-hyperemic vasocconstrictive stage. In the hyperemic edematous stage the vessels became dilated and engorged with red cells and the tissues filled with fluid. Thrombi then formed from the agglutinated erythrocytes, and secondary ischemic reactions followed. The skin showed vesiculation, ulceration, the sweat glands and ducts vacuolation, degeneration of the axis cylinders, dehydrination, lipid phagocytosis, and later scarring.
Atrophy, degeneration, and necrosis were widespread in the muscles. The connective-tissue fat became crystallized and necrotic, lipoid phagocytes and oil cysts appeared, and free and intracellular fat was seen in the vessels. The adipose tissue (presumably at a later stage; ? during repair) showed atrophy and scarring, an interstitial sclerosis similar to that seen in reaction after irradiation. Non-sequestrating necrosis and atrophy of bone also occurred with the formation of new bony lamellae apposed to the dead trabeculæ. Most of the changes in both superficial and deeper structures are attributed to the vascular occlusion resulting from thrombosis, and it is believed that injuries resulting from exposure to cold under a variety of conditions have a similar pathogenesis in which thrombosis plays the most important part. Structures rich in fats and lipids (adipose tissue and myelinated nerve fibres), however, appear to be affected directly by cold.

G. Poppik.


The author first describes the concept of thermal equilibrium, according to which the mean temperature of the body when exposed to heat rises to a new level, which may be as high as 103°F. An upper limit of 90°F. wet-bulb temperature for saturated air is about the highest which can be tolerated, levels 2°F. to 3°F. lower being necessary for clothed men. Some authorities suggest a rise of 1°F. of rectal temperature as the permissible maximum; but men have been observed to work for 4 hours or more with rectal temperatures of 103°F. It has been noted that high radiation causes a marked increase in metabolism. When general ventilation and cooling are impossible local cooling in suits and jackets or by localized air currents may be useful.

After a period of adaptation persons selected for work involving exposure to heat should work for 4 or 5 days in a hot atmosphere to the limit of tolerance. The greatest degree of toleration is seen in men between the ages of 21 and 28, after which there is a steep fall. Attempts should be made to lessen heat production in persons exposed to heat. As little output of work as 92 kg.-metres per minute is equivalent in heat production to a rise in air temperature of 12.5°F. After men leave hot environments the drop in body temperature seems to follow Newton's law, the greatest loss being in the first periods of exposure. Thus it would appear that frequent short intervals in cooler air will give more relief than rare and longer rest pauses. Men working at a wet-bulb temperature of 90°F. showed a drop in rectal temperature from figures between 100°F. and 104°F. above normal. The degree of relief given may be estimated to some extent from the pulse rate, which should be between 125 to 130 for fit young men. The loss of 1.5% of body weight by water deficit is equivalent to a rise in air temperature of 12.5°F. or an increase in work output of 92 kg.-metres per minute. The body may lose in 1 hour an amount of water equal to the blood volume; yet deterioration is seen with a loss as low as 6% of body weight. Thirst is not an adequate measure of water deficiency, and the author notes the need for salting the water to the extent of 0.1 or 0.5% by weight.

G. C. Pether.


The condition described is that resulting from the failure of the heat-regulating mechanism to deal effectively with increased production of heat due to a combination of excessive muscular exertion, high environmental temperature, and, in some cases, lack of acclimatization. All cases were in soldiers in training in the Southern States of the U.S.A. during the summer months. Clinically the onset was acute in 71%, sub-acute in 21%, and insidious in 8%. Death occurred, usually in coma, within 24 hours in 70% of patients, and in 1 to 12 days in the remainder. Where bronchopneumonia supervened there was no coma. Of the pathological changes, those in the brain were the most important; cerebral oedema and congestion, and progressive neuron degeneration were almost invariable, with glial proliferation in the longer-standing cases; petechial hemorrhages were common. Changes in the other organs were inconclusive and appeared to be those of shock and toxemia, suberosous and submucous hemorrhages being frequent. Laboratory investigations before death showed a platelet deficiency in 6 cases tested; in the cases in which death was delayed thrombokinin times were prolonged. It is concluded that two factors appear to operate in heat stroke—namely, hyperthermia and shock.

