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This is a facsimile edition, printed in a limited number of 10 copies, of the Australian Military Medicine Association Newsletter as originally published.

The original Newsletter editor was Major Mark Slatyer RAAMC, the current journal editor assuming the role for the March 1993 edition.

AMMA NEWSLETTER
March 1993

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EDITOR'S PAGE

The Editor

"Exigencies of the Service" have struck, as they so often do. The normal editor of the Newsletter, Mark Slatyer, has been prevented from exercising his usual functions, and so this Newsletter has been put together by Russ Schedlich, with copy supplied from at least four different sources, in most instances being despatched through an intermediary by "Fleet Mail" - and we all know how reliable that is!

Therefore, if there are deficiencies in the Newsletter, they are entirely my fault.

The Format

Due to the hard work of Marcus Skinner, now in Hobart, we have the availability of professional 'typesetting' services. Thus, the format of this Newsletter is enhanced compared to previous issues, and is moving towards a journal format.

CONTRIBUTIONS

This Newsletter, like the Association, is what its members make of it. Contributions PLEASE - original articles, member biographies, article reviews, news, views, comment, gossip (not slanderous), letters and anything you might think worth spreading amongst the Association.. Send them to:

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DEADLINE FOR JUNE NEWSLETTER:

20 MAY 1993

THE FUTURE

Your Council is pursuing plans to upgrade the Newsletter to a Journal format with the next issue. The Journal format will involve the use of a 'glossy cover', with stapled binding. The cost of this is considered reasonable (about $600 per issue), and will give members and other interested people a more 'up-market', durable and lasting vehicle for the dissemination of knowledge.

I stress, however, that there must be input into the Newsletter/Journal for it to become a worthwhile document (garbage in = garbage out).

Copy for the next issue MUST be in by 20 May, but the earlier the better (avoids RSI in the Editor)

EDITORIAL COMMENT

There aren't many advantages of being the Editor, but I guess one is getting to comment on anything you like, and without anyone to 'cull' - except, perhaps, the lawyers.

Over the last decade, the ADF has been moving more and more towards an integrated approach to many things. Most of us would see that as being to our collective benefit - certainly in the operational environment it is essential. However, most would also have some concern as to how this change will affect them.

The latest, and most significant, change affecting the Health Services is the abolition, on 1 March, of the Single Service Health Directorates in favour of a unified Office of the Surgeon General. Some may wonder whether there will be any tangible benefits in this change, however, it has happened, and we must make the best of it.

What is that best?

Firstly, health policy that has an appropriate degree of commonality - but NOT policy that makes sense for one Service but not the others.

Secondly, career opportunities that are enhanced by the ability to more easily move to jobs in other Services - but NOT to the detriment of any particular group, be it Service or profession.

Thirdly, an increase in the professional standing of the Health Branches amongst the rest of the ADF - but NOT at the expense of the Single Service identity that motivated us to join in the first place.

The challenge is there for all of us - to get on with the job, do it to our best ability, and avoid trampling on others in the process.

Russ Schedlich

Nomination for 1993 Council Elections

Please fill out the accompanying nomination form if you wish to nominate someone or be nominated to one of the AMMA council positions. the position will be for 12 months commencing from the next AGM, 21 August 1993.

Please note that you must nominate for a designated position on the Council. Should more than one person be nominated for a position, a postal ballot will be held in June. Unsuceessful nominees may be coopted onto the Council if there are vacancies following the election.

PRESIDENTS MESSAGE

Squadron-Leader James Ross RAAF

The topic of Military Medicine academic training is one that requires addressing by the Australian Military Medicine Association. Currently, Health personnel interested in post-graduate training in Military Medicine have a plethora of related courses from which to choose to specialise.

The reality of Military Medicine, and of course a significant attraction of it, is that it is indeed a mixture of so many specialties. Aspects of it can be found in Occupational Medicine, and its sub-specialties, Aviation and Naval/Underwater Medicine, Environmental Medicine, Public Health, Medical Administration, Preventive Medicine, NBC Medical Defence, Medical Economics, Tropical Medicine and Health Intelligence, Disaster Relief, epidemiology and medical logistics, all substantially non-clinical or preventive in focus. Equally important are the clinical specialties, the whole range of which impact on peacetime activities, and such fields as Surgery, Anaesthetics and psychiatry/psychology, which have even greater importance in an operational environment.

There are, however, few areas that can be said to be unique to Military Medicine. Submarine medicine and NBC Medical Defence are perhaps two. Specialities such as Wilderness medicine have involved themselves in issues of survival and health maintenance in hostile environments.

Thus questions that must be asked are just what is Military Medicine, how can it be best defined, how should it be promoted, is there a syllabus that could be developed to encapsulate it, and is it indeed appropriate to have a post-graduate course in Military Medicine?

My opinion is that a course in Military Medicine is feasible. It would have to concentrate on the 'preventive' medicine aspects of the field, while clinical specialties would be pursued separately, and the unique military aspects of these fields would need to be developed largely from experience.

A Master of Military Medicine could be pursued, either as a stand alone course, or as a significant stream within a Master of Public Health course currently in existence. Funding presumably comes substantially from ADF funds. Some aspects, such as Epidemiology, Research Methods, Biostatistics, Health Promotion, Policy formulation, Medical Administration and others which could be in common with a Public Health course as core subjects. Other topics, such as those outlined above, would entail the distinctly Military Medicine side of the course. This 'Master of Military Medicine' would produce an excellent generalist in Military Medicine. It would need to be sufficiently flexible to have all professional groupings undertake the course. There could easily be subjects on Military Dentistry, Radiation protection, Military Nursing and others. Those wishing to specialise in one particular area of Military Medicine would be able to use this training to gain significant credits in other courses.

I hope that some debate can be generated amongst AMMA members on this subject. There is a 'letters to the editor' section of the newsletter available for your contribution.

I also want to reinforce the main activities of the Association.

1. **Newsletter.** As you will have noted, there are some changes to the format, to bring it gradually more 'up-market'. We still intend to have a journal, but its development depends on receipt of appropriate copy. It is something of a chicken and egg situation: what comes first, the journal, or the papers? The newsletter is an excellent venue for publication of some research that you may have done but have not written up as yet, or if you have a review article.

2. **The Conference.** You will see a call for papers elsewhere. The conference is likely to be held at ADFA (but not confirmed at time of writing). It will feature Sir Edward (Weary) Dunlop, Col Hirsch, Professor of Surgery at Boston Hospital, and the VCDF on the roles of Military Medicine from the purview of the higher defence executive. Many other excellent presentations are planned.

3. **Elections.** Please consider whether you wish to nominate for the Council. Even if you are not on the Council, there are always opportunities for involvement in regional or special interest groups. you can contact either the Secretary or President regarding nomination/volunteering.

James Ross

ORIGINAL ARTICLE

ANTHRAX - Clinical characteristics and use as a biological warfare agent

Sub-Lieutenant Sue Sharpe RAN[a]

Aetiology

Anthrax is caused by the microorganism Bacillus anthracis, a large Gram positive rod-shaped bacterium which is commonly found singly or in pairs. The organism is capsulated in clinical specimens, but endospores are produced in vitro, in soil, and in decaying animal tissue.

These endospores are relatively resistant to heat and chemical disinfectants (they can be destroyed by boiling for 30 minutes or more, or exposing to 140°C dry heat for three hours), but may remain viable for months in animal hides for years or decades in dry earth[1].

Epidemiology

B. anthracis is found world-wide, particularly in Asian and African countries. It is widespread in south-eastern Australia due to distribution by dust storms and wild pigs and dogs.

Anthrax is naturally an infectious disease in farm animals occasionally transmitted to man, usually by inhalation or ingestion of spores or via sub-cutaneous abrasions. Almost all animals are susceptible, especially herbivores. There is no true reservoir, but spores may remain viable in soil.

Man-to-man transmission is extremely unlikely.

Pathology

Three principal antigens are associated with the pathogen.

Capsular antigen. D-glutamic acid polypeptide formed by virulent strains of B. anthracis in infected tissue. The capsule is anti-phagocytic, and protects the bacterium from lytic antibodies. It is important in pathogenicity and in the establishment of infection. The gene coding for this antigen resides on a plasmid known as pXO2[2].

