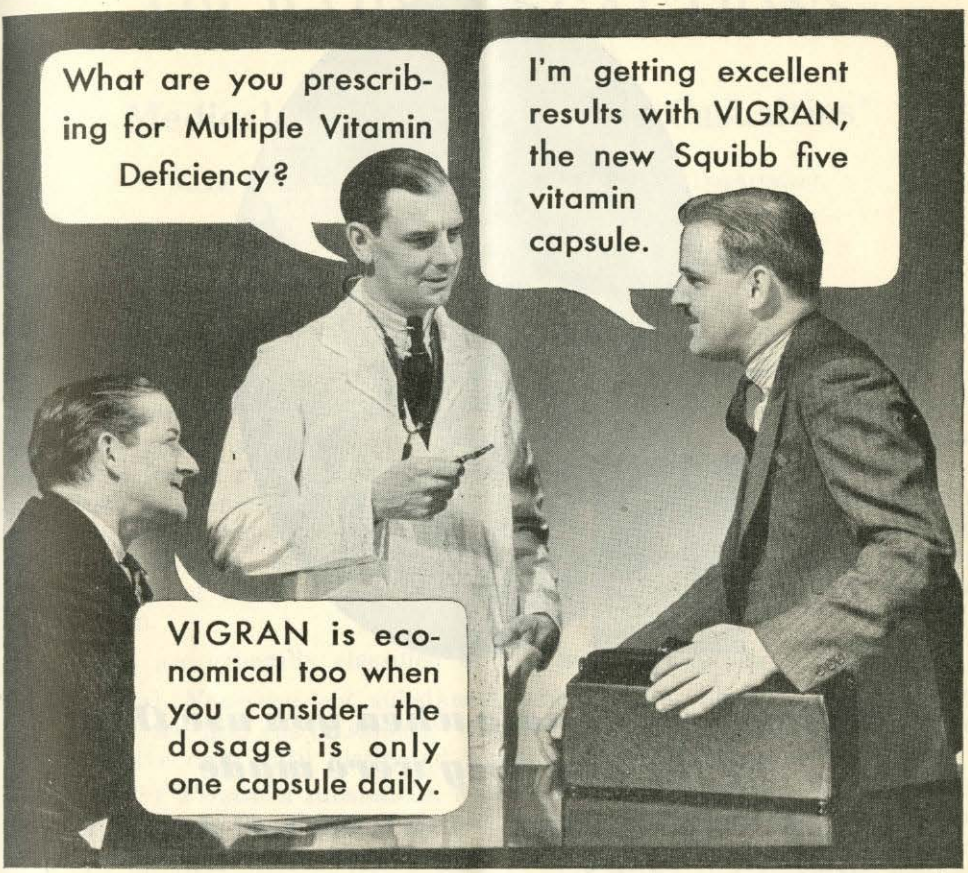
CONTENTS



There are many conditions in which a deficiency of more than one of the vitamins may be noted. Such deficiencies may result from peculiar dietary preferences as well as from the restricted diets imposed because of illness.

CONVENIENT—**VIGRAN**, Squibb Vitamin A-B-C-D-G Capsules eliminate the necessity of taking an unpalatable preparation, of eating food which the individual dislikes, or of taking two or three separate products in order to provide an adequate supply of these 5 essential food factors. The capsules are convenient, practical and economical—the dosage requirement is small. They dissolve readily after being swallowed.

POTENT—Each capsule contains in **stable** form the full estimated minimum adult daily requirement of Vitamin A (6300 I.U.), B (222 I.U.), C (500 I.U.), D (630 I.U.) and probably *G (10 gammas). The average dose is one capsule daily.

VIGRAN capsules are indicated for pregnant and lactating women, malnourished adults, convalescents, patients on restricted diets or with prolonged or wasting illnesses requiring supplements of several of the vitamins.

*Average adult minimum daily requirement unknown.

For literature and samples, write:—

E·R·SQUIBB & SONS OF CANADA, Ltd.

Manufacturing Chemists to the Medical Profession Since 1858

36 Caledonia Rd., Toronto

AIR RAID PRECAUTIONS

Medical Treatment of Gas Casualties*

Issued by the Home Office Air Raid Precautions Department

GENERAL DESCRIPTION OF WAR GASES

CHAPTER I

1. Meaning of "Gas" in Chemical Warfare

The term "gas", in connection with warfare, is used in a very general sense, to include any chemical substance, whether solid, liquid or true gas, employed for its poisonous or irritant effects on the human body.

Such substances are, generally speaking, dispersed in the air as vapours or as poisonous smokes, and exert their actions on persons breathing the air thus contaminated. Some of them, however, such as the blister gases, whether in the form of liquid or vapour, have also the power of acting directly on the skin.

Gases are generally classified in two main categories.

(*a*) *Non-persistent* substances which, when liberated, are rapidly converted into gas or smoke. Clouds of gas so produced continue to be effective only until dissipated by dilution with the surrounding air.

(*b*) *Persistent* substances, which are generally liquids. These liquids contaminate the objects with which they come in contact, and continue to give off vapour for a considerable period; mustard gas, lewisite and most tear gases are typical examples. Both the liquid and the vapour are poisonous.

2. Notes on the Use of Gas in the last War

Chemical warfare in the modern sense was first introduced by the Germans in April, 1915, on the Western Front, chlorine gas being used by them in successive attacks until May of the same year, when tear gases also were used. These attacks found the Allies not only unprepared, but also inexperienced in the effects that chlorine produces on its victims. The casualties sustained during this period of ignorance and unpreparedness cannot be estimated accurately, but they were very heavy, and improvised means of protection had to be adopted at once.

The first official respirator (a cotton pad soaked in thiosulphate of soda, glycerine and sodium carbonate) was issued in May, 1915, and after that date defence, on the whole, kept ahead of attack—so much so that phosgene gas, first used by the Germans in December, 1915, found the Allies relatively well protected against its effects.

With a view to overcoming this protection the Germans introduced the arsenicals (or "nasal irritants") and mustard gas. The former were intended

to penetrate the box respirator which was then in use by the Allies, while the latter, having a very faint smell and causing no immediate irritation, might be expected to take effect before the need for putting on a respirator was realised. Comparative failure attended the use of the arsenicals; mustard gas, on the other hand, was only too successful, for, in addition to its insidious latency, the gas possessed the power to attack all parts of the body not protected by the respirator and had, in addition, the great offensive value of persistency.

Much valuable information on the medical aspect of gas casualties is contained in the Official History of the War, Medical Services, "Diseases of the War", Vol. II.

The success secured by the use of mustard gas in the last war was chiefly due to the action of the vapour alone—vapour emitted from persistent deposits of the liquid. Mustard gas was then only used in shells; but there is no practical difficulty in using it in bombs or in the form of spray discharged by aircraft, when contamination of the bare skin and of clothing by the liquid might cause casualties over wide areas, if no precautions were taken.

3. Objects to be achieved by the Use of Gas

The objects which an enemy might seek to achieve by the use of gas may be summarised as follows:—

(*a*) To produce casualties by means of the gas itself.

(*b*) To produce casualties by contaminating streets, etc.

(*c*) To reduce, or even to arrest, industrial and commercial activities.

(*d*) To make food and similar stores unfit for use. (A separate handbook is being prepared on the protection of food supplies.)

(*e*) By causing widespread discomfort, anxiety and disablement, to lower the morale of the civil population and induce a will to compromise or surrender.

The type of gas which might be used would naturally vary with the object in view.

The respirators which will be provided by the Government will give protection for the eyes, nose, face and lungs against any type of gas which, so far as is known, could be used in war.

In view of the properties of blister gases, however, which are capable of attacking other parts of the body which the respirator cannot protect, advice is being given to the public to remain indoors in a gas-protected room during an air raid. Essential air raid personnel who might have to be exposed to risk of contamination in performing public services will be supplied by the Government with the necessary protective clothing.

4. Factors governing the Use of Gas

It is evident that the higher the concentration of the gas, the shorter will be the period of exposure required to produce pathological damage; and the converse also holds good.

The effective use of gas may be markedly influenced by meteorological conditions as well as by topographical features in the area affected.

A strong wind will rapidly dilute and disperse all concentrations of non-persistent gases, while in the case of a persistent gas the rate of evaporation of the liquid will be increased, thus tending to clear the area more rapidly.

With a low wind velocity, on the other hand, a high local concentration may be obtained with both types of gases, and the persistency of such liquids as mustard gas will be markedly lengthened, in the absence of other adverse factors.

Temperature plays an important role, both by influencing the diffusion of the gas by convection currents and by affecting the persistence of such liquids as mustard gas; hence warm sunny weather is inimical to the most effective use of gas. On the other hand, very cold weather has its disadvantages too, as it very markedly reduces the immediate value of persistent gases—in the case of mustard gas, for example, evaporation will be very greatly reduced as this liquid freezes at comparatively high winter temperatures. Mustard gas in the frozen state however is not by any means inert, as contact with it under these conditions will still produce a burn. If the frozen mustard gas contamination is carried (e.g. on boots) to warmer surroundings it will soon liberate an effective vapour concentration.

Conditions of excessive moisture are also unfavourable to the effective use of persistent gases, as rain tends slowly to destroy them or to wash them away.

The most favourable meteorological conditions for the employment of the two main types of gases are the following:—

Non-Persistent gases.

(*a*) A low wind velocity.
(*b*) Clear nights (cloudy days and nights are slightly less favourable, while clear sunny days are the least favourable).

Persistent gases.

(*a*) A low wind velocity.
(*b*) A high ground temperature.
(*c*) Absence of heavy rain.

Generally speaking, a clear, still night offers the most favourable conditions for the use of non-persistent gas. At such times the absence of air movements causes the gas to dissipate very slowly with the result that a high concentration is maintained for a long time.

In the case of persistent gases, a high ground temperature is usually the most important consideration, since this will induce rapid evaporation of the gas and the formation of a high local concentration of the vapour.

5. Medical Classification of Gases

The gases which, so far as can be anticipated, might be used in time of war may be classified as follows, the alternative names given in brackets being those by which the gases are described for purposes of civilian anti-gas training.

It is impossible to forecast which of these gases is likely to be chosen for chief use, but there seems a possibility that several different types might be employed simultaneously in order to confuse the measures for defence and treatment.

GROUP I. *Gases which may produce disablement or death.*

(a) **Vesicants** (or "Blister Gases"), such as **mustard gas** and **lewisite.** These are substances which, whether in the liquid, solid or vapour state, will damage any part of the body with which they come in contact. Typical

effects of the vapour are acute conjunctivitis, inflammation of the mucous membrane lining the respiratory tract, and burning of the skin varying from erythema to vesication. The effect of the liquid on the skin is severe vesication.

When death occurs after the inhalation of mustard gas, it is usually from a complicating septic bronchitis with broncho-pneumonia, while as a result of very extensive skin vesication death may result from secondary shock or sepsis.

(b) **Asphyxiants** (or "Lung Irritant Gases"). These gases, which include **chlorine, phosgene, di-phosgene** and **chloropicrin,** are essentially lung irritants exert ng their main action on the pulmonary alveoli although the upper respiratory passages are affected in addition. They are used primarily as lethal agents, and, in the absence of an efficient respirator, their action usually results in a pulmonary oedema which may be fatal.