W. S. Killpack.

INDUSTRIAL LUNG DISEASE


The authors describe the case of a stone-mason, aged 63, who had worked for 46 years with various kinds of stone containing quartz. Among these were the sandstones of the Palatinate and the Main Valley and also Grossmünster stone. The silica content of these ranges between 40 and 80%. It is considered that the silicosis risk in this occupation is comparatively small, this being attributed in part to the large average size of the dust particles. The patient first noted symptoms in 1935—namely cough, dyspnea, fatigue, and loss of weight. A radiograph was taken a year later and showed fine mottling of both lungs. No tubercle bacilli were found. As a result of this examination the patient was given a 100% disability pension. In 1943 he had signs of myocarditis and arteriosclerosis. Some doubt was cast on the original diagnosis, and it was noticed that the mottling was most marked in the upper zones. The lesions were calcified and there was also some pleural thickening. In 1945 the patient developed an esophageal cancer from which he died. Nodules in the lungs were found to be of a greyish colour, uniformly distributed, and up to 5 mm. in size. The lymph nodes around the bronchi and trachea, in the aortic region, and around the pancreas were enlarged and hard and contained scattered white nodules of mineral matter. Histological examination of some of these revealed numerous particles of coal dust and shiny needle-shaped crystals, later identified as lipid crystals. In some places where the nodules in the lungs were near the surface the pleura was thickened and adherent. The lungs were partly collapsed and showed emphysematous areas. By a special technique the authors were able to demonstrate the presence of quartz in the hilar and abdominal lymph nodes. Hydroxyl-apatite was found in the lungs and hilar nodes, calcium phosphate in the hilar nodes, and magnetite in the lung tissue.

The authors note the surprising fact that in the old silicotic nodules of the lungs, demonstrated histologically, no quartz could be found, but where the lesions
were active and reaction most violent, as in the hilar and abdominal nodes, quartz was identifiable. The findings support the views of Albertini that the quartz particles are gradually transported from the lung to the hilar nodes and thence to the abdominal nodes. The mineral particles are in a fine state of division or suspension, and are possibly broken up further in their passage. The authors reject the view that silica is dissolved and then precipitated, because it always comes down in the amorphous form when this occurs. They warn against identifying all crystals as of mineral origin, since many are organic and lipidic. In the patient described the appearance of hydroxyapatite together with calcium phosphate in the hilar nodes must be regarded as unusual since the former generally occurs alone. The authors do not think that the silicotic condition had anything to do with the development of the oesophageal carcinoma. G. C. Pether.


Owing to the difficulties sometimes encountered in the diagnosis of the presence of tuberculosis in silicotics, the author tried to find out if the erythrocyte sedimentation rate readings before and after effort would help. The method used was to estimate the E.S.R. in the morning on a fasting and resting patient. Then it was repeated after a standard exercise (still fasting). The exercise was the ascent of 60 stairs as fast as the patient's condition would allow. Those incapable of doing this were asked to go for a 15 to 30-minute walk. The test was performed on the following groups of patients: (a) uncomplicated reticular silicosis, 8; (b) confluent silicosis, 15; (c) silicosis with inactive (?) tuberculosis, 11; (d) silicosis with active tuberculosis, 10; (e) silicosis with unassociated disease, 6; (f) healthy controls, 20. Group (e) included those patients with pleural calcification and thickening, apical sclerosis, discrete nodularities in the lung fields, lobar fibrosis, and peribronchitis. Group (e) consisted of 2 cases of acute bronchitis and 1 each of cardiac failure, syphils, post-traumatic pneumothorax, and minor injury.