Somatic (Cellular) Antigen. Polysaccharide of equal proportions in D-galactose and N-acetylglucosamine in the cell wall.

Anthrax Toxin. Complex toxin produced in vivo mediated by a temperature-sensitive plasmid (pXO1)[3,4]; consists of a protective antigen (PA) (Mwt 85,000), lethal factor (LF) (Mwt 83,000), and oedema factor (OF) (Mwt 89,000)[5] - a combination of these factors produces toxicity. The toxin is responsible for the symptoms of the disease.

PA is the most important toxin in protection and contains the major immunogenic epitopes. It binds to the cell surface, where it undergoes proteolytic cleavage, exposing a site to which OF and LF

[a] Sub-Lieutenant Sharpe is a microbiologist who entered the RAN to become an Instructor Officer and who recently spent a period of time working with the Directorate of Occupational Health, Safety and Naval Medicine in the Office of DGNHS

bind. The complex is then internalised, probably by endocytosis[6]. It is believed that the oedema factor causes an increase in the amount of cyclic AMP in the cytoplasm of the host cell[7].

Virulence is dependent on the production of toxin and the presence of a capsule. Accumulation of toxin in tissues affects the central nervous system, which may result in respiratory failure and anoxia.

Antibiotic therapy may sterilise tissue, but toxin may persist until it is metabolised, prolonging the clinical disease[8].

Clinical Manifestations

Three different presentations of anthrax occur, depending on the route of infection. All can progress to fatal bacteraemia by dissemination via the bloodstream. Meningitis sometimes occurs as a complication of severe cases[8].

Cutaneous Anthrax.

This is the most common form of the disease in humans. Spores penetrate the skin via minor cuts or abrasions, which may become itchy. When the spores germinate - two to five days after exposure - an inflamed papule appears at the site of inoculation. Pus is usually not present unless a secondary infection is involved.

Within a few days, a vesicle (called a malignant pustule) forms, filled with a bluish-black fluid. This vesicle will eventually break down, being replaced with a black eschar with a gelatinous surrounding oedema (this lesion is not usually painful). The eschar will dry out after one to three weeks, separating from the surrounding skin and leaving a scar[8,9].

If untreated, or in extremely severe cases, cells may spread to regional lymph nodes, which may become enlarged and tender, and invasion of the blood stream by the pathogen may follow[5].

Mortality in untreated cases is between five and twenty percent, and under five percent if antibiotic therapy is prompt[9].

Inhalation Anthrax.

One to five days after inhalation of spores, common respiratory symptoms develop (fever, non-productive cough, myalgia, malaise). Spores are phagocytosed by macrophages, and carried to regional tracheobronchial lymph nodes, where they germinate and rapidly multiply[10].

Although an apparent improvement may occur, symptoms abruptly worsen after a few days; high fever, dyspnoea, cyanosis, chest and neck oedema, respiratory stridor, chest pain and pleural effusion are common. Haemorrhagic oedematous mediastinitis often occurs, and may develop into haemorrhagic meningitis[5,8]. Anthrax toxin may directly affect the pulmonary capillary endothelium which may result in thrombosis and respiratory failure[11].

A few bacteria are usually able to evade the host's cellular defences and escape into the blood stream via the efferent lymphatics. They are cleared by the reticuloendothelial system (especially the spleen), but are able to establish a fatal bacteraemia[5].

The patient's condition rapidly deteriorates, leading to respiratory distress, cyanosis, and death usually within 24 hours[5,8].

Unless the disease is identified and antibiotic therapy started within 12 hours after inoculation, inhalation anthrax is usually always fatal[11].

Chest x-ray shows distinct mediastinal widening[12].

Pneumonia caused directly from anthrax does not occur, but secondary infection causing pneumonia may result[5,11].

Gastrointestinal Anthrax

This is an extremely rare disease, following ingestion of spores in contaminated, undercooked meat. Deposition and germination of spores in the submucosa of the ileum and caecum and subsequent toxin production may cause oedema, haemorrhage and necrosis, and result in nausea, vomiting and diarrhoea. The

incubation period is usually between two and five days[8].

In severe cases, cholera-like gastroenteritis may follow, with abdominal pain, fever, bloody vomitus and diarrhoea, intestinal obstruction, prostration and shock. Haemorrhagic inflammation of the small intestine and bowel perforation may also occur. These symptoms are associated with a very high mortality rate (25% to 75%)[5].

Regional lymph nodes may become infected, leading to a systemic infection.

Very rarely, tonsillar or pharyngeal ulceration may also be evident. Formation of a pseudomembrane, followed by difficulty in swallowing and respiratory compromise may result[5].

DIAGNOSIS

Laboratory Diagnosis

Gram stains and immunoflourescent antibody assays on pustule exudates or blood are useful. Sputum is generally not suitable as spores do not usually germinate until they reach the lymph nodes.

Blood samples should be cultured, although specimens from cutaneous tissue, lymph nodes, sputum or CSF may also be suitable. B. anthracis grows on routine media, especially blood agar, and has characteristic grey-white, irregular, hair-like colony forms when grown optimally in aerobic conditions at 37°C[5,13].

Serology on paired sera is only worthwhile as confirmation.

Differential Diagnosis

Cutaneous anthrax: orf, plague, tularaemia, staphylococcal carbuncle.

Inhalation anthrax: initially influenza, or any of a wide range of bacterial, viral of fungal URT infections. Very hard to recognise promptly, although a BW attack would probably result in an explosive outbreak[9].

Look for mediastinal widening in chest x-ray, chest wall oedema, haemorrhagic pleural effusions and haemorrhagic meningitis.

May be confused with an aerosol attack of Staphylococcal B enterotoxin (SEB), although the onset of symptoms of SEB would be more rapid, and no mediastinal widening would be present[11].

Plague pneumonia also has similar symptoms to inhalation anthrax, but these patients would have pulmonary infiltrates, which are usually absent in anthrax[11].

Gastrointestinal anthrax: acute abdomen, appendicitis, gastroenteritis.

TREATMENT

The antibiotic of choice is penicillin-G administered parenterally, although tetracycline is also effective. Most strains are also sensitive to erythromycin and chloramphenicol[5,8,11].

Cutaneous lesions should not be excised and drained, as this may lead to dissemination of the pathogen into the bloodstream and septicaemia. The patient should be isolated, and the lesion kept sterile and dry. Skin grafts may be necessary after the infection has resolved. Corticosteroids are sometimes used to treat severe malignant pustules[8].

Pulmonary anthrax is usually diagnosed too late for antibiotic therapy, although administering both antibiotics and antitoxin may be of some benefit. Therapy should be continued for a prolonged period of time[8].

Recommended Therapy

2×10^6 units of penicillin-G every 2 to 6 hours until oedema subsides, followed by oral penicillin for at least 7 to 10 days.

Erythromycin, tetracycline, or chloramphenicol may be used in penicillin-sensitive patients.

In the event of a BW attack where multiple drug-resistant strains of B. anthracis have been used, treatment should be given as follows:

1,000 mg ciproflxacin orally at first sign of the disease, followed by 750 mg orally twice daily

OR

200 mg intravenous doxycycline initially, then 100 mg twice daily.

Unvaccinated personnel should also be given a single 0.5 ml dose of vaccine subcutaneously. Two additional doses of 0.5 ml should be given two weeks apart[11].

Personnel vaccinated with fewer than three doses should receive a single 0.5 ml booster[11].

Antibiotic therapy should be continued for at least four weeks. If vaccine is not available, antibiotics should be continued for a prolonged period of time.

If possible, the surrounding environment should be decontaminated: formaldehyde is effective for sterilising soil and equipment. (Gamma radiation has proven to be effective in factory decontamination, but ethylene dioxide and autoclaving do not appear to be as efficient)[8].

SUSCEPTIBILITY OF POPULATION

Susceptibility is very high in unvaccinated individuals. There appears to be no documented evidence for differences in susceptibility between males and females.

PREVENTION

Several different vaccines are suitable for human use, either live attenuated or killed vaccines. All efficient vaccines either contain or produce PA; neither LF nor OF are protective by themselves.

Non-Living PA Vaccines

Effective vaccines of protective antigen adsorbed onto an aluminium hydroxide adjuvant (from the US[14]) or alum precipitated (from the UK[15]) are available and appear to give protection against inhalation anthrax (although protection against large challenges or highly virulent strains of B. anthracis may not be afforded).

