# Gulf War Syndrome

## Research Paper 95/37

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This paper examines some of the medical issues relevant to Gulf-related illness. The Defence Select Committee is currently holding an enquiry into Gulf War Syndrome.

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# I. Introduction

In medicine, a syndrome is a group of symptoms which have been observed to occur together regularly in a pattern. For example, *Zollinger-Ellison syndrome* is the association of a peptic ulcer with a hormone-secreting tumour of the pancreas; *Irritable Bowel syndrome* is the association of alternating constipation and diarrhoea with abdominal pain and bloating.

Gulf War Syndrome (GWS), Desert Storm Syndrome, Persian Gulf Syndrome and Desert Fever are synonyms applied to a condition which may or may not exist. Distinct from other medical syndromes there is no agreed constellation of symptoms. The only unifying factor between those suffering from symptoms is their service in the Gulf conflict.

Is it possible that in a complex theatre of operation like the Gulf there could be a simple single causative agent to account for all the alleged cases of resulting ill health? Or is the phenomenon which has come to be known as Gulf War Syndrome rather a concatenation of overlapping histories, of entwined illnesses, some of which would have occurred whether or not the individual had served in the Gulf, others of which may be as a direct result of their experience there?

In this paper Gulf War Syndrome is used to encompass all those cases of unexplained illness arising in service personnel which may be related to their service in the Gulf. Though it is inaccurate so far as it implies a common origin for all such illness, the term is convenient and because widely used, has been adopted with reservations here.

This paper should be read with this caveat borne firmly in mind.

# II. Origins

Following the end of the Gulf conflict reports began to trickle through initially in the USA and then rather more slowly elsewhere, of ill health among service personnel. The symptoms generally reported were disparate and non-specific, with fatigue being the most common. Others reported included diarrhoea, irritability, headache, poor appetite, sleep disturbances, weight loss and rashes. There seemed to be no common symptomatology and no one event or exposure common to all the complainants. Most symptoms seemed to start on return home. It was feared that the symptoms were related to service in the Gulf and the name

"Gulf War Syndrome" was coined (in the US the term "Persian Gulf Syndrome" is often preferred).

## III. The US Veterans Health Care Act

In 1992, following mounting media and public pressure, the US government passed the *Veterans Health Care Act 1992* (Public Law 102-585) which, amongst other things, provided for the establishment by the Department of Veterans Affairs (VA) of a Persian Gulf War Veterans Health Registry.

The Registry includes the name of each individual who served in the US armed forces in the Gulf who:

a) applies for health care or services from VA
b) files a claim for compensation from VA based on disability associated with Gulf service
c) dies and is survived by a spouse, child, or parent who files a claim for dependency and indemnity compensation
d) requests a health examination
e) receives from the Department of Defense (DoD) a health examination similar to that provided by VA and requests inclusion in the VA registry.

The law also requires:

a) VA to notify individuals listed on the Registry of "significant developments in research on the health consequences of military service in the Persian Gulf"
b) the Congressional Office of Technology Assessment (OTA) to evaluate the potential utility of the VA registry.
c) VA to co-operate with the Department of Defense and seek to enter into an agreement with the National Academy of Sciences, for the Medical Follow-up Agency of the Institute of Medicine of the Academy to review scientific, medical and other information on the health consequences of Gulf service and to conduct epidemiological research
d) the President to designate the head of an appropriate department or agency to co-ordinate all research undertaken or funded by the US government on the health consequences of military service in the Gulf.

Such registries in the US are not new. VA also maintains similar registries for Vietnam veterans exposed to Agent Orange, and for those who may have been exposed to atomic radiation during the occupation of Japan at the end of World War Two, or during nuclear weapons testing. Approximately 220 000 Vietnam veterans have participated in the Agent Orange registry.[1] VA officials have concluded that such registries are not well suited for use in scientific research because they are based on self-referrals. Such self-selection often leads to skewing of results through selection bias. However, the occurrence of patterns of health complaints in those on the registry could eventually suggest avenues for future research[2].

Of the 700 000 US men and women who served in the Gulf some 43,000 veterans have reported health problems, which they believe to be a consequence of their service in the Gulf War and some of which they believe to afflict their families[3]. A wide variety of disparate symptoms has been reported including cough, muscle and joint pains, allergy-like symptoms, headache, irritability, memory loss, gastrointestinal problems such as diarrhoea, generalised fatigue, lassitude and debility[4]. It is thought that roughly 36 000 of the US veterans have diseases which can explain their symptoms. For those with no diagnosis, the questions remain as to what is causing their symptoms. Are they related to service and conditions in the Gulf? Is there one illness or are there many? Is the incidence of illness higher in those who served in the Gulf than in a comparable civilian population? This last is the key question and is of course the most difficult to answer.