The results showed that after the test effort, in groups (a), (e) except for the 2 cases of acute bronchitis in the febrile stage), and (f), the E.S.R. was unaltered. In group (b) it was raised by 7% to 35%. In group (d) it was constantly increased by 30 to 70%. In group (c) it was raised in some cases and unaltered in others. More careful investigation later proved that those patients in group (c) whose E.S.R. was raised by effort did actually have active tuberculosis. From these findings the author claims that the E.S.R. estimations before and after a standard exercise are of value in deciding, in conjunction with other signs, upon the activity of a tuberculous lesion in silicotics suspected of infection. Tom Rowntree.


Quartz is the most common form of free silica encountered in industrial hygiene work, and is usually the only one that need be considered in investigating a silicosis. The most common methods of analysis hitherto used are described at some length, while petrographic methods, the x-ray diffraction method, and differential thermal analysis are described more briefly. For several years free-silica determinations have been made at the Saranac Laboratory, New York, by a method applicable to a great variety of materials, such as atmospheric and settled dusts, ore and rock samples, and mineral residues of tissue. The sample is treated first with hydrochloric acid to remove easily soluble compounds, then with dilute hydrofluoric acid to dissolve colloidal silica liberated by the other acids. A small portion of the residue which survives this treatment may be subjected to petrographic or x-ray diffraction examination; the remainder is analysed by standard methods for its total silica content. From the data obtained the percentage of free silica can quickly be calculated. For details of the analytical methods employed the original paper should be consulted. It also includes details of the results obtained on treatment of various silicate minerals, various kinds of quartz, and of synthetic mixtures of powdered quartz and other minerals prepared to simulate common industrial dusts.

H. M. Vernon.


Silicosis used not to be regarded in France as a professional disease, and did not entitle workers to compensation. The Regulations of Aug. 2, 1945, which have been in force since Feb. 2, 1946, fill this gap. The authors inquire into the rules governing compensation for silicosis, their modifications, and the difficulties of their practical application. L. Roche.


Occupation, while it may predispose workers to tuberculosis, seldom causes it. The staff of sanatoria are exposed with impunity to highly infectious cases. The prevalence of tuberculosis among the middle aged and among males today is probably due to the heavier work carried out by the male. In industries where there is a special risk from silica dust the mean age of the tuberculous at death is higher than that of the tuberculous in other occupations. Apart from such specific risk, poor diet, over-work, anxiety, overcrowding, and poor ventilation are probably the chief predisposing causes. Dusts may increase catarrh and carry infection. Light work under bad conditions may be more harmful than heavy work under good conditions, as is seen by comparing the incidence among hairdressers and clerks with that of farm workers. The graphs shown in this paper of the age distribution of mortality from tuberculosis in various occupations and social classes are based on the years 1931–2 and are now out-of-date. Today, with the help of mass radiography, the industrial medical officer may be able to detect early cases, but he is then faced with difficult problems concerning the suitability of these patients for employment. If they are infectious, they should be placed under treatment; if the work exposes them to risk from injurious dust, they must stop such work. Many will be closed cases, and the question will arise whether the patients should be permitted in their own interests to continue at work. Each case must be dealt with individually, according to the nature of the occupation and the general health of the worker. Rehabilitation must be considered, and also the pro-

The author, in conjunction with Lee and Drinker, recently described a portable instrument for measuring the instantaneous rate of air flow during respiration without offering a significant resistance to air flow. The recording instrument for inspiration consists of a fine platinum wire suspended across the tube through which the air flows. The wire is pivoted at one end and connected with a spring at the other, and it is deflected in direct proportion to the rate of air flow. The deflection is photographed on a moving-paper camera. The expiratory instrument is of similar construction, but is provided with a heating bath to prevent condensation of exhaled moisture. For further details the original articles should be consulted.