(c) **Paralysants,** such as **hydrocyanic acid** and **hydrogen sulphide.** These highly toxic gases were used but did not prove a success in the last war. More effective methods of liberating them may, however, be found and knowledge of them from the medical aspect is desirable. In high concentration, both these gases can produce death rapidly through paralysis of the respiratory centre.

GROUP II. *Gases used primarily as harassing agents.* (These gases may not produce casualties, but they cause temporary distress and compel the wearing of a respirator.)

(a) **Lachrymators** (or "Tear Gases"), such as **chloraceto-phenone (C.A.P.), ethyl-iodo-acetate (K.S.K.)** and **bromo-benzyl-cyanide (B.B.C.).** Even low concentrations of gas given off by these compounds will immediately irritate the eyes, causing profuse lachrymation and intense spasm of the eyelids—symptoms, however, which disappear on leaving the contaminated area. In very high concentrations they may act as acute lung irritants.

(b) **Nasal Irritants** (or "Nose Irritant Gases"). These are organic arsenical compounds such as **di-phenyl-chlor-arsine (D.A.), di-phenyl-amine-chlor-arsine (D.M.)** and **di-phenyl-cyano-arsine (D.C.).** These solid arsenicals, when suitably dispersed, produce clouds of minute particles which, if inhaled even in low concentrations, will produce symptoms of acute physical distress. These symptoms are distressing gnawing pain in the nose and chest, with lachrymation, salivation and even vomiting. Inferior respirators are penetrated by these fine particles. The symptoms, however, are temporary, and, although alarming at the time, usually subside within an hour after removal from the affected area.

GROUP III. *Gases liable to be encountered under war conditions.* (These gases are not likely to be used directly as chemical warfare agents in the ordinary sense.)

(a) **Carbon monoxide.** This dangerous gas, though not used offensively as a war gas, is frequently met with in the course of mining and tunnelling operations, in the interior of burning buildings, and generally wherever combustion occurs in the absence of an adequate supply of oxygen. Typical instances occur in confined spaces following the burst of a high explosive shell, or from the use of slow combustion stoves, charcoal braziers, or internal combustion engines in such spaces. It is a constituent of ordinary illuminating

gas, leakage of which may cause serious poisoning. The gas produces its insidious effects through its well known interference with the respiratory functions of the blood. Ordinary respirators give no protection.

(b) **Nitrous fumes.** These gases are given off by burning cordite, or when detonation of nitro-explosives is incomplete. They act as powerful and very insidious lung irritants, with delayed symptoms resembling those of phosgene poisoning, and it is important to remember that they are often accompanied by carbon monoxide. Respirators generally afford partial protection against nitrous fumes, but none against the carbon monoxide.

(c) **Screening smokes.** Various chemicals may be used to provide smoke screens for concealing important areas or buildings. Such substances as **phosphorus, chlorosulphonic acid, titanium-tetrachloride,** and a number of the **chlorinated-hydrocarbon series** are utilised for this object, while phosphorus may also be used in bombs for incendiary purposes. These smokes are non-toxic in the open, but serious effects may follow the bursting of the bombs at close quarters.

(d) **Fumes which may be encountered in fire-fighting.** Apart from the risk of encountering carbon monoxide, and possibly nitrous fumes, when fighting fires in confined spaces in wartime, an additional danger may arise through toxic gases evolved by fire-extinguishing chemicals. Apart from its possible toxicity, such an atmosphere may be seriously deficient in oxygen.

CHAPTER VI

MUSTARD GAS

25. General Description of Mustard Gas

Mustard gas or di-chloro-di-ethyl sulphide (the "Yellow Cross" of the Germans and "Yperite" of the French) was certainly the most effective chemical agent used in the last war.

Lewisite, which is described in the next chapter, has similar properties.

Mustard gas, being a liquid with very persistent properties, may be discharged from the air either in bombs or as spray. Mustard gas bombs will disperse splashes of the liquid, larger near the crater and diminishing in size in the farther parts of the area affected, and these splashes will continue to give off dangerous vapour for days or even weeks unless the contamination is removed or neutralised. When discharged as spray it will fall in drops which will be larger or smaller according as the aircraft is flying low or high.

26. Physical and Chemical Properties of Mustard Gas

A knowledge of the physical and chemical properties of mustard gas is essential in order to understand the insidious action on the human body. Its outstanding characteristics are:—

Appearance.—In the pure state mustard gas is a clear, almost colourless, heavy and somewhat oily fluid with a faint mustard-like odour. In the crude form it is a heavy, dark coloured, oily fluid with a slightly more offensive smell resembling that of garlic or onions.

Odour.—In the absence of chemical methods for the ready detection of mustard gas, the sense of smell is the most reliable guide to its presence.

The mustard-like or garlicky odour, though faint in low concentrations, is characteristic of the gas, and it is most important that the smell should be memorised as part of anti-gas training. It is, however, well to remember that mustard gas may produce casualties in concentrations the smell of which may readily escape notice; also, that the sense of smell tires quickly, and that after a few minutes in a mustard gas atmosphere the smell of the gas may seem to have quite disappeared.

Boiling Point and Vapour Pressure.—The boiling point of mustard gas (217° C. or 422.6° F.) is high, and its vapour pressure is correspondingly low (0.05 mm.Hg. at 10° C. or 50° F., and 0.45 mm.Hg. at 40° C. or 104° F.)—hence its slow vaporisation at ordinary temperatures and its consequent quality of persistence.

Freezing Point.—The freezing point of pure mustard gas is 14.4° C. (57.9° F.), while that of the crude variety is considerably lower, viz., about 6° C. (42.8° F.)—somewhat high freezing points which limit the usefulness of the gas in cold weather, although contact with the frozen material is still a source of danger.

Density.—Mustard gas has a high specific gravity (1.28 at 15° C. or 59° F.) and, as it is not miscible with water, it readily sinks to the bottom when mixed with it.

Solubility.—Although mustard gas is only very slightly soluble in water (under 1 per cent), both the liquid and the vapour are freely soluble in animal oils, and it is due to this liquid solubility that mustard gas finds an easy entry into the skin. Other substances that readily dissolve mustard gas are alcohol, ether, petrol, benzene and kerosene or paraffin, carbon tetrachloride, acetone, carbon bisulphide, and many other organic solvents.

Stability.—Both physically and chemically mustard gas is a stable substance; it is unaffected by wide ranges of atmospheric temperature, though simple heat disperses it by hastening evaporation. It is only very slowly hydrolysed by water; boiling water, however, hastens this decomposition, the products of which (hydrochloric acid and thiodiglycol) under ordinary circumstances are practically harmless. For its chemical neutralisation strong reagents are usually required, such as chlorine (as in bleaching powder), strong nitric acid, or other strong oxidising agents.

Penetration.—One of the most important physical characteristics of mustard gas is its power of soaking into most materials other than metals, glass, glazed articles, etc. This property, combined with its persistence, greatly complicates the problem both of defence and of decontamination.

27. Toxic Properties of Mustard Gas

Toxicity.—Mustard gas is an extremely dangerous substance both in the liquid and in the vapour state, but its action is essentially local, and no general systemic disturbance usually supervenes in the absence of secondary infection. The gas is not selective in its action, and any part of the body exposed to it is liable to suffer.

Vapour concentrations.—Atmospheres which contain low concentrations of mustard gas are particularly dangerous, as the comparative absence of smell in such concentrations renders them particularly insidious. The presence of the poison may escape detection and thus cause the exposure to be unduly prolonged.

Insidious characteristics.—The fact that there is no immediate irritation of the skin on contact with the liquid, nor of the eyes or respiratory tract on entering moderate concentrations of the vapour, constitutes one of the more serious dangers of this gas, as contamination may be unsuspected. Even when the gas has been detected by its characteristic odour, the sense of smell is soon dulled and the odour will cease to be appreciated. If however the respirator is speedily adjusted the odour will be detected whenever the respirator is removed. It is important to remember, also, that harmful concentrations of the gas can easily be masked by innocuous smokes or other smells, in which case the gas will exert its effects undetected.

Delayed action.—After exposure to mustard gas vapour or contact with the liquid itself no effects are noticed for some time. Signs and symptoms do not begin to appear until after the lapse of two or three hours. Longer delay, even up to 24 or 48 hours, sometimes occurs.

Delayed healing.—It has already been stated that the action of mustard gas is local; the tissues affected are devitalised, they are easily injured by rubbing or pressure, and they are very prone to secondary infection. Where the gas has penetrated deeply, the healing process, even though sepsis be excluded, is very slow owing to damage to capillaries, veins and lymphatics. It is only when the action of the gas is superficial and localised that the condition clears up rapidly.

Sensitivity.—All persons are sensitive to the action of mustard gas, and so far as is known all who have not previously been exposed to its effects possess approximately the same degree of sensitivity irrespective of race or colour.

Acquired hypersensitivity.—In contrast to normal sensitivity it has been found that persons who have suffered injury as a result of exposure to mustard gas may in some cases become hypersensitive to its effects. The condition may be induced by either the liquid or the vapour of mustard gas. It is not possible to say with certainty whether a similar condition may be induced by other types of blister gas, such as lewisite; there is at present no evidence to suggest that this is so.

28. Summary of Dangers of Mustard Gas

The peculiar dangers from mustard gas described in the two previous Sections may be summarised as follows:—

High boiling point and low vapour pressure.	Endow mustard gas with great persistency on all materials.
High freezing point	Renders mustard gas comparatively ineffective in cold weather because little vapour is evolved and the liquid is frozen. Under these conditions, however, it is dangerous because it is not detected by the sense of smell; the skin may be contaminated by contact and burned, while the frozen liquid may be carried on boots or clothing into warmer surroundings where it will melt and vaporise.

Stability, i.e., not readily destroyed except by strong chemicals such as chlorine or strong nitric acid.	The chemical stability of mustard gas tends to increase the persistence due to its low vapour pressure, since the substance is not greatly affected by moisture or by contact with most ordinary materials under normal conditions. The result is that articles of the most varied natures may remain dangerous to handle for long periods after contamination, particularly if evaporation of the mustard gas has been in any way partially or wholly inhibited.
Solubility.—Readily dissolves in animal fats, but almost insoluble in water.	Enables mustard gas to penetrate the skin very easily. Not readily destroyed by rain, and difficult to remove by washing with water alone.
Penetration	Like other oily substances, mustard gas readily soaks into most materials other than metals, glass, etc.
Great toxicity	Even low concentrations of vapour evolved from the liquid are dangerous to the eyes, lungs and skin. The destructive effects of mustard gas on the tissues of the body are not obvious for some hours after contact. Hypersensitivity may be induced after repeated burns.

29. Nature of Casualties from Mustard Gas Vapour

Mustard gas vapour can be harmful in concentrations that may not be readily noticed by the sense of smell; also, the sense of smell for mustard gas vapour tends to become dulled quickly, in which case the danger may no longer be appreciated.

The cumulative effect of repeated small doses of the vapour is another insidious danger.

The vapour concentration necessary to produce effective results need not be of a high order. One hour's exposure to a concentration of one part of mustard gas vapour in one million parts of air is sufficient to incapacitate an unprotected man for about two weeks through conjunctivitis.