Doses at 0, 2 and 4 weeks, 6, 12 and 18 months and then every year are recommended. Protection seems to be acquired after the third dose (limited data available). These vaccines are the best option at present. Antibodies are produced in virtually all patients after the 12 month booster.

Reaction to the vaccine is usually only mild to moderate, with tenderness, erythema, oedema and pruritus. More severe complications are rare (less than 1% of cases), but may limit the patient's use of the extremities for 1 to 2 days, and induce myalgia, malaise, or low grade fever. Severe systemic reactions (anaphylaxis) are very rare.

The vaccine should be stored at 4°C - NOT frozen.

NB: no definitive field trials have been performed to evaluate vaccine efficiency, and no information is available correlating specific immune response to vaccination and protection afforded, particularly with respect to aerosol challenge, or against virulent strains of B. anthracis.

Live Attenuated Spore Vaccines

A live spore vaccine (STI - derived from the Sterne spore vaccine) from the former USSR of a non-encapsulated attenuated strain which lacks the pXO2 plasmid is also available. This vaccine is administered by scarification or even by aerosol[16]. Boosters are needed every year. Although protection is likely to be higher than that of the killed vaccine, no conclusive comparative experiments have been conducted[17]. Severe reactions are common - necrosis at the site of inoculation sometimes occurs.

If the patient survives the disease, recovery from anthrax provides solid immunity.

Recently, recombinant vaccines, and more efficient delivery systems of the PA antigen are being developed (see FUTURE DIRECTIONS).

POTENTIAL AS BW

Advantages as a BW

An aerosol attack of B. anthracis would cause inhalation anthrax, which has a short incubation period, is difficult to recognise promptly and, unless diagnosed early, would produce fatalities.

B. anthracis is easy to cultivate in large numbers in the laboratory, which would enable third world countries to acquire a large stock.

The protective qualities of the endospore allow stability of the pathogen in sunlight (for several days), in soil, (for decades) and in aerosol form.

The hardiness of the bacteria is its ability to survive in harsh environments, and the ease with which it can be distributed via the wind would be attractive if widespread dissemination of the pathogen is desired and long-term contamination of the environment is not deemed important (e.g. in terrorist activities)[8].

A small scale attack may be able to target key personnel, but without extensive contamination of the environment, and disinfection of the area would be possible[8].

Antibiotic-resistant strains are easily engineered in the laboratory.

Current vaccines may not provide enough protection against a large challenge of spores, and the prolonged therapy necessary following an attack could seriously deplete antibiotic stocks and medical resources.

Disadvantages as BW

Spores persist for prolonged periods of time, and their dissemination is difficult to control, which would be detrimental if the target area was of importance.

Protection of own personnel would be necessary[8].

FUTURE DIRECTIONS

Vaccines

Several different approaches are being researched. Ideally, vaccines should:

- be safe to humans;
- broadly protective after only one dose;
- effective, with negligible side effects; and
- give rapid and long-lasting immunity.

Novel approaches involve both non-living and living vaccines.

Non-Living Vaccines

Non-cellular vaccines containing PA which give strong, protective immune responses are being trialled. Several aspects of these vaccines must be examined.

Epitope analysis. The structure and function relationships of the anthrax toxins (most notably PA), as well as the molecular interactions between the toxins, are currently being elucidated[6]. If those epitopes which produce strong immune responses can be determined, synthetic peptide vaccines may be feasible. Ideally, these vaccines would effectively stimulate cell-mediated immunity, but with negligible side-effects.

Development of suitable adjuvants. Many adjuvants are successful as immune stimulants in animal vaccines but are unsuitable for human use because of unacceptable side-effects. Current adsorbed PA vaccine has increased efficacy when used with complete Freund's adjuvant, Corynebacterium ovis, or killed Bordetella pertussis[18]. However, these adjuvants are associated with allergic reactions in humans.

Recently, potential biological adjuvants have been investigated, which give a high stimulatory effect, but are otherwise innocuous. A bacterial peptidoglycan moiety (N-acetyl muramyl-L-alanine-D-isoglutamine [MDP]) has been shown to be effective[19] and synthetic muramyl dipeptide derivatives have been made[20]. Other compounds, such as dimethyl glycine (DMG), threonyl MDP,

monophosphoryl lipid A, trehalose dimycolate, and cell wall components of Mycobacterium phlei and M. bovis may also have potential[21,22].

Virus-expressed PA. Two different approaches are being investigated, using either baculovirus or vaccinia virus expression systems[23].

Baculovirus system. The PA gene is cloned into baculovirus genome and the virus is used to infect insect cell tissue culture. PA is produced and purified and injected into guinea pigs and mice.

Vaccinia virus system. The experimental animals are immunised with the PA-vaccinia recombinant which replicates and produces PA.

Both methods induced a high degree of protection in the animals against a highly virulent (Ames) strain of B. anthracis.

The PA produced was immunologically identical to the Sterne spore PA.

Genetically engineered vaccines. Site-directed mutagenesis of toxin genes may produce modified toxins (PA, OF, LF, and somatic antigens) which have an enhanced immunogenicity but a decreased toxicity. These could be used as either living or non-living vaccines[21].

Live Attenuated Vaccines

Several mutant B. anthracis strains have been examined as possible live vaccines. Transposon (Tn) mutagenesis, which has proven successful with Salmonella typhimurium vaccines[24], is now being applied to B. anthracis[25].

B. anthracis Tn916 mutants (aro mutants) of a non-encapsulated, toxigenic strain are unable to synthesise the aromatic amino acids phenylalanine, tyrosine and tryptophan, and only replicate a few times in the host. This self-limiting infection is enough to afford protection in guinea pigs against virulent strains of the pathogen[21].

Other Trends

Research into antibiotic prophylaxis, particularly with regard to better delivery systems (such as liposome-encapsulated drugs for improved persistence in the host) is occurring. Passive immune approaches are not yet feasible for human use.

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REVIEW ARTICLES

PHOSGENE - Chemical Weapon and Industrial Chemical

Surgeon Lieutenant-Commander Andy Robertson RAN[b]

Phosgene is used in industry widely and has potential use as a chemical weapon. In this paper, its chemistry, uses and effects will be reviewed.

Chemistry

Phosgene ($COCl_2$) was first synthesised by Davy in 1812 from carbon monoxide, chlorine and activated charcoal in the presence of sunlight. At room temperature and normal atmospheric pressure, phosgene is a colourless, non-flammable, highly toxic gas with an odour like musty hay in low concentrations[1]. In high concentrations, it is pungent and irritating. As a gas it is heavier than air and only slightly soluble in water. Phosgene is readily liquefied to a light yellow liquid and may be shipped in steel cylinders[2].

Phosgene's recommended Threshold Limit Value (TLV) is 0.1 ppm (0.4 mg m^{-3}). Diller[3] notes the following concentration-effect relationships in reference to phosgene.

perception of odour	> 0.4 ppm
recognition of odour	> 1.5 ppm
signs of irritation in eyes, nose, throat and bronchi	> 3 ppm
beginning of lung damage	> 30 ppm
clinical pulmonary oedema	> 150 ppm

Phosgene's molecular pathology was initially thought to exclusively be the result of the action of HCl, produced by the aqueous hydrolysis of the inhaled gas[4]:

$$O{-}C\begin{matrix}Cl\\Cl\end{matrix} + H_2O \rightarrow CO_2 + 2HCl$$

Diller[5] notes, however, that this theory has been abandoned for a number of reasons:

a. Phosgene is about 800 times more toxic than equivalent amounts of HCl. The small amounts of HCl produced are easily buffered by the lung tissue.

b. Phosgene inhibits Co-enzyme 1 while an equivalent amount of HCl does not.

c. Hexamethylenetetramine, free amines and thromboplastin protect against phosgene, but not against HCl poisoning.

d. Ketene, which resembles phosgene in toxicity and chemical constitution, contains no chlorine atoms and thus cannot release HCl.

It is likely that some of the effects are due to the acylation reactions of phosgene with $-NH_2$, -OH and -SH groups.