This paper gives numerous samples of the records obtained from normal subjects and from 5 patients with asthma, 8 with pulmonary tuberculosis, 19 with silicosis, and 3 with primary emphysema. Tuberculous patients with recently developed fibrotic tissue show a positive result, as the bronchial constriction causes a smoothing and damping of the air-flow curve, particularly in the expiratory phase of the cycle. Loss of elasticity in the lung, due to emphysema, also produces a damping of the air-flow curve. No appreciable change in the shape of the curve was noted in the first or second stage of silicosis, but a marked second and third stage cases showed a marked damping. The method appears to be of value in distinguishing between lung depositions such as silica, which cause fibrosis, and those such as iron fumes, which accentuate the x-ray appearance but do not produce any disabling fibrosis.

H. M. Vernon.

INDUSTRIAL DERMATITIS


An oily substance, and a resin soluble in alcohol, ether, and chloroform have been extracted from teak. These, as shown in skin-sensitivity tests, may be irritant to certain persons. It is suggested that the irritating powers of the resin are due to a high content in unsaturated acids. For tests to be reliable the wood samples used must be fresh. Splinters of wood may cause irritation. Extracts made in chloroform, alcohol, ether, benzol, oil, and water give cutaneous reactions of decreasing intensity. Although the evidence adduced seems convincing, the author inquires whether the resinous substances are alone responsible for the reactions seen. For if this were so one could not explain why aqueous extracts may contain an irritant. He concludes that several irritants may be present, and not only in the resins.

A patient of the author's, aged 47, a carpenter, a few days after his first contact with teak developed irritation and erythema of the forearms. This cleared after a few days' rest but reappeared when he again used the wood, the face becoming involved and the rash more severe. While this condition improved, skin tests were made with the wood dust and with teak oil and alcohol extracts, and these gave positive results. The skin eruption cleared with simple remedies.

The author investigated the possibility that the irritant is an alkaloid. An alcoholic extract of wood dust was made and treated with lime. Chloroform was then added, and acidified water in which the harmful substance was sought. Phosphotungstic acid was used as an indicator, but results were negative. Negative results were also obtained in a colorimetric test for saponins, with a concentrated sulphuric acid extract. The author suggests that the harmful substances are multiple, that the mineral salts cannot be ignored, and that repeated contact may neutralize the normal acid reaction of the skin. This leads to weakening of the keratin layer.

G. C. Pether.


The importance of contact irritants employed as topical medications or encountered as occupational hazards is discussed. All 250 cases were proved by patch tests. Topical applications were the commonest cause of contact dermatitis; sulphonamides and mercurials being the most potent sensitizers. Warning is given of the danger that patch tests with sulphonamides may photosensitize the patient or cause severe aggravation of the existing eruption; small test doses given orally are preferred to confirm sensitivity.

Of 86 cases of contact dermatitis of occupational origin, 23% occurred in the aircraft industry from formaldehyde and phenol formaldehyde (for plastics), glue, and rubber gloves—zinc chromate primer being the commonest sensitizer.

Attention is drawn to the importance of oleoresins in weeds as an occupational hazard to farmers and outdoor workers—35 (41%) of the total occupational cases being so caused.

Weed dermatitis usually begins in the spring on the ankles, later affects other exposed parts, and recedes in winter, but recurs more severely each succeeding spring. Polyvalent sensitization is the rule. Two forms of management of such dermatitis are advocated: (a) absolute avoidance of vegetation; (b) oral administration of specific weed oils during winter months.

Nickel is often the sensitizing agent in cases from jewellery or wearing apparel; in the list of 58 cosmetics implicated, 20 occurred from nail polish and 21 from hair lacquer.

Geoffrey A. Hodgson.

ACCIDENTS AND ORTHOPÆDIC SURGERY


Investigations were carried out in a boiler-making shop, a stamping mill, and a weaving mill. The first batch of 8 workers comprised 3 from a rolling mill and 5 from a boiler-making shop. Sound-spectrum analysis in proximity to the pneumatic chisel gave a maximum of 115 phons with the peak between 600 and 2,000 cycles. All workers showed the characteristic drop at 4,000 cycles in their audiograms, the loss being greatest and most generalized for those with the longest period of employment.