# IV. Possible Causes of Gulf War Illness

In the intense media speculation which has surrounded this issue in the past four years, numerous possible causes for symptoms have been mooted, from infectious diseases to exposure to chemical and biological agents of warfare. The following sections examine some of these possible aetiologies.

## A. Infectious Diseases

It is a recognised fact that some acute infectious illnesses may have long term sequelae. Infection with the *Epstein-Barr virus,* causing glandular fever, may result in low spirits, depression and lethargy which may persist for months or even years, long after the physical

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[1] *Persian Gulf Review*: Vol 1 No 2 February 1993
[2] ibid
[3] *British Medical Journal* 14th January 1995 p77
[4] "Gulf war syndrome to be investigated." *The Lancet* 5th February 1994

symptoms have disappeared[5]. Persistent viral infection has been suggested as one of the possible causes of myalgic encephalomyelitis (ME or post-viral fatigue syndrome).

Some infections themselves become chronic and cause persistent physical disease such as tuberculosis and hepatitis. Without suggesting that any of these agents has a relationship with Gulf-related illness in particular, it should be recognised that infectious disease may cause chronic symptoms, many of which are non-specific and generalised ( such as weight loss, intermittent fever, lethargy).

Both diarrhoeal disease caused by a variety of pathogens including *Escherichia coli, Shigella* (both bacteria) and Norwalk virus, and respiratory disease (asthma, cough and sore throat) were common among the US forces in the Gulf War. Other infectious diseases such as malaria, Q fever, and meningococcal infections were also reported.

Some symptoms could be due to infection with *Leishmania tropica*. Infection with other strains of this protozoan results in a disease called *leishmaniaisis* which is spread by the bites of sandflies.[6] In one of its forms leishmaniasis presents with symptoms very similar to those which many veterans report; chronic intermittent fever (in some sources GWS is referred to as Desert Fever), anaemia, swelling of the lymph nodes, wasting, cough and diarrhoea.[7] *Leishmania tropica* infection has been confirmed in 31 US veterans of whom 2 had a new presentation for this strain- *viscerotropic leishmaniasis.* In these, fatigue, weight loss and fever were common and the onset was delayed by up to 14 months. It is possible that new tests based on a genetic method of detecting the protozoan in the bone marrow (where it can escape detection by simple blood testing) together with other tests of immunity might reveal a pool of viscerotropic leishmaniaisis amongst veterans labelled as having GWS[8]. It is for this reason that there is a ban in the USA on Gulf veterans donating blood.[9]

In this country it has been asserted that:

> "The possible threat to UK personnel from sand fly bites during operation Granby was well recognised and effective protective measures were taken. Tests for leishmaniasis are routinely performed on all personnel whose service and personnel history, symptoms and signs are suggestive of the disease. No case of leishmania (sic) has been found in British armed forces personnel who served in the Gulf."[10]

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[5] *Oxford Handbook of Clinical Medicine* 1990 p 204
[6] *Oxford Textbook of Medicine* 1990 p242
[7] ibid
[8] *Lancet* 7th May 1994
[9] "NIH panel rejects Persian Gulf syndrome." *Nature* 5th May 1994
[10] HL Deb 6th December 1994 WA 74

The USA's recent review of research concluded that no current clinical tests for the disease are completely satisfactory and has requested specifically further research into a possible link between leishmaniasis and GWS.[11]

## B . Vaccinations

### 1. Risk vs Benefit.

Another focus of interest has been the regimen of vaccinations given to service personnel during Operation Granby. In the general population, most vaccinations are relatively safe. Minor reactions, such as soreness of the arm, redness and swelling are common and usually subside within a day or two. Mild fever and malaise also commonly occur but this too is not usually serious. Severe reactions to vaccination are rare but may be fatal[12].

When considering any programme of vaccinations the theoretical risk of the vaccination has to be weighed against the risk of contracting the disease. In the military context it has been stated that there is another consideration:

> "...the assessment must also gauge the risk of natural or contrived disease denying successful completion of the mission. Failure to protect a force adequately could jeopardise an operation."[13]

All vaccines are extensively tested for safety and efficacy before licensing, but suspected side effects of any vaccine (or any other drug) especially those which are serious or fatal should be reported by doctors to the **Committee on Safety of Medicines (CSM)** through the Yellow Card system[14].