Industrial Uses

Phosgene was initially used by the Germans as a chemical warfare agent in 1915. Phosgene is used today in the manufacture of dyestuffs based on triphenylmethane, coal tar and urea; in the organic synthesis of isocyanates, carbonic acid esters and acid chlorides; and in metallurgy and in the manufacture of some pesticides and pharmaceuticals[6]. Phosgene may also be liberated when halogenated hydrocarbons are heated. An example of this process is welding in an area where degreasing agents like trichloroethylene or carbon tetrachloride are

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[b] Lieutenant-Commander Robertson is Staff Officer, Medical Services in the Office of DGNHS, and a member of the Council of the AMMA

being used[7]. It may also be seen in firefighting where portable fire extinguishers containing carbon tetrachloride are used on hot surfaces, producing phosgene gas.

Respiratory Effects

Pathophysiology

Phosgene poisoning can be divided into several distinct phases[8].

Initial Reflex Syndrome. Phosgene inhaled in concentrations greater than 3 ppm often triggers a bioprotective vagal reflex by interaction with sensory receptors in the bronchial tree. This leads to frequent shallow respirations, decreased respiratory volume, decreased vital capacity and a drop in arterial oxygen partial pressure[9]. Arterial carbon dioxide partial pressure may rise with a drop in pH. Also, a bradycardia and a fall in systemic blood pressure may occur.

The intensity of these reflexes varies greatly between individuals[10], and Coman et al[11] notes that the response is not strictly in proportion to the inhaled dose of phosgene.

Phosgene inhaled in concentrations greater than 3 ppm seems to undergo partial hydrolysis within the aqueous film covering the mucus membranes of eyes, nose, throat and bronchi. The small amounts of HCl produced interact with the sensory receptors, precipitating signs and symptoms of eye and upper airways irritation. There may be an overlap with the vagal reflex[12].

Phosgene concentrations greater than 200 ppm produce apnoea of short duration, bronchoconstriction[13], bronchial epithelial desquamation and inflammatory bronchiolar changes[14]

Clinical Latent Phase. The inhaled phosgene reacts with extracellular substances and all constituents within the respiratory tract. Presently there is no consensus as to the exact localisation of the action of phosgene. Gross et al, Coman et al and Pawlowski and Frosolono[15] reported that histological changes first occurred in the respiratory bronchioles while Diller et al, Short, and Cameron and Courtice[16] noted that the first histological changes were more distal at the blood-air barrier, where swelling of alveolar cells and later rupture of endothelial cells were seen. Gross et al[17] suggests that the apparent disparity derives from different phosgene dose - small doses producing changes in the respiratory bronchioles while larger doses produced changes in the alveolar region.

The alveoli and interstices slowly fill with blood plasma. Depending on the dose, the alveolar oedema may occur within a few minutes, commencing in the region of the large bronchi. There is substantial increase in lymph drainage from the lungs. Haematocrit initially falls and then later rises. The arterial oxygen pressure tends to remain normal until the end of this phase and any ventilation-perfusion mismatch is well compensated for until a protracted right-left shunt occurs at the end of this phase.

Many enzyme systems are inhibited by phosgene, although glycolysis in the lung appears only to be slightly disturbed. Histamine is liberated but with little symptomatic effect. Also, some enzymes are released by anoxaemia and cellular decay, eg LDH. The lining of the lungs becomes stiffer, and compliance decreases[18].

Clinical Oedema Phase. The oedema fluid gradually rises from the alveoli into the proximal regions of the respiratory tract, and gas exchange becomes insufficient[19]. The protein content in the fluid rises due to increasing defects in the blood-air barrier, and the increased respiratory movements agitate this fluid into a froth. The mucus membranes of the bronchi become necrotic and are shed, leading to further restriction of respiration. Boyd and Perry[20] note that the pulmonary artery pressure remains normal up to the terminal phase. At this point the heart rate is increasing, peripheral arterial pressure falling and venous pressure increasing. Cause of death is usually paralysis of the respiratory centre due to anoxaemia, cessation of cardiac function being a secondary role. Patt et al[21] note, however, that, if anoxaemia is treated effectively, circulatory shock may become an important factor.

Hyperacute Poisoning. At very high doses (greater than 200 ppm) phosgene passes through the blood-air barrier and reacts

directly with the blood constituents. The resultant haemolysis produces haematin formation, congestion by erythrocyte fragments and cessation of capillary circulation. Death occurs within a few minutes from acute cor pulmonale often before pulmonary oedema can result[22].

Signs and Symptoms

Clinical Symptoms depend on the dose inhaled and to some extent on the phosgene concentration in the atmosphere. The rare extremely high doses inhaled are usually followed rapidly by death from acute cor pulmonale. Most frequently small to medium doses are inhaled and at > 3 ppm, the HCl in solution produces mild symptoms of irritation[23].

The symptoms include catching of the breath, choking, tightness of the chest, lacrimation, difficulty and pain in breathing and subjective weakness of the legs[24]. These complaints usually disappear rapidly, and the symptoms produced by even a fatal dose may be relatively mild. There is a following latent phase, the duration of which is inversely proportional to the dose inhaled. After relatively large doses it may be 1 to 4 hours and after small doses, 8 to 24 hours[25].

Bruner and Coman[26] note that a gradual collection of oedema fluid may be seen on chest x-ray even during the latent phase. The clinical oedema phase is marked by crepitations across the lower lobes and lengthening of respiration. The symptoms are dizziness, chills, discomfort, thirst, increasingly tormenting cough and viscous sputum. Sputum may then become thin and foamy; dyspnoea, a feeling of suffocation, tracheal rhonchi and grey-blue cyanosis may follow[27]. Blood pressure falls, heart rate increases and the terminal phase is one of extreme distress where the intolerable dyspnoea finally passes into respiratory standstill[28].

Late Sequelae

If the patient survives the poisoning, clinical and radiographic oedema usually regresses within a few days, and blood gases and CO diffusion capacity return to normal within a week[29]. In the absence of adequate antibiotic prophylaxis, secondary pneumonia may develop[30]. Exertional dyspnoea and increased bronchial resistance may persist for several months[31]. After an acute episode, Diller[32] notes that complete recovery may require up to several years in healthy patients while those with pre-damaged lungs (eg cigarette smokers) may experience continued deterioration or their lung functions with increased emphysema and chronic bronchitis. Waldron[33] notes that repeated acute episodes can lead to chronic lung disease.

With regard to chronic exposure, Diller[34] notes some of the Russian literature that reports that chronic exposure to phosgene at 0.1 ppm (and occasionally over this) does not produce detrimental health effects in humans. However, Sittig[35] suggests that chronic exposure to phosgene, although providing some tolerance to acute doses, may cause irreversible pulmonary changes of emphysema and fibrosis. Sittig did not specify at what level this chronic exposure might be.

Conclusion

Phosgene, which can be a workplace contaminant in a number of industries, poses a major respiratory hazard because of its highly irritating, oedemogenic and potentially lethal effects. As there is a suggestion that even at low levels it may have some chronic effects on the lung, concerted effort should be taken to maintain concentrations below the TLV of 0.1 ppm.

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33. Waldron. *Op cit.*
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35. Sittig. *Op cit.*

ABSTRACTS FROM THE LITERATURE

Unfortunately, due to the vagaries of 'Fleet Mail', el presidentés 5 abstracts from the literature cannot be included in this Newsletter. Hopefully, they will turn up for the next one!

Anyone who has read an article of relevance to Military Medicine is invited to submit a short abstract or review for publication.

BOOK REVIEWS

Neville Howse VC
by Alison Starr

Review by LCDR Andy Robertson

Neville Howse won the Victoria Cross in the Boer War, the first Australian, and the only Australian medical officer, to do so. He then went on to be the Director of Medical Services of the A.I.F. for most of the First World War. After the war, he served as the Federal Member for Calare. His parliamentary career included service as the Minister for Health and Defence in the mid 1920's.

Neville Howse was a visionary. During his time with the A.I.F., he fought to have the A.I.F. medical services under Australian command and control, dental services established, strict medical entry standards and good rehabilitation services. He also worked towards Tri-Service medical services, training for medical officers and equitable promotion policies. As an M.P., he was involved in developing public health policy, aviation medicine policy and in supporting research, especially into cancer and native animals.