The second group comprised 7 workers employed in a stamping mill. All showed the characteristic loss at 4,000 cycles. The third group contained 8 weavers. The noise level in the mill was such that the weavers could hear each other only if they shouted at close
range. All 8 weavers showed the typical 4,000-cycle drop in the audiograms. In those with the longest period of employment there was a high-tone falling curve, inability to hear a whisper, and tinnitus.

The second part of the investigation was carried out among the weavers, who were tested on Friday evening after a 48-hour week, on Monday morning after a 60-hour rest, and again on Monday evening after a work period. They complained of tinnitus, tiredness, desire to sleep, and in some cases a feeling of pressure in the head and giddiness. The test of 2 hours in the weaving mill in 4 normal controls was repeated with earplugs inserted. No hearing loss was recorded. The same test was carried out on 2 people with normal hearing, earplugs being put in the right ear only. The right ear was completely protected, but the left showed the usual changes. Finally 8 weavers, tested after a 60-hour rest period, wore earplugs on return to work. The recovery which had occurred during the rest period was maintained after a full working day.[This is a comprehensive investigation. The literature is amply dealt with, but there is no reference to the work of Dickson and others in this country in 1939 on the effect of aircraft-engine noise.] Stephen Suggit.


This report is based on 100 cases examined and evaluated by the Medical Advisory Board of the Industrial Commission of Arizona in 1934-43. The author points out the difficulty in assessing the compensation for injuries, alleged or real, sustained by workers whose radiographs immediately after an accident show evidence of developmental anomalies or pathological changes. He considers that, while such conditions as rheumatoid arthritis produce clinical signs before radiographic changes, osteo-arthritis changes are usually symptomless long after they are radiologically evident. A worker with either of these conditions who sustains an injury may well be disabled for a very long time, and serial radiographs show progressive development of the pathological processes. The assessment of compensation for this " last straw " damage is very much more difficult than is suggested by the awards of the Medical Advisory Board. J. F. Brailsford.


For the removal of a magnetic foreign body from the eye precise location of it is necessary, since the application of a magnet may fail if the incision is even 1 mm. away from the site. Ordinarily x-ray examination will disclose the presence of a foreign body, and also its size and approximate position. However, x-ray examination may not be available, or the radiographer may not be skilled in special ophthalmic technique.

At the New York Eye and Ear Infirmary the Berman locator has been found helpful; its use in location is simple, direct, immediate, and of pin-point accuracy. Its application is readily mastered by an ordinary surgical staff. It is a portable electromagnetic device, similar in size and appearance to a wireless set. It has a sensitive probe holding a detecting element small enough for intraocular foreign-body work. The changes in the field caused by the approach of a metallic body register on an indicator, where it can be seen, or the changing pitch can be heard on the built-in loud-speaker.

The tip of the probe is applied first to the closed lid; if a ready response is obtained the search is continued by moving the probe along the surface until the "peak indication" occurs. If no immediate response is obtained, the probe is pressed into the tissues with the forefinger, the pressure being made and relaxed in a regular rhythm; if a foreign body is within range beneath the surface the indicator will respond. If there is no response the magnetic foreign body must be out of range of the surface, and initial exposure must be made of the globe, with the aid of radiology alone, and the search made as before. Whenever the "peak indication" is obtained the probe is held against the lid or the globe at that point and the patient is instructed to open his eye and rotate it in various directions; a consistent change in response to the movements of the globe indicates that the foreign body is either intraocular or in tissues which move with the eye; if there is no such change the foreign body is extraocular. When the foreign body, after having been located, changes its position, the new position can be recognized easily; the incision into the globe is made just beneath the centre of the probe where the "peak indication" was obtained.