### 2. Vaccines Administered During Operation Granby

Vaccines administered to UK service personnel who are deployed abroad for whatever reason fall into 2 categories: routine vaccinations and additional vaccinations.

**Routine vaccinations** are given routinely to all service personnel to maintain up-to-date immunity to tetanus, poliomyelitis, yellow fever and typhoid. In addition, vaccine against

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[11] "Gulf War syndrome needs coordinated study." *British Medical Journal* 14th January 1995 p 77
[12] *British National Formulary* September 1994 p 467
[13] *Report on the Vaccinations used for Operation Granby* Dep 9853 November 1993
[14] *Immunisation against Infectious Disease* Department of Health 1992 p 10

the virus hepatitis B is given routinely to those whose work is likely to bring them into contact with blood and body fluids, chiefly medical and dental personnel.

Boosters of the above would only have been given prior to deployment to the Gulf if the individual's immunity was out of date (and thus protection was ineffective) or would become so during the likely duration of the operation.[15]

**Additional vaccinations** are those administered to combat diseases specific to the area of deployment. In this case additional vaccines were given against:

a) cholera
b) meningococcal meningitis ( given to medical staff and personnel in contact with host nation personnel only)[16]
c) agents of biological warfare (BW).

### 3. Mode of Administration.

There has also been additional concern as to whether the rapid co-administration of several vaccines simultaneously or in rapid succession could account for some of the symptoms reported by some of those returning from the Gulf. However, the rapid or simultaneous administration of vaccines such as yellow fever, hepatitis A, typhoid, cholera, poliomyelitis and tetanus, are commonly given to those who have to go abroad at short notice. It is now standard practice for infants, whose programme of immunisation begins at 2 months of age, to be given vaccinations against polio, diphtheria, tetanus, whooping cough (pertussis) and *Haemophilus influenzae* type B all at the same time. Generally it is not advised that two live virus vaccines be given at the same time (unless they are available as a combined preparation e.g. MMR) they should either be given at different sites or separated by an interval of three weeks.[17]

However, a recent study has suggested that in children, the risk of developing polio vaccine-associated paralytic poliomyletis is increased if the child receives multiple intramuscular injections shortly after exposure to oral polio vaccine.[18] Although such "provocation paralysis" is rare, and this particular study was conducted in Romanian children, it is

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[15] Dep 9853
[16] HC Deb 21st November 1994 c 58w
[17] *British National Formulary* September 1994 p 467
[18] "Intramuscular injections within 30 days of immunization with oral poliovirus vaccine- a risk factor for vaccine-associated paralytic poliomyelitis." Strebel PM et al *New England Journal of Medicine* February 23rd 1995

interesting in that it suggests a link between multiple injections and the ability of one particular vaccine to cause disease.

### 4. Contraindications

Public confusion tends to surround this issue. Most vaccines have some basic contraindication to their use and the manufacturer's leaflet should always be consulted, but the situation that a vaccine should be absolutely withheld from an individual exists less commonly than is generally supposed.

Such situations include:

a) *feverish illness* at time the vaccination is to take place,
b) a *previous severe reaction* to that vaccination,
c) *specific allergies to various components of the vaccines themselves.* Some viral vaccines contain small amounts of *antibiotics* such as neomycin or polymyxin: such vaccines may need to be withheld from individuals who are sensitive to the antibiotic. Hypersensitivity to *egg* contra-indicates influenza vaccine which contains egg protein, and if there is evidence of previous anaphylaxis[19] also the mumps, measles and rubella (MMR) and yellow fever vaccines.[20]

A more comprehensive list is given in the British National Formulary.[21]

Before vaccination an individual should *always* be questioned about any allergies or previous reactions to immunisation as a positive response may indicate that a vaccine is contraindicated and that it is safer not to proceed.