Neville Howse's biography is a short but extremely captivating overview of his life. the book suffers from poor editing and proofreading which makes some segments confusing. Perseverance, however, will be rewarded by the insight developed into both an extraordinary man and interesting times.

NEWS AND VIEWS

CONFERENCE DINNER
NAVAL AND MILITARY CLUB, MELBOURNE
7 August 1992

At the dinner held on the Friday night prior to the Inaugural Scientific Meeting of the AMMA, three eminent Australians with long and illustrious associations with the Military and its medicine, having been elected to Honorary Membership of the Association by its Committee, were introduced to members. Two of the speeches of introduction are reproduced below. The third will appear in the next Newsletter.

SIR EDWARD DUNLOP
CMG, OBE, KSJ, MS, FRCS, FRACS, FACS, D.Sc

Captain Bob Stacey RAAMC (Res)

I am honoured to be able to introduce to the Australian Military Medicine Association Sir Edward Dunlop. He is known to many as 'Weary' Dunlop. It was only recently that I had the privilege of meeting Sir Edward. He was

disappointed that he was unable to be here tonight, and sends his apologies to the members of the Association.

Sir Edward was born in Stewarton, Victoria, in 1907.

After a brilliant academic career, he qualified as a Pharmacist in 1928, and as a doctor in 1934.

In 1938, he went to England for post-graduate studies at St Bartholomew's Hospital and at the outbreak of war, he became a specialist surgeon to the emergency Medical Service at St Mary's Hospital, Paddington.

In 1940, he was posted to Jerusalem, Palestine, as a Captain. During these early war years he served in Greece, Crete and Tobruk with 2/2 Aust CCS.

In 1942, he landed in Java and was promoted to command No 1 Allied General Hospital. At capitulation, he elected to stay with his hospital and patients, and became a prisoner-of-war himself.

In 1945, he returned to civilian life in Australia, and married.

In 1960, Sir Edward returned to South-East Asia to the Vietnam war, where he was Team Leader of the Australian Surgical Team, caring for civilians.

Sir Edward has made the care of former prisoners-of-war his life's mission. He has many interesting and moving stories to tell. In fact, I was rather taken by his freedom to discuss the many lessons learnt from his time in military service. In our time together, we kept returning to two issues.

These were firstly the importance of highly mobile medical and surgical teams on the battlefield, an idea he had first proposed during the North Africa Campaign in 1941.

Secondly, he has a warning for us that we should not become too reliant on technology. It will not always be there when we need it, and when it is not, we have to fall back on good solid training and resourcefulness. Technology is a tool and cannot replace people. I personally support this warning as I too have seen many examples where a serviceman's chance of survival has been limited due to our blind reliance on technology.

If anyone is interested in more of his escapades, may I recommend his War Diaries.

I am therefore privileged to welcome Sir Edward Dunlop as an Honorary Life Member of the Australian Military Medicine Association.

DR JOHN CHARLES LANE

AM, MB BS (Hons), MPH (Harvard), FACOM, FRAeS

Dr Nader Abou-Seif

John Lane was born in Sydney in 1918 and educated at the Scots College. In 1935 he entered the Faculty of Science, University of Sydney, later transferring to the Faculty of Medicine.

After graduating in 1941, John spent 1941-42 as an RMO at Sydney Hospital prior to joining the RAAF in 1942. In the RAAF, he was posted as Medical Officer to No. 3 OTU and No 20 Squadron (Catalinas). At the latter posting, he carried out research into crew fatigue in long range flying boat operations and the effects of low dose Benzedrine in combating this. This work led to a posting as the OIC High Altitude Training Units which was followed, in turn, by a period as Flying Personnel Medical Officer with Training Command.

Soon after the end of World War II, John was posted to the position of MA4 (Staff Officer, Aviation Medicine) at RAAF headquarters. In this posting, he was responsible for the post-war distribution of RAAF Aviation Medicine

resources. In addition, he was a strong advocate for a continued RAAF involvement in Aviation Medicine research and teaching. In 1946, he wrote to the Director of Medical Services (Air) stressing the importance of the development of a RAAF School of Aviation Medicine, proposing the current location at Point Cook and outlining a scope of responsibility that is reflected in the unit's present activities.

After leaving the RAAF in 1947, John became the first Director of Aviation Medicine in the Department of Civil Aviation, a position he held until 1982. During this time, he was involved as a Medical Monitor in the US Manned Spaceflight Programme. His work with Projects Mercury and Gemini resulted in his recognition by the USAF as a 'Space Surgeon'.

He was also a member of the team which developed the TVASIS visual approach aid. In addition to this he was involved in the RAAF Reserve for a number of years and attempted to develop an Australian Diploma of Aviation Medicine centred around the RAAF Institute of Aviation Medicine. Seven Australian Diplomas were awarded prior to the cessation if this diploma due to institutional problems.

John remains active as an Associate at the Monash University Accident Research Centre, and an Honorary Lecturer in the Department of Social and Preventative Medicine.

John has made a valuable contribution to Military Medicine as a pioneer in the field of Aviation Medicine. His vision of the future of this discipline is reflected in the way it is practised today.

MEDICAL HISTORY CRAFT GROUP

All those interested in becoming involved with a craft group dealing with Military Medical History in all of its aspects are invited to contact Dr Nader Abou-Seif at the address below:

P.O. Box 147
BLACKBURN VIC 3130

It is hoped that the group will be able to liaise with other groups interested in Medical History and provide a forum for discussing issues in past experience that retain their relevance today.

As with any group, the vitality of the group as a whole will depend on the contribution of its members.

NADER ABOU-SEIF
Member Biography

Currently in General Practice and part time at the RAAF Institute of Aviation Medicine. He graduated at Monash in 1982, joining the RAAF as an undergraduate in 1980 and serving in the PAF until 1990. He is currently in the RAAF Reserve. Married with 2 children, his interests include Aviation Medicine, History, Cricket, Philately and collecting anything from military hats to Goon shows.

YOUR COUNCIL AT WORK

The seven-member Council of the Association continues its hard work. Since the meeting held in conjunction with the Annual Scientific Conference, one other teleconference has been held. On 28 February, a face-to-face conference in Canberra was held. Following are 'highlights' from the teleconference.

New ACT liaison officer is LCDR Andy Robertson, replacing CMDR Tim Dillon, who has 'gone south' (HMAS Cerberus).

LEUT Morris Harden RAN will be asked to try to engender some interest and enthusiasm across the Tasman during a one-year exchange posting (will he survive the Test series?)

Dr John Wettenhall has formally written to the Association offering 90 percent of the 3MD Medical Officer Trust Fund to the Association for the formation of an AMMA Journal.

Finances. Profit from the Conference is expected to be $5,000. $10,000 has been placed in a term deposit, and the current float is in excess of $4,000. Current membership stands at 268.

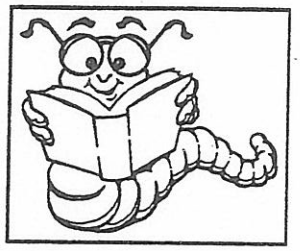
Work continues to progress with respect to the 1993 Conference, planned for Canberra around August (skiing?).

Continued discussion occurred regarding the formation of a formal Academic association with an appropriate Institution.

The go ahead was given for the development of a Military Medicine Library, to be based in Canberra. An initial grant of $1,000 was approved (see separate article).

ASSOCIATION LIBRARY TAKES SHAPE

Following approval by the Association's Council at its November meeting, three members of council (N.A-S., A.G.R, R.B.S.) have been scrounging through a variety of sources to produce the beginnings of a library.



This task took less time than originally thought, and the library is currently housed on the seventh floor of Campbell Park. The collection covers historical and technical works, and is available for local 'light' reading as desired.

Titles in the collection are listed below.