D. Matheson Mackay.

ENVIRONMENT


In 1943 the United States Public Health Department reported epidemics of dysentery, chemical and food poisoning, gastro-enteritis, typhoid, paratyphoid, scarlet fever, trichinosis, and botulism, all of which were carried by foods. There were numerous outbreaks of trench mouth, septic sore throat, and common cold, spread by improperly washed dishes. As a result of experiments it was concluded that the temperature of the washing water should be between 130° and 140° F. and that of the rinsing water 170° F. Dishes should be immersed in the rinsing water for not less than 10 seconds. Perishable goods should be stored at temperatures below 50° F. and cooked foods, such as custards and salads, should not be allowed to cool at room temperature before refrigeration. Geoffrey McComas.


Utensils in 25 kitchens of hotels, school canteens, and snack bars, were examined. Samples of washing-up water were taken, and swabs moistened in nutrient broth employed for cultures from spoons, cups, forks, glasses, and plates, which had been used, washed, and stored for re-use. Coliform organisms were found on 21% of implements; coagulase-positive staphylococci on 5-5%; hemolytic streptococci on 2-3%, the most frequent isolations belonging to groups B and G. A group A strain was found once only (on a fork). Other organisms found were Bacillus fæcalis alcaligenes, "paracolon bacilli," Proteus, Pseudomonas pyocyanea, and, once, a
Sonne dysentry organism. Fecal streptococci, Streptococcus viridans, and Staphylococcus albus were found on most implements.

Examinations were made of 38 samples of dish-washing water, of which 19 had counts of more than a million organisms per c.c.m. at 37 °C., and 9 of more than a million organisms per c.c.m. at 22° C. The ratio of counts at the two temperatures suggested animal origin rather than soil or dust, and coliform counts were high. The water was thus bacteriologically similar to sewage. In 11 samples there was no soap or soda. The value of soda is indicated by the fall in the number of specimens with high total and coliform counts when the pH was over 10 as compared with a pH range of 7 to 10. The temperatures of water—average 40 °C., and maximum 50 °C.—were found to be too low to have any bactericidal effect.

The cleanest utensils were found where a washing machine with soda was used and a drying oven took the place of hand-drying—half the swabs being sterile. Drying-cloths were also examined; 17 of 36 yielded only fecal streptococci, Staph. albus, Str. viridans, and spore-bearing aerobes. The others yielded one or more of the following: coliform bacilli, paracolon bacilli, Staph. aureus, and B. faecalis alkaligenes. Sanitary arrangements and washing facilities for the staff were in most cases unsatisfactory.

G. T. L. Archer.

Dishwashing Practice and Effectiveness (Swab-rinse Test)


The first of these investigations deals with the technique of "swab-rinse" tests of utensils in restaurants, and is of interest to those using such a method. The second gives the results of a survey of 1,000 restaurants in New York City. Hand washing of utensils was practised, wholly or partly, in 88% of these, and machines were used in 17.5%. In the establishments where utensils were washed by hand only 10-5% of glasses and cups reached a satisfactory standard of cleanliness; even in the small number of restaurants where mechanical methods were used only 35-8% reached the standard. Better figures were obtained with spoons and forks, and there was little difference between those washed by hand and those washed by machine. In cafeterias the standard of washing, whether by hand or by machine, was inferior to that in "water service restaurants."

C. O. Stallybrass.


The danger of spread of infection by mess equipment arises partly from cross-transmission of nose, throat, and intestinal commensals when mess tins are immersed in a common rinse, and partly from fly-borne spread when the tins are left exposed between meals. Organisms which have been isolated from eating utensils include Staphylococcus albus and aureus, Escherichia coli, hemolytic streptococci, pneumococci, and diphteroids. The efficient sterilization of equipment in barracks, where washing and drying machines, cleansing powders, and detergents are available, presents little difficulty. The problem confronting a mobile field force using army-pattern mess tins is more formidable. The basis of most practices is the swilling of the utensils in a container of water. Any sterilizing action is expected to result in some cases from the heat of the water, in others from an added chemical.