In the event of a mustard gas attack on a large town some persons who have actually been exposed to the gas may, owing to local conditions, be unable to get away from their places of business before the inflammation of the eyes has become severe. If for that reason they can no longer see they should be treated like blind persons and should be conducted to the first aid post, the hospital, or their homes, as the case may be. The personnel of the Voluntary Aid Organisations should be prepared to give their assistance in such cases, and it need only be pointed out that if this type of casualty is numerous, it is possible to collect a small number of them into a party, each man holding on to his neighbour, when a single guide can lead the whole party.

The possibility of the odour of mustard gas being masked by smokes or the fumes from high explosive, and its lack of immediate sensory irritation in what are yet effective concentrations, are additional dangers.

The degree of severity of mustard gas vapour casualties naturally varies with the concentration and the period of exposure. The least severe case may only show light conjunctivitis, with almost no erythema of the skin and only a slight hoarseness of the voice; the most serious, on the other hand, may present a picture of the most profound illness, usually with widespread skin burns, severe eye effects and damage to the respiratory tract.

A moderately severe case of exposure to the vapour when quite unprotected will present a typical appearance in 24 hours, with eye symptoms predominating; general reddening of the skin occurs, most marked in the genital region where the excoriation of the skin may cause distressing irritation, while, at about the same time, the respiratory system begins to show signs of involvement by a partial loss of voice and by a troublesome cough.

In the last war, the death-rate among well disciplined troops with effective respirators was low, approximately 2 per cent. of the mustard gas casualties, but the death-rate among those without the protection afforded by a satisfactory respirator was much higher. Fatal cases were almost unknown within the first 24 hours after exposure. Death occurred at any date from the second or third day in the most severe cases to the third or fourth week in the more lingering ones, the highest death-rate being at the end of the third or fourth day after exposure; and almost all the deaths were due to secondary broncho-pneumonia.

The main features of mustard gas vapour casualties may be briefly summarised as follows:—

(*a*) An insidious onset, with a latent period of two to 48 hours according to the concentration of the gas and the duration of exposure.

(*b*) Injury to the eyes, varying from simple conjunctivitis of a temporary nature to a severe keratitis and secondary septic complications of a grave character.

(*c*) Laryngitis, involvement of trachea and bronchi, and possibly necrosis of the mucous membrane, leading to severe bronchitis or broncho-pneumonia.

(*d*) Early nausea, or persistent vomiting, accompanied by epigastric pain.

(*e*) Erythema of the skin—early in the case of exposed areas or of hot, moist surfaces—which may proceed to vesication or excoriation, and may be followed by secondary septic infection.

(*f*) Slow healing of the blistered, devitalised areas and pigmentation of the ensuing scar.

The types of injury which might result from exposure to mustard gas vapour are summarised below.

(1) *Action on the Eyes.*

The eyes are usually the first to show signs of the irritant action of mustard gas vapour. Even so the visible onset of injury may be long delayed, the latent period varying from two to 48 hours, according to the dosage; but, once established, it usually develops with rapidity. The initial symptoms of smarting and irritation are soon followed by lachrymation, pain in the eyes

and headache; swelling of the eyelids quickly supervenes and may be so extreme as to close completely the palpebral fissure, while the simple lachrymation becomes muco-purulent as a result of secondary infection, and blepharospasm and photophobia are marked.

Changes in the eyeball itself are equally rapid; the injection which marked the onset of ocular signs is followed by swelling and oedema, to such an extent that the conjunctiva at the interpalpebral aperture may even project between the eyelids, forming a characteristic yellowish-white, opaque band on either side of the cornea. A similar swelling of the palpebral conjunctiva under the eyelids may produce two chemotic folds which add to the distressing appearance of the eye by projecting between the lids.

The cornea, in the early stages, is grey and hazy, the haziness fading off above and below where partial protection is given by the eyelids; its surface becomes blurred and lustreless, and later exhibits a typical "orange skin" appearance. Exfoliation of the corneal cells may occur, and in the presence of trauma ulceration may follow which, if complicated by secondary infection, may lead to permanent opacities and impairment of vision.

In serious cases, the condition of the cornea calls for the most careful and regular examination—a difficult procedure in view of the intense photophobia and blepharospasm. Recovery is slow; the oedema gradually subsides and the corneal epithelium begins to regain its lustre; gradually a condition is produced which is the exact opposite of the original appearance, that is to say, the inter-palpebral area previously a dead white is now once more vascular and goes through a period of injection, whilst the previously injected areas, protected by the eyelids, are regaining their normal tint.

In the absence of corneal ulceration or conjunctival adhesions no permanent after-effects are usually met with, but lachrymation and photophobia are liable to persist for some time, and neurasthenic conditions may supervene in susceptible individuals.

The experience of the last war, when eye casualties were produced by the vapour more often than by a direct splash of the liquid, showed that eye injuries fall into three main groups:—

(*a*) Mild cases, 75 per cent. of the total, fit for duty, on an average, in two weeks.

(*b*) Intermediate cases, 15 per cent., recovery in four to six weeks.

(*c*) Severe cases with corneal changes, about 10 per cent., recovery in two to four months. Of these only a very small minority sustained total loss or impairment of vision.

(2) *Action on the Respiratory Tract.*

The toxic effects of mustard gas vapour on the respiratory tract are shown by an early rhinitis (almost simultaneous with the onset of the conjunctivitis), accompanied by sneezing and the discharge of a profuse watery secretion, soon to become muco-purulent.

The larynx is usually affected early, and hoarseness or aphonia is frequent. The laryngitis may be mild if exposure has been limited to a low concentration, but oedema and even sloughing of the vocal cords may follow exposure to a high concentration.

In a severe case, the laryngeal inflammation tends to be reproduced in the trachea and bronchi, when the dry irritating cough, originally complained

of at the onset of the laryngitis, is replaced by a loose cough accompanied by profuse muco-purulent expectoration and pain behind the sternum. A rising temperature and pulse indicate the onset of a severe bronchitis which may be complicated by sloughing of the inflamed tracheal mucous membrane; secondary infection of the latter soon leads to the development of a bronchopneumonia with cyanosis. Rarely, abscess of the lung, bronchiectasis, or even gangrene of the lung may occur—not as a direct result of the gassing by mustard gas vapour, but of the secondary bacterial invasion which follows.

In the great majority of cases, however, the lesion is confined to a bronchitis which clears up in the course of a month or six weeks, leaving no after-effects.

(3) *Action on the Skin.*

Before describing the effects of mustard gas vapour on the skin it may be useful to mention some of the factors that influence the penetration of the gas or modify the severity of its action.

As in the case of liquid mustard gas, the vapour owes its penetrative powers to its ready solubility in the lipoid constituents of the skin. The degree of skin burning which follows is accentuated if the exposed skin area be a highly sensitive and tender region such as the scrotum, or if it be a surface which is subjected to constant friction, as is the case in the neck, the wrist and the ankles.

If the exposed skin surface be bare, the attack of the vapour will be direct, and the result more rapid than if the skin be clothed. This temporary protection of clothed areas is due to the fact that ordinary porous clothing material absorbs the vapour and retards its access to the skin; but if such clothing be worn beyond the period of actual exposure, or if the exposure be prolonged, the vapour retained by the clothing will increase the severity of the resulting skin burns.

This temporary protection varies in duration according to the nature, texture, thickness and degree of humidity of the clothing. Thus, a thin open-work cotton garment in close apposition with the body surface will not greatly retard the access of the vapour to the skin, whereas thick close-woven material, such as serge and woollen clothing generally, will definitely do so, and may even save the area from burns provided it be discarded on leaving the contaminated area.

After the lapse of the usual latent period, which may vary from 2 to 48 hours after exposure to the vapour of mustard gas, an erythematous blush appears over the affected area and gradually deepens in intensity until the skin looks scorched. This redness is not unlike the eruption of scarlet fever, and is usually accompanied by only a slight degree of irritation. The erythema is most marked on the skin areas which are hot and moist; dense tissues like the scalp, the palm of the hand or the skin of the heel usually escape unless the concentration of the vapour be high and localised to that area, as, for example, from drops of liquid mustard gas on a cloth cap.

The affected area soon begins to show superficial blistering in the form of small vesicles which rapidly coalesce to produce large blisters full of a clear, yellow serum; on evacuating this fluid and removing the overlying epithelium, a raw, red, weeping surface is exposed. As a rule vesication is complete by the second day, but blisters may appear in crops for days following exposure, even though all contaminated clothing was discarded at an early stage. Systemic disturbance is absent, unless the burns are extensive and severe; inter-

ference with sleep, however, may be caused by the distressing itching which may accompany the developing burns. Very mild cases may show simply erythema, followed later by pigmentation with scurfy desquamation, the "blister" stage being absent.

In severe cases the erythema may deepen to a dusky, almost violet tint, oedema of the skin is marked, and blisters appear in the dark background overlying a deep red or haemorrhagic base. Such blisters progress slowly, and are very prone to sepsis owing to the serious devitalisation of the tissues; ulceration is liable to spread beyond the limits of the blister, and healing is very slow. If sepsis occurs, it adds to the severity and duration of all lesions; the necrosed tissues form an excellent medium for pathogenic organisms, and death may result if extensive or deep burns are thus affected.

The healing of an uncomplicated vapour burn is more rapid than one due to liquid mustard gas, but a common feature of all mustard gas burns is the long time they take to heal. The chemical irritant seriously damages the vitality of the affected tissues, and all processes of skin repair are delayed.

The healing stage is characterised by a brownish or coppery pigmentation of the epithelial layers in the areas previously affected by the erythema. This staining, however, is superficial, and usually disappears with the normal desquamation of the superficial layers of the skin.

As a rule, serious after-effects are absent, and the scars resulting from vapour burns are shallow, but a chronic eczematous condition or a generalised furunculosis may, rarely, follow such burns and prove obstinate to treatment.

(4) *Other Effects of Mustard Gas Vapour.*

Apart from its direct action on the eyes, the respiratory organs and the skin, mustard gas vapour may indirectly, and mainly owing to secondary infection, produce signs and symptoms in more remote organs of the body:—

(a) *Alimentary tract.*—It has already been mentioned that an early nausea, or even vomiting, accompanied by epigastric pain, often occurs in vapour poisoning by mustard gas. This effect is due to the swallowing of saliva or nasal secretion impregnated with the gas. Although it may prove obstinate during the first day, it rarely persists for more than 48 hours; similarly, the accompanying epigastric pain is of short duration, and the intestines are not usually affected. There are no lasting after-affects, but a functional condition of persistent nausea or vomiting has been observed occasionally.

(b) *Urinary tract.*—Traces of albumen have been found in the urine of early fatal cases, most probably due to congestion from circulatory weakness and not as a result of the action of the gas on the kidneys. It is only in the late stages of fatal cases, and particularly in those instances where widespread septic burns have occurred, that renal complications have been noticed, such as an acute haemorrhagic nephritis. Pain on micturition, however, and even retention of urine may result from a local oedema and vesication of the penis.

(c) *Circulatory system.*—Blood changes are not met with, and any alteration in the leucocyte count is due either to pneumonic complications or to sepsis of the skin burns. Apart from the effects of the general toxaemias of pulmonary sepsis, no primary changes occur in the cardiac mechanism, but a functional condition of disordered action of the heart is not uncommon as a result of the gassing.