### 5. Interactions

At present there is no scientific or medical evidence to suggest that vaccines can interact with each other to produce long term health effects.[22]

It is known that some vaccines can interact with other drugs taken simultaneously: *influenza* vaccine is known to *occasionally* potentiate the effects of drugs such as warfarin (an anti-

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[19] Anaphylaxis is a rare severe life-threatening allergic reaction, most commonly to an insect sting but also seen after the injection of a drug such as penicillin or a vaccination, or less commonly after the ingestion of a particular food ( e.g peanuts) or drug has been taken by mouth. The individual may suffer sudden collapse and shock with obstruction of the airways. Treatment has to be prompt if death is to be avoided.
[20] *British National Formulary* September 1994 p 467
[21] ibid
[22] HC Deb 8th December 1994 c 305w

coagulant), phenytoin (an anti-epileptic) and theophylline (an anti-asthmatic)[23]. If *rabies* vaccine is given concomitantly with chloroquine, a drug widely used in the treatment and prevention of malaria, the antibody response may be affected.[24] The newly developed oral *typhoid* vaccine is inactivated by the simultaneous administration of antibiotics or sulphonamides[25]. It is also well known that live vaccines (i.e. those composed of live infectious particles which have in some way been "weakened" to prevent them causing active disease) such as yellow fever and polio vaccine should not be given to those who are lowered immunity, either as a result of radiotherapy, chemotherapy with immunosuppressive drugs, or through treatment with high doses of corticosteroids, as their immune systems may be overwhelmed in such cases and serious disease may result.[26]

### 6. Consent

It has been stated that in Operation Granby all vaccinations were given in accordance with the Department of Health guidelines as laid out in the Department of Health publication *Immunisation against infectious disease*[27] in which it states:

> "Consent must always be obtained before immunisation."

The Ministry of Defence has said:

> "Vaccines against those biological agents identified as a threat in Operation Granby were made available to Service personnel on the basis of informed consent between patient and medical officer, and were administered with Department of Health guidelines ...."[28]

and again:

> "All vaccines administered to British forces during operation Granby were offered on the basis of voluntary informed consent. Any vaccines without a UK product licence were licensed in their country of origin, fully tested in the UK and cleared for use."[29]

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[23] *British National Formulary* September 1994 p 518
[24] ibid p 478
[25] ibid p 479
[26] ibid p 467
[27] *Immunisation against infectious disease* Department of Health 1992 p 10
[28] HL Deb 6th June 1994 WA 71
[29] HL Deb 7th December 1994 WA 91

Although it has consistently been reiterated by the government that vaccination was offered on the basis of voluntary informed consent, it is also true that "refusal to receive treatment could lead to disciplinary action." [30]

### 7. Record keeping

There have also been concerns about the quality of the records kept, and whether the records of every individual have been fully annotated as would happen should a civilian undergo a vaccination:

> "During operation Granby vaccinations or prescribed medications were entered on a nominal roll for later transfer to individual records. Given the rapid repatriation and demobilisation of personnel at the end of the conflict, it is likely that some individual medical records were not fully annotated."[31]

Although service medical records are the property of the Ministry of Defence they can be made available to service medical officers or civilian general practitioners on request.[32]

### 8. Licensing

The Government has stated:

> "All vaccines administered to military personnel in the Gulf War of 1990-1 were licensed. Civilian vaccine product licenses do not however cover prophylactic use against a biological warfare threat , but those administered to United Kingdom troops for this purpose were licensed for similar civilian use in their country of origin."[33]

Of the biological warfare vaccines administered to UK service personnel two were not licensed in the UK for civilian use. One was licensed in the US and Canada and the other was licensed in France, the Ivory Coast, Senegal and Venezuela. Both vaccines were said to be tested by the UK National Institute for Biological Standards and Control and cleared for use both by the Institute and the Department of Health[34].

> "...the vaccines administered to counter the identified OP Granby BW threat have a well established, if restricted place in normal peacetime medical practice as

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[30] HC Deb 21st November 1994 c60w
[31] HL Deb 7th December 1994 WA 92-93
[32] ibid
[33] HC Deb 21 November 1994 c 59 w
[34] HC Deb 20th December 1994 c 1185w

> preventative measures against disease. Their safety and efficacy in civil medicine are proven and they are licensed in this context".

### 9. Classified Vaccines

All information relating to vaccines used in the Gulf to counter the possible threat of chemical and biological attack remains classified.

> "Information....could be useful to terrorists and potentially hostile intelligence services. Its continued classification is to protect British troops who may face a biological warfare threat in the future"[35]

## C. Nerve Agent Pretreatment Set (NAPS) or pyridostigmine bromide

*Pyridostigmine bromide* is used as a pre-treatment for those at risk of poisoning from nerve agents. In this context it is called NAPS, is used internationally in this way[36] and was issued to both UK and US troops in the Gulf.