Investigations proved that though low-temperature rinses with cold hypochlorite solution might be effective in sterilizing comparatively clean utensils, greasy mess tins were not so much as cleansed, even at temperatures up to 50° C.; the free-chlorine content of the hot hypochlorite solution in the presence of organic matter very rapidly fell to negligible values. At the effective heat alone as a sterilizing agent, although a 5-second contact with water at a temperature not less than 80° C. resulted in the sterility of utensils contaminated by E. coli, this procedure was not sufficient in the case of tins impregnated with Staph. aureus, the organism most resistant to heat. Even a double rinse of 5 seconds, duration, the first in hot water at 80° C, the other in cold hypochlorite solution, failed to destroy this organism. A double rinse, each of 5 seconds' contact in hot water at 80° C., was almost always completely successful. As an indicator that the water was at 80° C. a small phial containing 2 g.-of naphthalene and a crystal of brilliant green were used. Below 80° C. the naphthalene is solid, but at this temperature it liquefies.

A suggested drill for field sterilization of mess tins is that at the end of a meal the tins rinse their dirty mess equipment in water at or above 80° C., the maintenance of this temperature being shown by the immersion indicator. This single rinse will destroy all E. coli, all hemolytic streptococci, and most of the Staph. aureus. On entering for the next meal, troops again rinse the mess equipment in a drum containing water at not less than 80° C. This second rinse will destroy all the remaining Staph. aureus and organisms resulting from any contamination of flies which might have occurred. The second rinse, incidentally, warms the containers—an advantage when hot meals are being served.

[Experiments are urgently required to determine the measures necessary to destroy the viruses of infective hepatitis and poliomyelitis.]

Caryl Thomas.


Almost all the houses in Mogadishu (capital of former Italian Somaliland) are seriously infested with cockroaches. Spraying with pyrethrum or D.D.T. having produced poor results, it was decided to attempt control with gammexane dust containing 10% active ingredient, which was applied with a simple hand-duster. The author states that the dust did not affect the eggs and that it was advisable to dust again after an interval of 3 or 4 weeks. Provided these two dustings were carried out, using about 250 ml. of dust for each treatment of a five-roomed house, the premises so treated remained reasonably free from cockroaches for about 3 months, after which time they were gradually re-invaded and treatment had to be repeated.

R. M. Gordon.


The authors began their experiments by testing, in the field, the repellent properties of the following nine substances or compounds against Glossina: (1) N-sec-butylphthalalimide; (2) 2-phenyl-ethyl-α-hydroxyisobutyrate; (3) N,N-α-aminosuccinimide; (4) benzyl ether; (5) 2-phenyl-cyclohexanol; (6) n-butyll-dl-malate; (7) ethylhexane-diol-1,3 (Rutger's 612); (8) 2,2'-dimethyl-2-carbobytoxy-dihydro-7-pyrene (indalone); (9) Formula 622 (dimethyl phthalate, 6 parts; indalone, 2 parts; Rutger's 612, 2 parts). The result of this preliminary
screening proved that indalone and Formula 622 gave the most striking results, and in consequence the following additional tests were carried out with these compounds, controls being employed in each observation. (1) Duration of effectiveness of indalone and Formula 622. To determine the time during which these compounds were effective they were applied at intervals of from 7 to 8 hours before exposure to tsetse flies. Both compounds showed a loss of efficiency between 4 and 6 hours after application. (2) The effect of sunlight on the efficiency of Formula 622. Two treated and 2 control fly-boys sat for 30 minutes exposed to the direct rays of the sun in a tsetse-free area. They then sat for 1 hour in a shaded tsetse area. Some loss of repellent power was noted under these conditions. (3) The effect of sweating on the efficiency of Formula 622. Two treated and 2 untreated fly-boys danced strenuously in the shade for 30 minutes. They were then exposed to tsetse flies for 1 hour. No loss of efficiency as the result of sweating was noted.