30. Nature of Casualties from Liquid Mustard Gas

The great majority of mustard gas casualties in the last war were caused by exposure to the vapour emanating from collections of the liquid deposited by shell. Aircraft bombs, owing to their different methods of construction, can contain more liquid gas than shells of the same total weight, and in addition aircraft can discharge liquid mustard gas as spray. Casualties in future wars may therefore be of more serious types caused by contamination by the liquid itself.

Casualties from the liquid may result in the case of:—

(i) persons in the open under falling spray;

(ii) persons near enough to the burst of a bomb to receive direct splashes of the liquid; and

(iii) persons who touch material objects which have splashes of the liquid upon them.

The types of injury which might result are summarised below.

(1) *Skin Burns due to the Liquid.*

(a) *On bare skin.*—Although liquid mustard gas is a direct irritant to the skin, the sensory irritation is not immediate; its high lipoid solubility enables it to penetrate tissues rapidly, but hours may elapse before the clinical signs make their appearance.

Penetration is rapid, and this rapidity is enhanced by an elevated temperature of the skin, or under hot weather conditions. Indeed, there is reason to suspect that constant exposure to heat, as in tropical or semi-tropical countries, leads to the acquisition of some degree of sensitivity to mustard gas.

The initial signs and symptoms of a typical mustard gas burn are an erythema at the site of contact, often accompanied by some itching; the capillaries become engorged, and oedema, with thickening of the skin, supervenes. The erythema deepens, and in severe cases may even assume a livid hue; a pale, parchment-like area makes its appearance in the centre of this erythematous zone, and a vesicle, tensely filled with clear, yellow serum, gradually forms. This vesicle is the result of an inflammatory exudation of fluid which may continue for several days, according to the depth of penetration of the liquid mustard gas; the exudate, however, contains no actual mustard gas.

If the liquid contamination of the skin be widespread, as in a smear or splash, the erythema is followed by the appearance of numerous small vesicles which gradually coalesce to form large blebs, the underlying area being raw and oedematous; such blisters may continue to develop in crops for several days after contamination.

There is no evidence that any of the liquid mustard gas finds its way into the general circulation. Apart from the itching—which may be most severe where warm moist parts of the body are affected—there is little or no irritation except some stinging while vesication is developing, and no pain follows the appearance of the latter. The danger of sepsis following, however, is a real one, especially if the blistered area be extensive, as the tissues affected are devitalised, and the blood supply is impaired.

In the absence of secondary infection no constitutional disturbance is usually noted, and primary shock is absent. Healing, however, is a slow process (partly because the blood supply has been damaged, and partly on account of residual mustard gas or its derivatives persisting in the tissues). The result-

ing scar, which is soft and pliable, often assumes a coppery pigmentation which disappears after a time.

(b) *On clothed skin.*—Drops of liquid mustard gas on clothed areas of the body act by virtue of the high concentration of vapour evolved, the warmth of the underlying skin naturally assisting the process. A gross contamination of the clothing, on the other hand, such as may be produced by splashes or by accidental spilling, may result in actual contact of the liquid with the skin, when the action of the vapour would be superadded to that of the liquid.

All ordinary clothing is pervious to liquid mustard gas; but it is obvious that penetration will be much more rapid in the case of the single thin cotton garment of tropical and sub-tropical countries than with the multiple layers of woollen clothing worn in temperate climates.

If the garments be damp or wet, small drops of liquid mustard gas will readily penetrate and burn the skin. Although no reasons can be given for this, it has been proved experimentally to be an accurate statement of fact.

(2) *Eye Burns due to the Liquid.*

Contamination of the eye by spray or splash represents one of the gravest dangers to which the body can be subjected in the presence of liquid mustard gas, as permanent damage will result.

The degree of discomfort which immediately follows contact of the liquid with the eye may be slight, and usually subsides; symptoms often commence within half-an-hour, however, and within an hour or two the eye is inflamed and the eyelids are swollen and painful.

The clinical signs are ushered in by profuse lachrymation and conjunctivitis, and the condition develops with great rapidity. The eyelids become painful, swollen and greatly thickened by oedema, the palpebral conjunctiva is red and oedematous and the cornea develops opacities, while the ocular conjunctiva becomes congested and shows signs of ulceration. Intra-ocular tension is increased, pain and headache are severe and a muco-purulent secretion exudes from the closed eyelids. Photophobia and blepharospasm may be extreme, and great difficulty is encountered in examining the swollen and painful eye.

Following actual liquid mustard gas contamination of the eye, large areas of the conjunctiva may readily be shed, and partial or complete loss of vision results from the extensive ulceration and subsequent scarring.

Persons who have suffered from severe liquid contamination of the eye are liable to a recurrence of the symptoms on the slightest abrasion even up to 20 years later. This is probably due to the devitalised condition of the eye.

31. Need for Preventive Treatment in case of Mustard Gas Contamination

In reading what follows on the treatment of persons contaminated by mustard gas, it should be remembered that many of these may also be suffering from wounds or physical injury. Such casualties will have to be dealt with according to the particular circumstances of the case, but the treatment for contamination should follow that laid down in the later sections of this chapter so far as is compatible with the nature of the wounds. Clothing should be completely removed, and the patient himself thoroughly cleansed in order to remove the contaminant, before the wounds are dressed.

Preventive treatment consists essentially in the speedy and complete removal of all contaminated clothing and in freeing the skin from the contaminant, whether liquid or vapour.

Exceptions to, or modifications of, this general rule may be met with, as, for example, in the case of a small localised liquid contamination of the bare hand, or after exposure to a low concentration of the vapour, when prompt local cleansing of the skin or a change of clothing respectively will suffice.

In view of the rapid penetration of the skin by mustard gas, treatment should not wait until a doctor is called, and it is part of the training advocated in A.R.P. Handbook No. 1 (Personal Protection against Gas) that all members of air raid precautions services, and as far as possible the general public, should be taught to undertake treatment for themselves. Nevertheless it is a matter of importance that it should be thoroughly understood by doctors.

Each case will have to be considered on its merits, but, whatever the type or extent of the contamination, *speed is the essence of all preventive treatment.* Delay of a minute or two in the case of liquid contamination, or of ten to fifteen minutes following exposure to the vapour, before cleansing of the skin is undertaken enhances the danger and may result in definite burns of the affected areas.

When the skin is hot as a result of exercise, and in hot or tropical countries, the results obtained by all preventive methods of decontamination of the skin are inferior to those obtained when the skin is cool and dry, and the need for prompt action is even greater.

After removal of all contaminated garments (which must not be used again until decontaminated) preventive treatment of the skin should be undertaken without delay. The choice of methods is not large, but one or more of them should be readily available at all times. The method adopted must be that which can be most promptly applied.

32. Preventive Treatment for Contamination from Mustard Gas Vapour

After contamination with the vapour of mustard gas—i.e., after exposure to an atmosphere contaminated with the gas, or when the outer clothing has been sprayed, or has otherwise come in contact with the liquid form of the gas—preventive treatment should consist of a rapid removal of all clothing, followed as soon as possible by a thorough washing of the whole body surface with soap and water, preferably under a shower.

Lavage of both eyes with warm water or normal saline should be carried out as soon as possible, and should be repeated every two hours. Similarly, the effects of vapour contamination of the nasopharynx may be minimised by prompt irrigations.

Attention is directed to the paragraph at the end of Section 10, describing the fundamental differences between affections of the eyes by lachrymatory and by vesicant gases.

33. Preventive Treatment for Liquid Mustard Gas Contamination

The following methods are possible:—

(a) *Bleach treatment.*—Thoroughly rub into the affected area, for a minute or so, either bleach ointment or other approved protective ointment, or aqueous bleach paste. This procedure chemically neutralises the mustard gas.

As a first step in the prevention of burns, when the contamination is small and localised, thorough rubbing with the ointment is the method of choice. For extensive contamination by the liquid, however, a thorough inunction with aqueous bleach paste will be found more easy of application.

When the operation is completed the ointment should be wiped off, or, if the aqueous paste was used, the affected part should be flushed with water —the object being, in each case, to remove surplus bleach from a potentially injured area. Bleach will destroy free mustard gas quickly, but it will also irritate the skin if left in contact with it. Care must be taken to prevent access of bleach to the eyes.

Bleach should *not* be used if an erythema has already developed, as it aggravates the condition.

Actual vesication of the skin by drops from mustard gas spray may be avoided if preventive treatment be undertaken within a minute or two after contamination. Even though the delay be longer, bleach will still be the method of choice so long as liquid mustard gas is visible on the skin, as it will mitigate the severity of the resulting burn.

Bleach ointment is made by mixing equal parts, by weight, of "supertropical" bleach and white mineral jelly, while the aqueous bleach paste consists of "supertropical" bleach mixed to a creamy consistency with water —roughly, one part of bleach to one or two parts of water by volume. The ointment keeps well in temperate climates, while the aqueous paste retains its effectiveness for several days if it be stored in enamelled containers with well fitting lids; for tropical climates a special protective ointment is desirable.

Bleaching powder is ordinary chloride of lime, while "supertropical" bleach is the same substance stabilised by the addition of quicklime, and fulfilling certain conditions of stability and chlorine-content.

Ordinary bleach is more irritating to the skin than the supertropical variety, but in the absence of the latter is suitable for preventive treatment when made up as an ointment with white mineral jelly, or into a paste with water, provided prolonged storage is not required.

The use of *white* mineral jelly is essential: yellow mineral jelly in contact with bleach may generate heat, and may even produce combustion on storage. If mixing is carried out in bulk, the employment of a mill is advocated in order to ensure a thorough and uniform consistency.

(b) *Removal of contamination by means of a solvent.*—Swab the contaminated area repeatedly with *petrol, kerosene, carbon tetrachloride* (but see Section 56), *or other solvent of liquid mustard gas.* It is important to remember that these solvents do not destroy the gas, but merely dissolve it; hence the swabbing must be confined strictly to the contaminated area, and must be repeated.

This method is effective if carried out by skilled individuals, and solvents are within easy reach; certain precautions, however, are very necessary. Oilskin or rubber gloves must be used if available; otherwise, the swab should be only partly immersed in the solvent, and it should be held between finger and thumb by the dry portion, or preferably in forceps, the wet portion is then applied to the contaminated skin so as to soak up the liquid contamination, care being taken that none of the solvent runs over the skin of either the subject or the operator; the contaminated swab is then discarded and the process is repeated for several minutes with fresh swabs, or as long as the characteristic odour of the gas persists on the skin. Thorough washing with

soap and water, if available, will complete the treatment. The contaminated swabs, must, of course, be destroyed by burning and the gloves and forceps decontaminated.

One disadvantage of this method in the hands of unskilled persons is that the solvent is apt to "run" on the skin and cause burns on areas comparatively far removed from the original site of contamination; a further disadvantage is the liability of the operator's fingers to become contaminated in the absence of gloves. Employed with care and intelligence, however, the method is valuable in an emergency.

(c) *Thorough washing.*—Wash thoroughly the affected part with *soap and water*, using frequent changes of water. This process does not destroy the mustard gas, but merely removes it in the lather; the scrubbing must, therefore, be confined to the contaminated area, and the hands should be safeguarded, if possible, by suitable gloves.

If the liquid contamination be small, localised and of known situation, this is an effective method of removing it if carried out promptly. In any case, vesication of the skin is usually prevented if the treatment is not delayed beyond five minutes, though an erythema will probably result.