US Army	Medical Consequences of Nuclear War
Australian Army	Jungle Warfare
-	As You Were - 1948
Rupert Goodman	Hospital Ships
Rob Nash	Medical Stores
E.E. Dunlop	The War Diaries of Weary Dunlop
Alan S. Walker	Medical Services of the RAN and RAAF
Alan S. Walker	Middle East and Far East
-	RAMC Training - 1911
-	Medical Treatment of Gas Casualties
-	RAMC Training - 1935
Gordon Seagraves	Burma Surgeon
Gordon Seagraves	Burma Surgeon Returns
Dixon	On the Psychology of Military Incompetence
-	The Origins of the RAAMC
Dr Burnett Clark	Behind the Wire
Barker	Nightingales in the Mind
Irving Benson	The Man With the Donkey
-	Handbook of the Royal Navy Sickberth Staff
Connolly	Medical Soldiers
Steward	Recollections of a Regimental Medical Officer
Dienaide	Civilian Health in Wartime
Gil Elliot	Twentieth Century Book of the Dead
Australian Army	Soldiering On
-	As You Were - 1947
RAN	HMAS Mk III
Rupert Goodman	Our War Nurses
Arthur Bowes-Smyth	Journal of Arthur Bowes Smyth, Surgeon - Lady Penhryn
Alan S. Walker	The Island Campaign
Alan S. Walker	Clinical Problems of War
Mary Tilton	The Gray Battalion
-	Memorandum on Medical Diseases in Tropical and Sub-Tropical Areas - 1941
Ada Harrison	Gray and Scarlet
-	Elementary Hygiene
Rupert Goodman	A Hospital at War
Joan Crouch	A Special Kind of Service
John Pearce	Pioneer Medicine in Australia
Meisel	Miracles of Military Medicine
J Henry Durant	A Memory of Solferino
Brereton	The Great War and the RAMC
Alison Starr	Neville Hause VC
W. Deane Butcher	Fighter Squadron Doctor
Hamilton	Soldier Surgeon in Malaya
Caldwell	Military Hygiene

Books in the collection are currently stored on Level 7 of Campbell Park Offices, and viewing can be arranged by contacting LCDR Andy Robertson of (06)266-3878. It is hoped that a couple of reviews will be available for the next Newsletter.

2nd Annual Scientific Conference

CANBERRA, 20 to 22 August 1993

The second annual scientific conference of the Association will be held in August, probably at the Australian Defence Academy. Whilst the programme is not yet finalised, a draft outline of the programme is printed below. This may give some guidance to those thinking of submitting papers, although do not feel constrained by the subject areas. The keynote speakers have not yet been confirmed.

Friday 20 August

1200 Registration

1330 **Opening**
Admiral Beaumont - CDF
President
Major-General Rossi - SGADF

1520 **Around the World**
1800 Conclude

1915 for 1945
Conference Dinner

Saturday 21 August

0830 AMMA Annual General Meeting

0945 **Keynote Address**
Lessons from the Past
Sir Edward Dunlop

1115 **Tropical Medicine**

1230 **Underwater Medicine**

1415 **Military Surgery**

1540 **Military Cardiology**

1620 **Free Papers**
1800 Conclude

Sunday 22 August

0900 **Early Management of Severe Trauma**

1000 **Occupational Health and Safety**

1115 **Education in Military Medicine**

1145 **Aviation Medicine**

1245 **Free Papers**

1345 **Close and Award of Prizes**

The Neville Howse Award

The Council has proposed that it will award a prize at each scientific conference. This prize, which for the 1993 conference is set at $500, will be known as the Neville Howse Award, and will be for the best original paper presented at the conference, as determined by Council.

MEMBERSHIP OFFICERS

The Association desires to promote its membership, particularly outside the medical practitioner field. Council therefore seeks the assistance of members in any of the fields - medical, nursing, dentistry, medics and paramedical groups - to act as 'Membership Officers' to help recruit interest people into the Association.

If you feel you can help, please contact the Secretary, Dr Marcus Skinner:

AMMA
PO Box 373
MOONAH TAS 7009

or any member of Council

RENEWAL OF MEMBERSHIP

If your membership is due (and you will have received a renewal notice if it is), it expired on 31 December 1992.

Members are reminded that if their subscription is not paid within 6 months of falling due, they become unfinancial and lose the privileges of membership.

PLEASE RENEW NOW

FINANCIAL ASSISTANCE TO SPECIAL INTEREST GROUPS

Council recently resolved that financial assistance would be made available to Regional, Craft and Special Interest Groups of the Association to support activities they undertake.

Group Treasurers, or members who are running Groups can obtain more information from the Treasurer:

SURG LCDR Chris Maron
DOHSNM
CP4-7-21
Campbell Park Offices
ACT 2600
AUSTRALIA

Tel: (06)266-3854

NEW MEMBERS

In this edition of the Newsletter, a complete listing of all members is enclosed. This list is almost certainly inaccurate. Therefore, if your details are incorrect, please forward amendments to:

Dr Marcus Skinner
Secretary
AMMA
P.O. Box 373
MOONAH TAS 7009

FOR YOUR DIARY

20 to 22 August 1993 **2nd Annual Scientific Conference** **CANBERRA**

Anyone wishing to advertise an event that is related to the AMMA or Military Medicine in general, may forward details to the Editor at any time. (See "Editor's Page" for contact details)

AUSTRALIAN MILITARY MEDICINE ASSOCIATION

NOTIFICATION OF

CHANGE OF ADDRESS

Rank:..... Name: .....

Old Address: .....

State: ..... Post Code: .....

New Address:.....

.....

State.....Post Code: .....

.....
Signature

AUSTRALIAN MILITARY MEDICINE ASSOCIATION

NOTIFICATION OF

CHANGE OF ADDRESS

Rank:..... Name: .....

Old Address: .....

State: ..... Post Code: .....

New Address:.....

.....

State.....Post Code: .....

.....
Signature

AUSTRALIAN MILITARY MEDICINE
ASSOCIATION

CALL FOR PAPERS

2nd Annual conference
CANBERRA, AUGUST 20-22 1993

The organising committee of the conference requests the submission of abstracts on the accompanying sheet. Any presentation relevant to Military Medicine will be considered. Such areas may include:

- Medical Logistics
- Underwater/Naval Medicine
- Military Dentistry
- Military Medical History
- Human Factors
- Roles of military medical personnel today
- Future directions of Military Medicine
- Tropical Medicine
- Aviation Medicine
- Occupational Health and Safety
- Field Hygiene
- Military Nursing
- Operational Health
- Medical Evacuation
- Peacekeeping/UN missions
- Disaster Health
- Battlefield Surgery

but such a list is not all encompassing. Membership of AMMA is not necessary to present at the conference.

An award of $500 will be made to the best original research paper presented at the Conference.

Send your abstract to:

LCDR Chris Maron
DOHSNM
CP4-7-21
Campbell Park Offices
ACT 2600
AUSTRALIA

Closing date: 30 April 1993

ABSTRACT

AUSTRALIAN MILITARY MEDICINE ASSOCIATION
2nd Annual Conference Canberra 20-22 August 1993

Title: (max 80 characters)

Author/s: (Presenter first)
1. _____
2. _____
3. _____

Presenter's address for correspondence:

_____

Contact phone number: ( ) _____
Fax number: ( )

Abstract: (Max 250 words)

AUSTRALIAN MILITARY MEDICINE ASSOCIATION

The Australian Military Medicine Association is a professional organization with the main aims of:

- **promoting the study of military medicine**
- **bringing together those with an interest in military medicine**
- **disseminating knowledge on military medicine**
- **circulating newsletters and journals on military medicine**
- **promoting research in military medicine.**

The patron of the AMMA is the Surgeon-General Australian Defence Force. While still a very young organization, established in mid 1991, it has grown rapidly. As at December 1992 there were 232 members. Most of the membership are doctors, but there are also nurses, dentists, pharmacists, human factors and specialists and others.

There are three membership categories:

1. **Full:** Available for anyone with a health-related tertiary degree or those with a degree and who have been working in a health area. Those without such a degree may be admitted to full membership if they have had a long and/or distinguished career in military medicine.

2. **Student:** Open to any student studying for a degree in a health-related field.

3. **Associate:** Available for any other person. This provides no voting rights.

Activities of the association thus far are:

- **Newsletter:** Issued 3 times per year. This will be expanded to a journal over the next few years.

- **Annual conference:** Held in August each year. Next to be in Canberra - August 20 - 22 1993.

- **Special interest groups:** Groups will be formed as interest demands, in fields such as underwater medicine, military nursing etc.

- **Regional groups:** Groups in Melbourne, Sydney and Adelaide at present and can be expanded depending on interest.

- **Library:** This began in 1992 and will concentrate on books not readily found elsewhere.

- **Research award:** Presented for the best original research paper at the Annual Conference.