R. M. Gordon.


The author describes experiments with mosquitoes and other insects to test the effectiveness of wire screening with square and rectangular apertures. The screening tested was made of wire of 0.011 in. diameter, but the meshes investigated were 18 x 18, 16 x 16, and 14 x 14 for square meshes and 18 x 16, 18 x 14, and 18 x 12 for rectangular meshes. The majority of the tests were carried out with laboratory-bred mosquitoes—Anopheles quadrimaculatus, A. quinquemaculatus, and Aedes aegypti—in cages made of the screening under test. None of the meshes permitted the escape of A. quadrimaculatus or A. quinquemaculatus, but undersized Aedes aegypti escaped through all the meshes and normal-sized A. aegypti through most. The percentage of Aedes escaping was found to be directly proportional to the length of the diagonal of the aperture. A mesh of 18 x 14 proved as effective as one of 16 x 16. The placing of the rectangular aperture with the long axis vertical was important, since in 18 x 12 mesh a greater proportion of Aedes escaped when the long axis was horizontal. The effectiveness of different meshes against small light-attracted insects (gnats, tiny moths) was studied, and in these also the proportion of penetrations was directly related to the length of the diagonal of the aperture. Only 18 x 18 or finer mesh acted as an appreciable barrier to these small insects.

This is a careful study of the comparative effectiveness of wire screening with the rectangular or the square apertures. The former is more rapidly woven and should therefore be cheaper. No reference is made to British literature on the greater importance of aperture measurements as compared with mesh counts.) T. H. Davey.


This paper draws attention to the value of D.D.T. and "gammexane" in insect infestation on shipboard. Gammexane, the gamma isomer of benzene hexachloride, is both reliable and persistent, but suffers from a disagreeable odour due to impurity; the powder D.034 contains 20% crude gammexane. This powder is applied with a blower into crevices where the dust will remain active for several months. A purer form in solution in kerosene will, it is stated, be available shortly.

D.D.T. has a faint smell; it is insoluble in water but soluble in kerosene. In ships it is commonly used as a 5% solution in kerosene and is applied by hand or a power spray; there is risk of fire from the use of sprays, and all precautions should be taken until the spray has dried. D.D.T. is effective as a 5% powder, though in the U.S.A. 10% is preferred; it can be applied by a blower—either hand-blown, or automatic as in the "Freon" bomb. Both gammexane and D.D.T. are effective under practical conditions against bugs and cockroaches as well as lice; both approach the ideal as insecticides. C. O. Stallybrass.

GENERAL


In 1940-41 a follow-up review was carried out of 283 men who had been treated for diabetes between 1930 and 1939. Replies to a questionnaire were received from 154 (65%); 12 (5%) had died in the interval. The average age was 38, and the duration of disease varied from 2 to 18 years; in more than half it was greater than 7 years, with an average of 7 5 years. Most cases were fairly severe, 87% requiring more than 20 units of insulin daily, with a daily average for all cases of 55 units. A table shows the types of occupation pursued; one-half at least could be classed as heavy workers, but in most cases working hours and meal times were regular.

The replies showed that 87% (134) considered themselves completely fit for work and were continuing in their previous occupations; 11 (7 2%) were partially fit, having been forced to change to a more suitable occupation; while 9 (5 8%) reported that they were unfit for work. Three of these last cases of disability were not entirely due to diabetes, but partly to epilepsy and tuberculosis, and the remaining 3 could give no satisfactory reason for their incapacity. Patients were asked if they had adjusted themselves to a state of chronic illness, or if they felt it a hindrance in daily life; 111 (72%) had grown accustomed to their disability, while 34 (28%) felt that their disease was a hindrance, mainly on account of difficulties of diet. Of the total who replied 42% had had to call in medical assistance several times a year after discharge from hospital, 34% did so less frequently, and 24% were able to control the disease without outside aid.

D. J. Bauer.