With a gross contamination, or when the drops of liquid mustard gas are multiple, the results of scrubbing with soap and water are unfavourable, as it is difficult to avoid spreading the contaminant in the soapy lather to surrounding areas. Under these circumstances bleach treatment is the method to adopt if available.

Should it not be possible, however, to deal with such a contamination until some time has elapsed, thorough washing should still be carried out at the first available opportunity in the hope of mitigating the degree of burning.

(d) *Special treatment for eyes.*—Apart from the skin surfaces, the only other areas to which preventive treatment can be extended are the eyes.

Contamination of the eye by liquid mustard gas presents a very serious problem. Should an eye be contaminated by the liquid, however small the drop may be, immediate preventive treatment should be undertaken. None of the methods recommended for the skin is applicable for this purpose; simple, but rapid, removal of the contaminant by bland, unirritating methods is indicated.

This may be done by thoroughly flushing out the conjunctival sac with warm, plain water, or some bland solution, after opening the eyelids wide. This flushing should be most thorough and should be repeated hourly in the hope of mitigating the damage to the eye. If evidence of local irritation appears, a drop of liquid paraffin or castor oil should be instilled to prevent the eyelids adhering. Cocaine is contraindicated.

34. Curative Treatment for Mustard Gas Casualties*

The first essential in the treatment of mustard gas casualties is the prevention of further infection from contaminated clothing; it will be necessary, therefore, to strip the patient completely and to wash the entire body surface, employing frequent changes of soap and water. The opportunity should also be taken at this stage to douche the eyes thoroughly.

The second essential is to relieve immediate symptoms.

The question of treatment is best dealt with by taking in succession the various parts affected.

* The treament of Lewisite casualities is almost identical, except that vesicles are opened to lessen the danger of arsenic poisoning.

(a) *Treatment of the Eyes.*

Although *liquid* contamination of the eye may produce some irritation on contact, this usually subsides and may be followed by an absence of symptoms lasting about half-an-hour. Within one hour, however, the eye is red and swollen, and the lids are half closed. It should be unnecessary to stress the futility of waiting for such signs, or for subjective symptoms to appear, before undertaking systematic treatment. The risks attending liquid contamination of the eye are so grave that any history of such an accident should be sufficient to justify immediate and thorough treatment.

At this early stage treatment is limited to thorough and frequent lavage of the eye with a warm 2 per cent. solution of boric acid, or normal saline solution, in the hope of mitigating the severity of the inevitable lesion.

After the onset of clinical signs, treatment is largely symptomatic, and in the earlier stages will be confined mainly to the relief of pain and to free irrigation; the latter, however, will present some difficulty owing to the intense photophobia and blepharospasm which exist, and the general oedema which pervades the tissues.

When spasm and pain are marked the application of sterilised 1 per cent. atropine ointment (or perhaps an aqueous solution or lamellae) every 12 hours will give relief, and in all cases where the cornea is affected this treatment should be persisted in. Cocaine should not be used to allay the pain, as this drug, which exerts only a transient anaesthetic action, tends to loosen the corneal epithelium and facilitate ulceration.

Free drainage of the discharge is essential, and on no account should the eye be bandaged as this will only result in damming back the secretions with disastrous results. Shades of brown paper or other light material may readily be improvised to relieve the photophobia, and a few drops of sterilised liquid paraffin may be inserted several times a day to prevent the eyelids becoming glued together and impeding free drainage.

When the discharge becomes muco-purulent the instillation of a weak (2 per cent.) solution of argyrol or protargol twice daily will be found useful. This treatment is of particular importance when the cornea is grey and roughened, in order to avoid the danger of an infiltrating ulceration. Should this occur, the ulcer may be cautiously cauterised by the light application of pure carbolic acid put on with a nearly dry brush slightly moistened with the liquid. Frequent bathing and hot applications over the closed lids four times a day will assist in relieving pain.

If hypopyon supervenes and does not clear up with hot bathing, atropine and frequent cleansing of the conjunctival sac, Saemisch section is indicated.

With *vapour* contamination of the eye the prognosis is very much more favourable, and it is important that the patient be reassured from the outset that his eyesight will not be lost. Treatment, however, must be prompt and assiduous, as all contamination of the eye, however light, is a prolific source of invalidism.

For mild cases, where exposure to the vapour has been of a short duration, frequent lavage or warm irrigations every two hours will suffice to clear up the condition. The instillation of a few drops of liquid paraffin will prevent the tendency of the eyelids to adhere, and a quiet, darkened room or an eyeshade will materially add to the patient's comfort if any degree of photophobia be present. An astringent lotion and general tonic treatment will complete the cure.

In more severe cases, however, both pain and spasm may be marked, and the cornea may be affected. Under these conditions the treatment should be on the lines of that recommended for cases of liquid contamination, the primary indication being the prevention of corneal ulceration or the formation of adhesions.

(b) *Treatment of the Respiratory Tract.*

The early *rhinitis* is usually overshadowed by the condition of the eyes; should there be pain and distressing discharge it may be treated with copious warm douches of sodium bicarbonate in 5 per cent. solution several times daily. In the rare cases where a persistent muco-purulent discharge, associated with ulceration and occasionally with epistaxis, is long continued, an astringent lotion containing zinc sulphate with boric acid will be found helpful.

Laryngitis.—The laryngeal irritation is best dealt with by topical treatment such as laryngeal spraying or by the inhalation of steam from a pint of boiling water containing a teaspoonful of a mixture of menthol grs. 10 in 1 oz. tinct. benzoin. co.

Broncho-pneumonia.—As the majority of deaths from mustard gas in the last war were due to secondary infections of the respiratory tract, treatment should be directed, from the outset, towards combating bacterial invasion of the bronchi.

As a preliminary step against extraneous infection, all cases of mustard gas poisoning in which the respiratory tract is involved must be kept apart from other patients suffering from infective pulmonary disorders; they should, if possible, be segregated in special wards, and the onset of broncho-pneumonia in one of them should entail his isolation.

The routine employment of volatile antiseptics from the earliest stage will be facilitated by the adoption of a pliable, perforated mask, fashioned in the form of a Burney Yeo inhaler, containing a pad of gauze on which a few drops of the antiseptic are placed hourly. A useful formula is the following:—

Menthol	gr. 20
Chloroform	min. 60
Creosote	min. 60
Ol. Eucalypti	min. 20
Tinct. Iodi	min. 30
Sp. Vini Rect.	to one ounce

The value of menthol in mustard gassing is enhanced in those cases which require operative treatment for some concomitant wound. In these cases the laryngitis is such that, until it has been allayed by the inhalation of menthol, it may be impossible to induce anaesthesia, as the anaesthetic sets up paroxysms of coughing.

In the various stages of the broncho-pneumonia, treatment is symptomatic and follows the recognised rules of procedure, including the employment of expectorants when the muco-pus is tenacious and difficult of expulsion. It may be stated here that the prophylactic venesection advocated for phosgene cases, which is of value in the early treatment of pulmonary oedema, has no place in the treatment of mustard gas cases, though occasionally it may be indicated at a later stage to relieve the right heart of embarrassment and cyanosis induced by a diffuse broncho-pneumonia. The same may be said

of oxygen therapy, which, although essential in the pulmonary oedema caused by phosgene, is only indicated occasionally and at a late stage in mustard gas poisoning when a condition of oxygen want is established as the result of grave and widespread pulmonary damage.

(c) *Treatment of the Skin.*

As in other regions of the body, septic infection is the most potent factor in delaying the satisfactory healing of skin burns. When it is remembered that mustard gas penetrates, and in so doing devitalises, the skin, it is obvious that early preventive treatment is of paramount importance, inasmuch as it will lessen the severity of the skin burns and reduce the risk of sepsis, and that any curative treatment should have some antiseptic value.

As a preliminary to all local treatment it is essential to cleanse the skin as thoroughly as its damaged condition permits, and to clip short all hair, if any, on the affected area. *It may be useful to repeat here that the application of bleach in any form to a skin which is already showing signs of damage will aggravate the ensuing burn.* It must also be noted that skin surfaces damaged by mustard gas are exceedingly susceptible to trauma, and that even the continued pressure of an ill-fitting bandage may lead to an extension of the damage.

As treatment will vary according to the nature and degree of the burns, it will be best to consider these in detail:—

(i) *Erythema.*—Mild cases which do not proceed beyond an erythema heal spontaneously, with possibly some desquamation and pigmentation. They may be compared to sunburns in severity and discomfort, and clear up just as readily. If the skin is unbroken a mildly antiseptic dusting powder may be applied.

(ii) *Vesication.*—It is this stage that will afford a critical test of successful treatment through the elimination of secondary infection, as the devitalisation of the tissues in these cases is much more profound.

Any available cleansing treatment in use in surgical practice will suffice for the undamaged skin surrounding the burn itself. In the last war extensive use was made of Eusol and of Dakin's solution for the treatment of burns, but they are too painful for continued use on raw surfaces. Picric acid and similar powerful germicides are undesirable because of the toxic symptoms that may follow their absorption, while ointments and pastes are, as a rule, contraindicated because of their tendency to seal up discharges; for the same reason powders are undesirable as they are apt to produce crusts which retain the discharge.

When discrete, circumscribed blisters make their appearance they should be evacuated, under aseptic conditions, by means of a hypodermic syringe or a sterile needle, gentle pressure being applied, if necessary, upon the walls of the blister with a sterile swab to ensure complete evacuation; the intact epithelium should then be allowed to collapse and seal down the raw, sensitive surface underneath. This evacuation of fluid from blisters may have to be repeated owing to the continued oozing of serum from the raw area; if this procedure be delayed some hours the serum may be found to have coagulated, in which case the overlying epithelium should also be removed. The further treatment of these circumscribed vesicles consists in the application of dry dressings.

Satisfactory results have followed the use of crude cod liver oil in the

treatment of comparatively small mustard gas burns after evacuation of the blister and removal of dead skin: the healing of the burns was rapid. The oil is freely applied on lint, which is then covered by a pad of cotton wool. The dressings are changed daily; little or no irritation is caused, and the oily dressings come off easily and without pain.

When larger areas are affected, however, and when the blisters are confluent, better results will follow the use of a non-irritating antiseptic such as "Dettol", made by adding 20 per cent. by volume of "Dettol" to a freshly prepared 5 per cent. solution of tannic acid. After evacuating all blisters and removing the loose epithelium, the solution is applied directly to the raw surfaces either as a spray or, preferably, on lint, as a coagulum appears to form more quickly on a moist dressing than when an atomiser is used. Three or four layers of the lint are soaked in the mixture and applied to the burnt area, which is then covered lightly with cotton-wool and a gauze bandage; the cotton-wool and bandage may be removed every two or three hours, but the lint is left in position and is re-soaked. The entire dressing may be removed at the end of 8 to 12 hours, by which time a firm coagulum has formed; this is then sprayed with 5 per cent. tannic acid solution and dried.

A further step towards the reduction of possible infection may be taken by swabbing a large area surrounding the burn with the antiseptic, for the sepsis which sometimes occurs at the edges of the coagulum appears to originate from the surrounding skin; further, it is advisable to repeat this swabbing every four or six hours until the coagulum has separated.

After the separation of the coagulum, the general principles of wound treatment are applied to the unhealed areas which remain; stimulating lotions or scarlet red ointment will be found of use in encouraging the growth of new epithelium.