All members receive a membership certificate.

For further information please write to:

Dr. Marcus W. Skinner, Secretary, AMMA, PO Box 373
MOONAH TAS 7009.

Australian Military Medicine Association

Council election - Nomination Form

I, _____ being a full member of the Australian Military Medicine Association, nominate

_____ for the position of (tick one position only:

- ☐ President
- ☐ Vice-President
- ☐ Secretary
- ☐ Treasurer
- ☐ Editor
- ☐ Member (3 positions)

on the Association Council.

Signed _____ (member proposing)

Signed _____ (member being proposed)

Date: ___/___/___

Return to: Dr Marcus Skinner
Secretary
AMMA
PO Box 373
MOONAH TAS 7009

by 15 April 1993

Current Financial Members as at February 1993

Surname	Given Names	Title/Rank	State	
BUCKLEY	Paul Thomas Richard	Col	ACT	2600
COOMBES	Elizabeth Ann	FLT LT	ACT	2600
DOWSETT	Michael Hutton	Commodore	ACT	2600
GIBSON	Andrew David Stuart	LCDR	ACT	2600
GORDON	Andrew	Maj. (Dr.)	ACT	2606
HERRING	Maurice MacGregor	Dr./GP Capt (RLT)	ACT	2605
HINE	Margaret Joy	NGCDR	ACT	2600
MILLER	Michael Douglas	Air Vice Marshal	ACT	2600
MOLLER	Graeme David	AIR CDRE	ACT	2600
PARKES	Frederick John	CMDR	ACT	2600
ROSSI	David Glen	Brig.	ACT	2600
SENIOR	David Phillip	GP Capt.	ACT	2600
WELLS	Glenn	LT COL	ACT	2600
WILKINS	Peter Sydney	GP Capt.	ACT	2600
14	14	14		14
AQUILINA	Peter Joseph	SBLT	NSW	2033
AUSTIN	Tony Kenneth	SQNLDR	NSW	2314
BERAN	Roy Gary	LCDR	NSW	2067
BOWDEN	Virginia Elizabeth	FLT LT	NSW	2007
BRENNAN	Leonard Basil	Capt.	NSW	2173
BRUCE	Gregor Kirkham	SQNLDR	NSW	2154
BURKE	Edward Michael Georg	LEUT (RAN)	NSW	2540
BURROW	Gregory Howard	Surg Lt.	NSW	2300
CANALESE	Joseph	LT	NSW	2830
CATERSON	Ian Douglas	SQNLDR	NSW	2050
DILLEY	Anthony Vincent	Dr.	NSW	2190
DOBLER	Jill Suzanne	FLG OFF	NSW	2325
DONOVAN	Kevin Max	CMDR	NSW	2011
DOUGLAS	David Brookes	COL	NSW	2000
DUFFY	Peter	SQDNLDR	NSW	2122
FAIZ	Parwin	LT DR.	NSW	2166
FLYNN	Michael John	Surgeon Captain	NSW	2350
FLYNN	John Murray	LT COL	NSW	2350
FOSTER	Hamish C. McA.	LC DR/DR	NSW	2298
FRITH	John Francis	CMDR	NSW	2021
FULLER	Carmel Elizabeth	FLT LT	NSW	2755
GALEA	Frank Alfred	FLT LT	NSW	2560
GOVIND	Jayantilal	Dr.	NSW	2300
GREENTREE	Richard Ashton	WG CDR	NSW	2037
GREIG	Bruce Lindsay	SURG. LT	NSW	2000
GRIMMER	Rachel Christina	FLT LT	NSW	2755
HARDEN	Maurice John	LT	NSW	2283
HARREX	Warren Keith	GP CAPT	NSW	2773
HORGAN	Terence Joseph	Surg. Capt.	NSW	2075
KITCHENER	Scott James	Surg. LT	NSW	2000
LAND	William Alexander	G Capt.	NSW	2099
LEEKS	Nicole Julie	Dr. LT	NSW	2764
MACDONALD	Colin John	LC DR	NSW	2478
MARON	Christian Roger	LCDR	NSW	2611
MENOGUE	Nigel Robert	Surg. LCDR	NSW	2576
MURPHY	Terence Michael	CMDR	NSW	2011
NEW	Charles	Capt. Dr.	NSW	2300
OVERTON	John Herbert	A/Prof.	NSW	2050
PAGE	Richard Samuel	LT	NSW	2091

Surname	Given Names	Title/Rank	State	
PARKER	Christine Elizabeth	LT	NSW	2653
PARSONS	Helen Elizabeth	FLT LT	NSW	2755
PAYNE	John Ernest	SQNLDR	NSW	2139
RICKARD	Kevin Albert	Capt.	NSW	2000
ROE	Jennifer Wendy	FLT LT	NSW	2755
ROYAL	Elizabeth Ruth	LT MDNS	NSW	2091
RUDZKI	Stephan James	Maj.	NSW	2174
SCHEDLICH	Russell Bryan	SQDN LDR	NSW	2091
SCHUSTER	David Edward	SQNLDR	NSW	2830
SCOTT	David Mickle	FL LT	NSW	2031
SHIRTLEY	Graeme Spencer	CMDR	NSW	2165
SINNAMON	Rollin Blandford	LT SSSG	NSW	2540
WALLACE	Duncan Bruce	LCDR	NSW	2010
WARFE	Peter George	COL	NSW	2021
WEBSTER	Allen John	LT	NSW	2533
WHITE	Anthony Duckett	Dr. COL	NSW	2025
WILLIAMS	Anthony Thelwell	COL	NSW	2039
56	56		56	55
ANDREW	Martin Kenneth	CPL	NT	850
JOHNSON	Andrew James	FLT LT	NT	800
WEBB	Elizabeth	SBLT	NT	810
WINTER	Cheryl Ann	SBLT	NT	810
4	4		4	3
BARTHOLOMEUSZ	Hugh	WG CDR	QLD	4305
CARVER	Pamela Una	Mrs. SBLT	QLD	4868
CUNNEEN	Christopher James	Capt.	QLD	4173
DUNCAN	Darrell John	Dr./Maj	QLD	4817
GALLAGHER	Naomi	LT	QLD	4104
GLASSON	William John	LT COL	QLD	4000
JEFFERY	Robert John	COL (R)	QLD	4305
JOHNSTON	Andrew Joseph	Capt.	QLD	4814
JONES	Ian Stuart Crawford	CMDR	QLD	4053
LEWIS	Edward David	COL	QLD	4812
MARTIN	Bruce Alexander	WCDR	QLD	4066
McAULIFFE	Michael Joseph	Maj.	QLD	4870
McPHEE	Ian Bruce	LT COL	QLD	4000
NAUGHTON	Michael	Dr.	QLD	4104
PALMER	Kym Elizabeth	SQNLDR	QLD	4306
SINTON	Terence John	LT	QLD	4120
SKINNER	Marcus Welby	SQNLDR	QLD	4306
STEPHENSON	Elizabeth Carmel	SBLT	QLD	4103
STONE	Michael Jason	SB LT	QLD	4105
STRONACH	Dale Robin	FLG OFF	QLD	4306
SWEENEY	David John	LT COL	QLD	4813
THOMAS	Dale Leonard	SBLT	QLD	4005
TUCH	Michael Melvyn	Maj.	QLD	4000
WARD	Rodney Thomas	LT COL	QLD	4810
WOODRUFF	Peter William Harold	SQN LDR	QLD	4000
25	25		25	25
ATKINSON	Robert Neville	COL	SA	5000
BABU	SuresH Chandra	WGCDR	SA	5111
BEAL	Robert William	COL	SA	5000
BEARD	Donald Douglas	COL	SA	5000
BIRZER	Sigrid	Capt.	SA	5109
BROWN	Christopher Howard	Major	SA	5006
BYRNE	Peter Dudley	COL	SA	5006