In cases where the condition is already septic continuous baths, at body temperature, of a mildly antiseptic nature will prove both soothing and efficacious, while hot hip baths of isotonic salt solution are helpful in allaying the intense irritation of mustard gas burns of the groin and genitalia. If hot compresses or fomentations be employed, lint should be used in preference to gauze as it is less painful to remove; oiled silks should be avoided, as they keep the burns sodden and retain the discharge.

35. General Treatment for Mustard Gas Casualties

Where nausea, vomiting or epigastric discomfort is present, the diet should be light and fluids may be given freely; should these not be retained, the administration of 10 to 20 grs. of sodium bicarbonate may be of assistance, and the patient should be encouraged to drink water freely. As convalescence proceeds, and in all cases of uncomplicated body burns, a full diet is required, and this should be as varied as possible. Cases showing evidence of commencing fever, which may be a prelude to broncho-pneumonia, should be suitably dieted.

Experience has shown the importance of combating functional after-effects. Functional disorders fall, in the main, into two classes. In the first, exposure to gas, often to a minimal and barely toxic concentration, may yet prove the final factor in upsetting a nervous system already breaking down as the result of physical or mental strain. In such circumstances, and especially when combined with ignorance, it may produce an "anxiety state" similar in all respects to the neurosis so common in the last war.

The second class is a more important one, because in these cases alocal, but real, organic lesion from mustard gas causes certain irritant reflexes, such as coughing or photophobia, and these sensory reflexes are perpetuated by introspection, almost in a form of conversion hysteria, long after their organic cause has been cured. Lack of appreciation of this possibility by doctors will cause much delay in discharging casualties.

Functional photophobia and aphonia are responsible for the great majority of cases. This is not surprising when it is realised that the initial trauma affects a highly organised special sense, and that fear of blindness or dumbness resulting from the injury may very well act to prolong the symptoms. Ill-advised and unnecessary treatment, however, is also a probable factor in many cases, as, for example, the continued retention of eye-shades long after the necessity for them has passed and the actual lesions have totally disappeared. There can be no doubt that the suggestive influence of wearing a shade under these conditions will prolong the functional manifestation.

Persistent aphonia, often accompanied by a useless, harsh cough, is another striking evidence of auto-suggestion arising from the initial laryngeal irritation. The characteristic cough is either dry, or accompanied by watery sputum mainly of salivary origin; it is usually much worse at night, and is of a ringing, harsh quality. If the doctor realises the nature of the condition and gives the patient confidence in his early recovery, this functional aphonia yields very rapidly to treatment by suggestion and breathing exercises.

Of all after-effects, functional or organic, those which seem to affect the heart present the greatest difficulty in assessment. Disordered action of the heart ("D.A.H." or effort syndrome), with its shortness of breath and tachycardia following exercise, arises from so many diverse causes that gassing was naturally regarded as one of them. It is clear, however, that under competent medical treatment, the incidence of "D.A.H." in mustard gas casualties should be very low provided that serious complications, such as broncho-pneumonia, have been absent.

36. Invalidism after Mustard Gas Poisoning

Experience from the last war showed that the chemical damage to the skin, to the respiratory passages, and to the outside of the eyes might cause prolonged devitalisation of these tissues and a poor resistance to secondary bacterial infection but no deeper trouble resulted. There has been no subsequent evidence of the irritation leading to later malignant changes in any tissue. The skin ultimately regained perfect vitality. The trachea and bronchi in some cases showed a tendency to relapses of bronchitis, but there was no special proneness to pulmonary tuberculosis. In a few, and fortunately very rare, cases the cornea never regained its natural vitality, and after even 15 or 20 years a superficial abrasion and infection might spread rapidly and cause permanent loss of sight.

Invalidism in general was not prolonged, but it should be remembered that the casualties dealt with in the war were very largely from exposure to mustard gas vapour and only rarely had they been affected by direct splashes of the liquid. In all cases admitted to hospitals there was some degree of conjunctivitis and laryngitis as well as skin burns. The skin lesions from vapour healed quickly, usually in less than a month. Prolongation of invalidism was due rather to trouble in the respiratory passages and eyes, and to general debility. By following up the times of recovery in a large number

of cases at convalescent depots in France, it was proved that at least 75 per cent. of mustard gas casualties admitted to hospitals on the lines of communication, these being the severer cases evacuated from the army zone, could be returned to full duty in less than eight weeks. This involved an average stay in hospital of two to three weeks, during the last half of which time the casualties did not require to be in ward beds or to be specially attended by nursing orderlies.

The worst cases might remain in hospital for two months or even longer. Photophobia, either functional or associated with a tendency to recurrent keratitis, often lingered. Next as causes of invalidism came bronchitis and laryngitis, and lastly D.A.H. and neurasthenia or some general debility. But out of a group of nearly 800 severe cases detained in hospital beyond the ninth week, none died and ultimately only 0.5 per cent. were discharged as permanently unfit for service. The ultimate invalidism from mustard gas vapour was therefore very small. As in the instance of phosgene poisoning, it is probable that any persistent chest trouble was due to mischief wrought by the smouldering inflammation of secondary bacterial infections rather than by a direct chemical action. Doctors should realise that gas poisoning, whatever the chemical irritant concerned, does not in itself cause a permanent poisoning of the patient or chronic impairment of his health. It is necessary to insist on this truth lest the patient be allowed to develop a morbid dread, and drift into neurasthenia and general debility.

APPENDIX A

TABLE OF GASES

Example.	Properties.	Effects.	Remarks.
Tear Gases—			
Chlor-aceto-phenone (C.A.P.) (non-persistent).	A solid. Almost invisible in gaseous state. Recognised by irritation to eyes.	Irritation or stinging of eyes followed by copious flow of tears and spasm of eyelids. Slight skin irritation.	Respirator affords complete protection.
Ethyl-iodo-acetate (K.S.K.) (persistent).	A dark brown liquid. Invisible in gaseous state. Recognised by irritation to eyes.	Do., but no skin irritation.	Do.
Bromo-benzyl-cyanide (B.B.C.) (persistent).	A yellowish-brown crystalline solid when pure. As used—a liquid mixture. Invisible in gaseous state.	Similar to K.S.K.	Do.
Nose Irritant Gases—			
Di-phenyl-chlor-arsine (D.A.) (non-persistent).	A colourless, crystalline solid which when heated gives off an almost odourless smoke. Generally invisible except near the source. Can still be effective although not visible. Recognised by effects, which are slightly delayed.	Produces sneezing; burning pain in chest, throat, nose and mouth; mental depression.	Do.

APPENDIX A

TABLE OF GASES

Example.	Properties.	Effects.	Remarks.
Di-phenyl-amine-chlor-arsine (D.M.) (non-persistent).	A bright yellow, crystalline solid. General properties similar to D.A.	Produces sneezing; burning pain in chest, throat, nose and mouth; mental depression.	Respirator affords complete protection.
Di-phenyl-cyano-arsine (D.C.) (non-persistent).	A crystalline solid with properties similar to D.A.	Do.	Do.
Lung Irritant Gases—			
Chlorine (non-persistent).	A gas-greenish colour. Corrodes metals. Is dissolved in water. Will eventually rot clothing. Smell of bleaching powder.	Highly lethal, owing to damage to lungs. Early symptoms: cough and watering of eyes. Signs of lung damage develop later.	Do.
Phosgene (non-persistent).	A gas—almost invisible. Corrodes metals. Is rendered less effective by heavy rain. Smell of musty hay.	Do.	Do.
Di-phosgene (non-persistent).	A colourless liquid. Invisible in gaseous state.	Do.	Do.
Chloropicrin (P.S.) (semi-persistent).	A colourless, volatile liquid with a pungent odour.	Generally similar to above. Also causes sickness and slight irritation of eyes.	Do.
Blister Gases—			
Mustard gas (H.S.) (very persistent)	An oily liquid which may vary in colour from dark brown to straw yellow. Soluble in oil and spirits. Neutralised by bleaching powder. Great power of penetration. Smell of garlic, onions, horse-radish or mustard. Liquid may be seen.	(1) Vapour. (a) In eyes; irritation and inflammation with swelling and Temporary loss of vision usually develop within 24 hours, but tears earlier if the vapour concentration is high. (b) In lungs; loss of voice and cough. Later possibly bronchitis and broncho-pneumonia. (c) On skin; redness, irritation and perhaps blisters; but to an unprotected man, the eye damage is worse than the lung or skin effects. (ii) Liquid. (a) In eyes; immediate irritation, eye closes in about one hour. (b) On skin; no irritation. redness in 2 hours followed by blister in 12 to 24 hours. (c) The effect of swallowing food contaminated by liquid mustard gas is severe injury to stomach and intestines.	Respirator protects eyes and lungs only.

APPENDIX A

TABLE OF GASES

Example.	Properties.	Effects.	Remarks.
Lewisite (very persistent, but less so than mustard gas).	A colourless liquid when pure; brown in the crude state. Gives off an invisible gas. Is rapidly destroyed by water and any alkali. Great power of penetration. Has a low freezing point. Smell of geraniums.	(i) Vapour. Causes severe irritation to nose. Hence respirator will be adjusted immediately so that there will be no permanent effects on eyes, nose or lungs. Is less effective on skin than mustard gas vapour. (ii) Liquid. (a) In eyes; immediate effect and permanent injury. (b) On skin; blisters develop more rapidly than with mustard gas.	Respirator protects eyes and lungs only.
Paralysant Gases—			
Hydrocyanic acid (non-persistent).	A colourless, volatile liquid with a smell of bitter almonds.	Small amounts of vapour cause giddiness and headache; larger doses cause unconsciousness and death	Respirator affords complete protection to the lungs.
Hydrogen sulphide. (non-persistent).	A colourless gas with characteristic smell of bad eggs.	Small doses cause irritation of eyes and nose; large doses cause unconsciousness and death.	Respirator affords complete protection.
Other Gases—			
Carbon monoxide. (non-persistent).	A colourless, odourless gas.	Causes giddiness, tiredness, then unconsciousness and death.	Respirator does not protect against this gas. Unlikely to be used as a war gas on account of its physical properties.
Nitrous fumes (non-persistent).	Reddish-brown fumes. Pungent smell.	Irritation of nose, throat and lungs.	Respirator gives adequate protection for limited periods.

In the case of Lewisite if vesication occur, and especially if the area thus affected be extensive, it is essential that the fluid in the blister be evacuated early, the epithelium removed and the raw surface irrigated, in order to lessen the danger of absorption of arsenic. In the absence of sepsis such burns heal more rapidly than the corresponding mustard gas burns.

The Nova Scotia Medical Bulletin

Official Organ of The Medical Society of Nova Scotia.

Published on the 20th of each month and mailed to all physicians and hospitals in Nova Scotia. Advertising forms close on the last day of the preceding month. Manuscripts, preferably typed and double-spaced, should be in the hands of the editors on or before the 1st of the month. Subscription Price:—$3.00 per year.

VOL. XVIII. SEPTEMBER, 1939 No. 9

IN view of the unhappy fact that our country is now in a state of war your Editors have thought it to be fitting to devote this number to the subject of Air Raid Precautions. The probability of any city, town or village even in this sea girt province being bombed is in all likelihood quite remote. It must, however, be considered a possibility and the wisdom of taking precautions is beyond question.