Surname	Given Names	Title/Rank	State	
CAMERON	Alexander Scott	LT COL	SA	5000
CAPPS	Roger Auan	WG CDR	SA	5000
CARTER	Rodney Frederick	COL	SA	5034
CLOSE	David Maynard	GP Capt.	SA	5035
DEW	Sally Angela	LT	SA	5050
DOHNALEK	Jiri Antonin	FLT LT	SA	5046
FAHLBUSCH	Douglas James	SBLT	SA	5081
FIELKE	Kenneth Ray	Dr. Maj.	SA	5087
FINN	Brian Peter	FLT LT	SA	5006
FOREMAN	Robert Kingsley	LT COL	SA	5041
FREEMAN	Robert ROGER	Col	SA	5006
GRIGGS	William Middleton	WG CDR	SA	5000
HAMILTON-CRAIG	Ian	R/SQNLDR	SA	5006
HEDDLE	William Frederic	CMDR	SA	5035
JENSEN	Neil	LT COL	SA	5040
LEITCH	Ian Oliver Westwood	LT COL	SA	5006
McNEILL	Elizabeth Helen	LCPL	SA	5035
MOLLISON	Brenton Graham	COL	SA	5065
MOSS	Iona Margaret	LT	SA	5000
NICOLSON	Hamish	WG CDR	SA	5006
RAWSON	George Leonard Donal	LCDR	SA	5066
ROSS	JAMES	SQNLDR	SA	5065
SANDOW	Michael John	Maj.	SA	5000
SCARBOROUGH	Ian	Mr.	SA	5073
SCHULTZ	Barry Graham	Dr. LT	SA	5031
VAWSER	Lynette Joy	Maj.	SA	5046
WILLIAMSON	John Aubrey	Dr. SQNLDR	SA	5000
WILSON	Gregory Colin	FLT LT	SA	5097
35	35	35		33
BLACK	Robert Barham	GP CAPT	SA	5006
1	1	1		1
MERRIDEW	Colin George	SQNLDR	TAS	7250
WERTHEIMER	Michael Arnold	Maj.	TAS	7000
WESTPHALEN	Neil	Surg. LCDR	TAS	7248
3	3	3		3
McGRATH	Christopher James Ro	FLT LT	USA	98195
1	1	1		1
ABOU-SEIF	Nader	Dr. (SQNLDR)	VIC	3029
ADAMS	Robert Leslie	Major	VIC	3130
ANDREW	David Arthur	CPL	VIC	3027
ATKINSON	Ross Girvan	Leut	VIC	3920
BARO	Graeme Lehm	Dr.	VIC	3127
BERNARD	Roger	FLT LT	VIC	3027
BOLT	Mark Andrew	SBLT	VIC	3143
BOMS	Alan John	Dr.	VIC	3004
BOOTHBY	Graham	WGCDR	VIC	3027
BROOK	Wilfrid Henry	SQN LDR	VIC	3168
CATO	Alexander Ralph	SPCAPT	VIC	3190
CHAMPNESS	Peter Leonard	LGDR	VIC	3079
CROFT	Joanna	FLG OFF	VIC	3027
CRONIN	John Robin	SQNLDR	VIC	3065
DAVISON	Gary James	Dr.	VIC	3690
DILLON	Timothy Alan	CDR	VIC	3920
DINES	Amanda Jane Imrie	SQNLDR	VIC	3004
DUGDALE	Michael Robin	WG CDR	VIC	3027
DUNLOP	Edward	Sir	VIC	3002

Surname	Given Names	Title/Rank	State	
ELLIOTT	Barry Gilbert	WNG CDR	VIC	3144
FARAG	Sherif Shafik	Capt.	VIC	3146
FAWCETT	Rodney Ian	GP Capt.	VIC	3004
FERGUSON	Austen Stewart	Surgeon Captain	VIC	3027
GARNHAM	Arthur Charles	Dr.	VIC	3004
GREEN	Robyn Barbara	FLT OFF	VIC	3029
HABERSBERGER	Peter Graeme	Surg. Capt.	VIC	3144
HARDCASTLE	Juanita Linda	Capt. Dr.	VIC	3693
HARRY	Dianne Lorraine	SQNLDR	VIC	3027
HUMPHREY	Timothy	Dr.	VIC	3134
IRELAND	Jennifer Maree	Dr.	VIC	3047
IRVING	William Howe	Dr.	VIC	3942
JENSEN	Damien Maxwell	Wing CDR	VIC	3000
KELLY	John William	LT COL	VIC	3144
KEMP	Warren Atyeo	Surg. CMDR	VIC	3000
KING	David Thomas	LT COL	VIC	3124
LANDY	Rosemary Anne	Maj.	VIC	3004
LANE	John Charles	Dr.	VIC	3124
LEE	Stirling YIP-NAM	LT	VIC	3920
LESLIE	Douglas Robert	COL	VIC	3002
LOUREY	Christopher John	Dr.	VIC	3199
LUMSDEN	Jennifer Karen	FLT OFF	VIC	3181
McKENZIE	Douglas Wallace	LCDR	VIC	3183
MILLAR	Robert Gerald	LT COL R	VIC	3004
MOORE	Derek Chesterman	SQNLDR	VIC	3132
MYERS	Paul Christopher	MR	VIC	3677
NEWMAN	David	Flt. Lt.	VIC	3027
NICHOLSON	Geoffrey Charles	Prof. A-WG CDR	VIC	3220
NORTON	Leslie James	LCDR	VIC	3011
PRENTICE	Desmond A.	Dr.	VIC	3141
QUIRK	Ronald Philip	GP Capt.	VIC	3004
REITH	Marguerite Janet	FLT LT	VIC	3012
ROESSLER	Peter Malcolm	Capt.	VIC	3662
ROSENFIELD	Jeffrey Victor	Dr. Capt.	VIC	3168
RUSSELL	Thomas John	WG CDR	VIC	3121
SALTER	Rooney Richard	Maj.	VIC	3204
SAMUEL	Martin Victor	SQN LDR	VIC	3101
SCALZO	Frank	LT	VIC	3065
SCARFF	Anthony William	WG CDR	VIC	3000
SERRLE	Russell John	SQN LDR	VIC	3027
SHANNON	Michael James	LT COL	VIC	3002
SILVER	John Hodgson	CMDR	VIC	3122
SMITH	Trevor James S.	Dr.	VIC	3058
STACY	Robert John (Bob)	Capt.	VIC	3124
STAHLE	Ian Oliver	LT COL	VIC	3000
STORY	Rowan Darroch	SQN LDR	VIC	3000
SWANN	John Barry	LT COL	VIC	3144
TERRY	Michael Charles Gade	LT	VIC	3181
WARLEY	Charles C.	LT COL	VIC	3144
WARTON	Robert BRUCE	COL	VIC	3121
WEBB	David Rowan	SQNLDR	VIC	3050
WETTENHALL	John Milton	LT COL	VIC	3199
WHITEHEAD	Iain Stuart	CMDR	VIC	3920
WILSON	Charles Michael	LCDR	VIC	3175
WOLFE	Richard James Bowman	LCDR	VIC	3931
WRIGHT	Gavin Michael	FLT LT DR.	VIC	3027

Surname	Given Names	Title/Rank	State	
	75	75	75	73
DENNERSTEIN	Graeme Joseph	GP Capt	VIC	3040
PERINA	Annette	SQNLDR	VIC	3027
	2	2	2	2
CARTER	George Martin	Surgery LTCDR	WA	6158
DENEVIL	Gregory Pierre		WA	6158
HANDLEY	Paul Andrew	FLT LT	WA	6000
HILLS	Robert Charles Patri	LCDR	WA	6168
HOCKINGS	Bernard Edward	WG CDR	WA	6000
LANGFORD	Stephen Alan	LC DR	WA	6164
LITTLE	Mark	Maj.	WA	6008
McCARTHY	Peter David	Maj.	WA	6555
McLAREN	Alison Sarah Anne	LT	WA	6958
PROVAN	James Thomas	SBLT	WA	6062
ROBERTSON	Andrew Geoffrey	LCDR	WA	6168
ROBINS	Anthony Martin	LT	WA	6011
SLATYER	Mark Anthony	Maj.	WA	6010
SLAVEN	Maureen Reta	SBLT	WA	6019
SMART	Tracy Lee	FLT LT	WA	6084
WALKER	Robyn Margaret	LT	WA	6168
WITHERS	Kenneth Derek	LT	WA	6050
WONG	Robert Manching	CMDR	WA	6000
WOODS	Thomas Brian	WG CDR	WA	6005
	19	19	18	18

AMMA MEMBERSHIP BY STATES
FEBRUARY 1993