It is considered to be a matter of national importance that as many as possible of the medical practitioners in the country should learn the effects of war gases and the appropriate methods of treatment. This is necessary so that, in the event of air attack accompanied by the use of gas, they can treat casualties among the civilian population; and in addition they will be able in time of peace to speak with authority on occasions when reference is made to the dangers of gas in war. Great importance is attached to the doctor, with the influence of his professional status, having the knowledge and authority to speak on the problems which might arise if gas should unfortunately ever be used against our people. On this, as in other matters, a doctor should be prepared to be consulted by his patients.

Major Gerald R. Burns who has had special training in dealing with the casualties resulting from this type of warfare has guided us in the selection of material deemed most practical from Air Precautions, Handbook No 3. Medical Treatment of Gas Casualties.

H. W. S.

Department of the Public Health

PROVINCE OF NOVA SCOTIA

Office—Hollis Street, Halifax, N. S.

MINISTER OF HEALTH - - - - HON. F. R. DAVIS, M.D.,F.A.C.S., Halifax

---

Chief Health Officer - - - - - - - DR. P. S. CAMPBELL, Halifax.
Divisional Medical Health Officer - - - DR. C. J. W. BECKWITH, D.P.H., Sydney.
Divisional Medical Health Officer - - - DR. J. J. MACRITCHIE, Halifax.
Divisional Medical Health Officer - - - Dr. J. S. Robertson, D. P. H., Yarmouth.
Statistician and Epidemiologist - - - Dr. Harold Robertson, C. P. H., Halifax.
Director of Public Health Laboratory - - DR. D. J. MACKENZIE, Halifax.
Pathologist - - - - - - - - - - DR. R. P. SMITH, Halifax.
Psychiatrist - - - - - - - - - - DR. ELIZA P. BRISON, Halifax.
Sanitary Engineer - - - - - - - - R. DONALD MCKAY, B.Sc., A.M.E.I.C.
Superintendent Nursing Service - - - MISS M. E. MACKENZIE, Reg. N., Halifax.

OFFICERS OF THE PROVINCIAL HEALTH OFFICERS' ASSOCIATION

President - - - - - - DR. H. E. KELLEY - - - - - - - Middleton
1st Vice-President - - - DR. R. C. ZINCK - - - - - - - - Lunenburg
2nd Vice-President - - - DR. C. I. MACMILLAN - - - - - - - Baddeck
Secretary-Treasurer - - - DR. P. S. CAMPBELL - - - - - - - Halifax

COUNCIL

DR. W. D. FORREST - - - - - - - - - - - - - - - Halifax
DR. J. E. LEBLANC - - - - - - - - - - - - - - West Pubnico
DR. T. R. JOHNSON - - - - - - - - - - - - - - Great Village

MEDICAL HEALTH OFFICERS FOR CITIES, TOWNS AND COUNTIES

ANNAPOLIS COUNTY

Hall, E. B., Bridgetown.
Braine, L. B. W., Annapolis Royal.
Kelley, H. E., Middleton (Mcpy. & Town).

ANTIGONISH COUNTY

Cameron, J. J., Antigonish (Mcpy).
MacKinnon, W. F., Antigonish.

CAPE BRETON COUNTY

Densmore, F. T., Dominion.
Fraser, R. H., New Waterford.
Francis, Bernard, Sydney Mines.
Sutherland, Harvey, Glace Bay.
McLeod, J. K., Sydney.
O'Neil, F., Sydney (County, South Side).
Murray, R. L., North Sydney.
Townsend, H. J., Louisbourg.
Gouthro, A. C., Little Bras d'Or Bridge, (Co. North Side).

COLCHESTER COUNTY

Eaton, F. F., Truro.
Havey, H. B., Stewiacke.
Johnston, T. R., Great Village (Mcpy).

CUMBERLAND COUNTY

Bliss, G. C. W., Amherst.
Gilroy, J. R., Oxford.
Hill, F. L., Parrsboro, (Mcpy).
Cochrane, D. M., River Hebert (Joggins).
Withrow, R. R., Springhill.
Stuart, C. E., Parrsboro.

DIGBY COUNTY

Belliveau, P. E., Meteghan, (Clare Mcpy).
DuVernet, Edward, Digby.
Rice, F. E., Sandy Cove, (Mcpy).

GUYSBORO COUNTY

Chisholm, D. N., Port Hawkesbury (Mulgrave).
Sodero, T. C. C., Guysboro (Mcpy).
Moore, E. F., Canso.
Monaghan, T. T., Sherbrooke (St. Mary's Mcpy).

HALIFAX COUNTY

Morton, A. R., Halifax.
Forrest, W. D., Halifax (Mcpy).
Payzant, H. A., Dartmouth.

HANTS COUNTY

Bissett, E. E., Windsor.
MacLellan, R. A., Rawdon Gold Mines (East Hants Mcpy).
Reid, A. R., Windsor, (West Hants Mcpy).
Shankel, F. R., Windsor, (Hantsport).

INVERNESS COUNTY

Chisholm, D. N., Port Hawkesbury.
Grant, T. E., Port Hood.
Proudfoot, J. A., Inverness.
McNeil, A. J., Mabou, (Mcpy).

KINGS COUNTY

Bishop, B. S., Kentville.
Bethune, R. O., Berwick, (Mcpy).
de Witt, C. E. A., Wolfville.
Moreash, R. A., Berwick.

LUNENBURG COUNTY

Marcus, S., Bridgewater (Mcpy).
Donkin, C. A., Bridgewater.
Donaldson, G. D., Mahone Bay.
Zinck, R. C., Lunenburg.
Zwicker, D. W. N., Chester, (Chester Mcpy).

PICTOU COUNTY

Blackett, A. E., New Glasgow.
Chisholm, H. D., Springville, (Mcpy).
Bagnall, P. O., Westville.
Crummey, C. B., Trenton.
Dunn, G. A., Pictou.
Parker, V. H. T., Stellarton.

QUEENS COUNTY

Ford, T. R., Liverpool.
Smith, J. W., Liverpool, (Mcpy).

RICHMOND COUNTY

Deveau, G. R., Arichat, (Mcpy).

SHELBURNE COUNTY

Corbett, J. R., Clark's Harbour.
Fuller, L. O., Shelburne, (Mcpy).
Dinsmore, J. D., Port Clyde, (Barrington Mcpy).
Lockwood, T. C., Lockeport.
Churchill, L. P., Shelburne, (Mcpy).

VICTORIA COUNTY

MacMillan, C. L., Baddeck, (Mcpy).

YARMOUTH COUNTY

Hawkins, Z., South Ohio, (Yarmouth Mcpy).
Caldwell, R. M., Yarmouth.
Lebbetter, T. A., Yarmouth, (Wedgeport).
LeBlanc, J. E., West Pubnico, (Argyle Mcpy).

Those physicians wishing to make use of the free diagnostic services offered by the Public Health Laboratory, will please address material to Dr. D. J. MacKenzie, Public Health Laboratory, Pathological Institute, Morris Street, Halifax. This free service has reference to the examination of such specimens as will assist in the diagnosis and control of communicable diseases: including Kahn test, Widal test, blood culture, cerebro spinal fluid, gonococci and sputa smears, bacteriological examination of pleural fluid, urine and faeces for tubercle or typhoid, water and milk analysis

In connection with Cancer Control, tumor tissues are examined free. These should be addressed to Dr. R. P. Smith, Pathological Institute, Morris Street, Halifax.

All orders for Vaccines and sera are to be sent to the Department of the Public Health Metropole Building, Halifax.

Report on Tissues sectioned and examined at the Provincial Pathological Laboratory, from August 1st., to September 1st., 1939.

During the month, 263 tissues were sectioned and examined, which with 27 tissues from 7 autopsies, makes a total of 290 tissues for the month.

Tumours, simple	44	
Tumours, malignant	33	
Tumours, suspicious of malignancy	..	
Other conditions	186	
Tissues from 7 autopsies	27	
		290

Province of Nova Scotia Division of Vital Statistics

Provisional Monthly Report—July 1939

	July, 1939				June, 1939
	Total	Male	Female	Rate	Rate
No. of live births	1,011	496	515	21.7	25.3
No. of stillbirths	34	19	15	32.5**	30.6**
No. of deaths	498	268	230	10.7	10.9
No. of deaths under 1 year of age	55	36	19	54.4*	53.5*
No. of deaths from puerperal causes	7	...	7	6.9*	6.1*

Causes of Death	Int. List No.	July, 1939				June, 1939
		Total	Male	Female	Rate	Rate
Typhoid Fever	....	..	..	..	.....	.....
Measles	....	..	..	..	.....	.....
Scarlet Fever	....	..	..	..	.....	.....
Whooping Cough	....	..	..	..	.....	.....
Diphtheria	10	1	1	..	2.1	.....
Influenza	11	10	4	6	21.5	33.3
Pulmonary Tuberculosis	23	37	19	18	79.5	66.6
Other forms of Tuberculosis	24-32	4	2	2	8.6	13.3
Cancer and other Malignant tumors	45-53	56	19	37	120.3	137.7
Cerebral homorrhage, thrombosis and ombolism	82a, 82b	17	9	8	36.5	20.0
Diseases of the Heart	90-95	95	62	33	204.1	182.0
Diseases of the Arteries	96, 97, 99, 102	39	20	19	83.8	115.5
Pneumonia (all forms)	107-109	21	11	10	45.1	51.1
Diarrhea and Enteritis under 2 yrs. of age	119	2	1	1	2.0*	.....
Nephritis	130-132	34	17	17	73.1	57.7
Diseases of Early Infancy	158-161	32	20	12	31.7*	29.8*
Accident	176-195	34	25	9	73.1	53.5

* Rate expressed as number of deaths per 1000 live births.
**Rate expressed as number of stillbirths per 1000 total births.

Provisional Monthly Report of Births and Deaths July, 1939.

	BIRTHS									DEATHS														
	Total Births	Live Births					Still Births			Total	All Causes		Puerperal	Under 1 year of Age	Influenza	Pulmonary Tbc.	Other forms of Tbc.	Cancer	Cere. hem. Embolism Thrombosis	Heart Disease	Disease of the Arteries	Pneumonia All Forms	Diarrhea under 2 years	Nephritis	Diseases of Infancy	Accident
		Total	Legitimate		Illegitimate		Total				M.	F.														
			M.	F.	M.	F.		M.	F.																	
Nova Scotia	1045	1011	466	487	30	28	34	19	15	498	268	230	7	55	10	37	4	56	17	95	39	21	2	34	32	34
Annapolis	21	21	9	10	2	..	..	..	..	13	7	6	..	3	..	2	..	1	..	2	1	..	..	..	3	3
Antigonish	26	25	12	13	..	..	1	1	..	11	6	5	..	1	..	1	..	..	..	1	..	..	..	2	1	..
Cape Breton	210	202	94	105	1	2	8	3	5	74	36	38	..	13	2	5	1	6	5	12	3	6	1	1	6	..
Colchester	49	48	21	24	..	3	1	1	..	18	6	12	1	..	..	1	..	4	..	3	3	1	..	1	..	2
Cumberland	71	70	36	31	3	..	1	1	..	35	17	18	1	3	..	..	..	7	..	6	2	..	..	5	2	..
Digby	33	32	14	17	..	1	1	1	..	23	13	10	..	3	1	2	..	1	1	5	2	..	..	3	2	..
Guysboro	26	26	14	10	1	1	..	..	..	7	3	4	..	..	..	1	..	3	..	2	..	..	..	1	..	..
Halifax	215	206	96	92	10	8	9	5	4	89	55	34	1	10	..	4	..	14	2	17	6	6	..	4	7	9
Hants	47	45	25	19	1	..	2	2	..	13	6	7	1	..	..	..	..	..	..	3	2	..	..	1	..	1
Inverness	36	33	11	20	1	1	3	1	2	16	9	7	..	3	1	2	2	..	1	2	1	1	..	1	..	..
Kings	73	72	29	40	1	2	1	1	..	50	28	22	..	4	4	13	..	5	..	11	2	3	..	4	1	1
Lunenburg	44	44	22	18	2	2	..	..	..	57	28	29	2	9	1	1	1	7	5	11	5	2	1	2	5	2
Pictou	74	71	36	27	4	4	3	2	1	33	20	13	..	..	..	2	..	3	1	10	4	1	..	5	..	3
Queens	28	24	11	11	1	1	4	1	3	5	3	2	..	2	..	..	..	..	..	..	..	..	..	1	2	..
Richmond	17	17	5	11	..	1	..	..	..	13	9	4	..	1	..	2	..	..	1	3	3	..	..	1	..	..
Shelburne	19	19	6	10	2	1	..	..	..	12	6	6	..	..	..	1	..	2	..	3	2	..	..	1	..	2
Victoria	6	6	4	2	..	..	..	..	..	3	2	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..
Yarmouth	50	50	21	27	1	1	..	..	..	26	14	12	1	3	1	..	..	3	1	4	3	1	..	1	3	1

Note: These figures are based on the Birth and Death certificates received by the Division of Vital Statistics, Halifax, N. S., up to and including August 10, 1939 and represent the number *registered* with the Division Registrars during the month of July, 1939.

OBITUARY

THE death occurred suddenly while presiding over a meeting of the Board of Health in the City of Halifax of Dr. William Duff Forrest on the afternoon of September 12th. Dr. Forrest was born in 1873, son of the late Rev. Dr. John Forrest, past president of Dalhousie University. He was educated first in the public schools of Halifax and later at Dalhousie University where he first received his B.Sc. degree in 1895 and the M.D.,C.M. in 1898. After serving as an interne at the Victoria General Hospital, Halifax, he went to London, England, where he received the degrees of M.R.C.S. and L.R.C.P. He established practice in Halifax in 1901 and was there from that time until his death.

Dr. Forrest took an active part in public affairs throughout his whole life. Besides his interest in medical matters he was an active member of the Canadian Club, the Commercial Club, the Red Cross Society and the Anti-Tuberculosis League. At the time of his death he was a director of the School for the Blind, Chairman of the Board of Health for Halifax City and member of the Legislative Assembly for Halifax Centre.

His funeral, which was one of the largest ever seen in Halifax, took place from Fort Massey Church on Friday afternoon, September 15th., the pall bearers were Premier Angus L. Macdonald, Mayor Walter Mitchell, Hon. A. S. MacMillan, Dr. James Corston, Dr. Angus McD. Morton and C. Jost Hamilton.

There remain to survive him his wife, formerly Miss Frances Thomas, two daughters, Nancy and Margaret, and three brothers, Archibald A. and George Munro Forrest of Rye, New York, and Jack Forrest of New Jersey; also one sister Miss Jean Forrest of Halifax.

The BULLLETIN extends its sympathy to Dr. Roberta Bond-Nichols on the death of her husband, Dr. Edward Wilber Nichols, which took place at Halifax on August 26th.

Dr. Nichols was born at Lansdowne, Digby County, and received his first education in the schools of Digby County. Following that he entered Dalhousie where he took his B.A. in Arts in 1906 and four years later his Masters degree. He then went to Yale University and received his Ph.D. degree in 1913. He first was instructor in Classics at Yale for a number of years, then returned to Dalhousie as Assistant Professor of Classics in 1919, and at the time of his death was head of the department.

The BULETIN extends its sympathy to Dr. C. O. Homans on the death of his father, Mr. Stephen Henry Homans at St. Margaret's Bay on September 1st, in his seventy-ninth year. Mr. Homans was born at Clam Harbour, Halifax County, and in 1905 moved to Port Mouton where he remained until seven years ago when failing health forced him to retire from business. Since that time he had made his home with his son, Dr. Homans, at Hubbards.

Personal Interest Notes

DR. THOMAS A. LEBBETTER of Yarmouth returned to Boston in August to continue his post-graduate studies in Advanced Cardiology under Dr. Paul D. White at the Massachusetts General Hospital. Dr. Lebbetter expects to return to Nova Scotia in October.

Dr. and Mrs. Skinner and daughter Betty, of Mahone Bay, have returned from a delightful motor trip to Montreal, Quebec, Boston and other American cities.

Dr. T. B. Murphy of Antigonish has returned after an extended post-graduate course in Surgery. The first part of his course Dr. Murphy took at the Chicago Post-Graduate School and later on he attended the Mayo Clinic in Rochester, Minnesota.

Dr. and Mrs. W. W. Bennett have returned to New Germany from England.

Dr. S. H. Keshen of Halifax was appointed Chairman of the City Health Board at a meeting held on September 21st. He succeeds the late Dr. W. D. Forrest, M.L.A., and his term will run for the balance of the current civic year.

The marriage of Dr. Margaret Elizabeth Burnside, daughter of Mr. and Mrs. A. Kirk Cameron of Montreal, to Dr. Norman Howard Gosse of Halifax was solemnized at St. Andrew's Church, Montreal, on September 15th, with Rev. F. W. Kerr officiating.

Dr. Harry Morton acted as best man for Dr. Gosse and the ushers were Hugh Cameron, brother of the bride, and Gordon MacOuat of Lachute, Quebec. Dr. Kerr was assisted by Rev. J. B. Paulin of Rosedale Presbyterian Church, Toronto, cousin of the bride, while Professor J. D. Ketchum of Toronto played the wedding music.

A reception for the immediate families only was held at the home of the bride's parents. Later, the bride and groom left for Newfoundland, the bride travelling in a stone blue wool ensemble with matching hat and black accessories.

Dr. R. Ian Macdonald of Toronto who has been visiting his parents, Dr. and Mrs. D. J. Macdonald at Halifax, has returned home. Mrs. Macdonald and her daughter are remaining in Halifax for a short time.

Of interest to many friends in the province is the marriage of Miss Claire Marryatt, R.N., daughter of Mr. and Mrs. Wilfred R. Marryatt of Mahone Bay, to Dr. Charles J. Macdonald, assistant medical superintendent of the Victoria General Hospital, and son of Senator and Mrs. John A. Macdonald of Cardigan, Prince Edward Island, which took place on September 1st at St. Mary's Cathedral, Halifax. The bride was attended by Miss Christiania

Macdonald and the groom by Dr. James Donohue of Souris, P. E. I. Following the ceremony a wedding breakfast was held at the Lord Nelson Hotel for the immediate families and intimate friends of the couple. Later Dr. and Mrs. Macdonald left on a motor trip throughout Nova Scotia and Prince Edward Island.

The announcement is made by Dalhousie University of the appointment as Assistant Professor of Physiology of Hugh Davson of London. Mr. Davson graduated from University College, London, 1931, with First Class Honours in Chemistry and Physics. He continued his studies in London in Biology, Physiology and Histology. He has held several demonstratorships in scientific subjects in the University of London, meantime carrying out research work under the auspices of the Medical Research Council. In 1936-37, as Fellow of the Rockefeller Foundation, he worked at Philadelphia, and elsewhere in the United States. For the last two years he has held the Beit Memorial Fellowship for Medical Research, carrying on his work in the United States and London. More recently he has acted as demonstrator under the celebrated physiologist Lovatt Evans, University of London. He comes to Dalhousie University with the highest recommendations. Professor and Mrs. Davson and their seven year old daughter, Caroline Jane, spent six weeks in New York on their way to Halifax. Mrs. Davson (under her professional name, Marjorie Heath), is a well known English portrait painter of notables in the fields of art, politics and society.

Memorial Marking Tatamagouche Naval Battle of 1745 is Formally Unveiled.

Pioneer days of the first colonizing of Nova Scotia in the eighteenth century when English and French waged a relentless struggle for supremacy were vividly recalled and fittingly commemorated on August 30th, when a beautiful memorial of Wallace freestone was unveiled to perpetuate the memory of a naval battle in the Tatamagouche Harbour in 1745. Dr. Daniel Murray of Tatamagouche unveiled the memorial and Professor D. C. Harvey, Halifax, provincial archivist and member of the Historic Sites and Monuments Board of Canada, which erected it, was chairman.

The ceremony opened with the singing of "O Canada" and concluded with The National Anthem. The speaker of the day was F. H. Patterson, K.C., Truro, author of *History of Tatamagouche*. He gave many interesting details of events preceding the battle as well as the battle itself and of those who took part. He said that one of two privateers who accompanied Captain Donahew and his ship "Resolution" was from Rhode Island and that in the public square in Newport two of the cannon used in the battle were in evidence.

G. T. Purdy, M.P., also spoke briefly and former County Court Judge Patterson was present on the platform. Following the unveiling all present partook of a picnic on the Community Field.

The monument is placed just at the corner of the field overlooking the harbour. It is in a fine location with a large elm tree overshadowing it. The

monument is the second on "The Sunrise Trail" between Pictou and Amherst, the other being unveiled last year at Wallace in honour of Simon Newcombe.

The monument is square in shape, four feet wide and eight feet high. A bronze tablet on the front bears the following inscription in English and French below:

Naval Encounter at Tatamagouche

(15th June, 1745.)

In this harbour Capt. David Donahew of New England with three armed vessels surprised Lieut. Paul Marin's allied force en route from Annapolis Royal to Louisbourg. He drove them ashore, disheartened the Canadian Indians and prevented the French and Micmacs from reaching Louisbourg before its fall.

A.D. 1939.

Early in 1745 a detachment of French and Indians was sent from Canada under Lt. Martin to attack Annapolis Royal. On May 17th it captured between Goat Island and Scotch Fort, a New England schooner, the Montague, under William Pote, Mr. On the 23rd Marin received orders from Louisbourg to come immediately with his forces to aid in defence of the fortress against the New Englanders. He hastened with his prisoners and troops to Tatamagouche to embark for Louisbourg. This they did on June 14 in a sloop, a schooner, two shallops and about sixty Indian canoes. As some of the vessels grounded in the river, they landed and camped in a sheltered cove for the night. On the following morning, setting out again, they were surprised by Capt. David Donahew of Newburyport, Mass., and three armed vessels. The Indians took cover quickly but the French vessels were exposed to Donahew's fire most of the day until they got into a small creek, where the New Englanders could not reach them. The battle itself was unimportant but as a result of it the Indians refused to go on to Louisbourg and Marin was unable to be of any assistance in the defence. The governor of Louisbourg claimed that if Marin had arrived earlier the enemy would have raised the siege; as Marin was a noted partisan leader and was said to have an army of 2500.

Capt. David Donahew was a privateer in the service of the state of Massachusetts. All information about the affair at Tatamagouche is taken from Capt. Pote's Journal.