### 1.Use in Myasthenia Gravis

The active constituent of NAPS is the drug *pyridostigmine bromide.* Pyridostigmine and its relatives, such as neostigmine and distigmine have been used in civilian medicine for many years in the treatment of *myasthenia gravis* (MG). In this condition the muscles become weak and tire easily; the total daily dose is in the range 300-1200mg (although it is inadvisable to exceed a daily dose of 720mg). This may be taken for many years or even for life.[37] The drug works by facilitating the transmission of nervous impulses at nerve endings. Side effects include increased sweating, salivary and gastric secretion, increased activity of the gut and the uterus and a slowing of the heart[38]. These effects disappear when the drug is stopped.

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[35] HC Deb 24th January 1995 c 190w
[36]HL Deb 6th June 1994 WA 71
[37] *British National Formulary* September 1994 p394
[38] ibid

### 2. Use as NAPS

When used as NAPS the daily dose is 90mg[39] (30 mg 3 times a day) and thus is much smaller than that taken by those with MG. Studies carried out to evaluate the use of pyridostigmine in providing effective protection against nerve agent poisoning have concluded that it gave:

> "considerable protection against all organophosphorus nerve agents with no significant adverse effects."[40]

Such studies were carried out at the Chemical and Biological Defence Establishment at Porton Down and elsewhere in the 70s and 80s, using service volunteers. The Government has said that these studies lasted up to 8 weeks and included an assessment of the effects of NAPS on volunteers undergoing strenuous exercise and in a thermally stressful environment.[41]

Licensed to the MoD by the Medicines Control Agency under Product Licence Number 4537/0003 for use in the pretreatment of service personnel at risk of poisoning from organophosphorus nerve agents,[42] pyridostigmine when used as NAPS is not issued as a medicinal product in accordance with the normal procedures for prescribing medicines and is not issued on a named patient basis.[43] It is claimed that all service personnel are made aware of the purpose of NAPS and are trained in its use[44] including being briefed not to exceed the stated dose, and when to begin taking the tablets[45] although anecdotal reports have disputed this.[46]

> "Taking NAPS is considered to be the personal responsibility of the person concerned"[47].

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[39] HL Deb 6th June 1994 WA 72
[40] ibid
[41] HC Deb 15th February 1995 cc725-6w
[42] ibid
[43] HL Deb 7th December 1994 WA 91
[44] HL Deb 6th June 1994 WA 71
[45] HC deb 14th December 1994 cc 667-8w
[46] "Gulf war nurse sues over nerve gas pills." *The Guardian* November 22nd 1994
[47] HC Deb 26th January 1995 c288w

## D. Post traumatic stress disorder (PTSD)-the psychological consequences of disaster

That major disasters have catastrophic effects has been known throughout the history of mankind. Disasters can take place suddenly, involve massive loss of life, lead to serious injury and loss of homes and property (such as the recent earthquake centred on Kobe in Japan or the Aberfan disaster of 1966) whereas others develop more slowly (famine) or involve only a few individuals. Disaster may be natural e.g fires or diseases, or man-made e.g. wars.

> "What disasters have in common is that they are so catastrophic and overwhelming that they go beyond anything the individuals involved normally have to cope with, so that their psychological capacity to function is stretched beyond their limits of endurance."[48]

### 1. History of PTSD

The defining and classification of PTSD as a separate diagnostic category in 1980 grew out of the Vietnam war. This was a seminal moment as it was the first time that a psychiatric diagnostic system recognised the possible existence of a psychiatric disorder that was *wholly environmentally determined*, and therefore had nothing to do with the personality of the person concerned prior to the event but was a function of the trauma of their experience and thus could occur in anyone.

### 2. Diagnosis of PTSD

The essential feature of PTSD is *the development of symptoms following a psychologically distressing event that lies outside the range of normal experience.*

Initially this was taken not just to be a bereavement or a business loss but something more uncommon, such as being under extreme stress in a combat or hostage situation. The sufferer continually re-experiences the traumatic event:

> "...in the form of recurrent intrusive recollections or dreams and nightmares or absences (dissociations) in which the event may be relived to the extent of the person acting as though they are once again present at the scene.....There is usually an avoidance of stimuli associated with the event, which may even amount to an apparent

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[48] *UCH Textbook of Psychiatry* p 187 1990

> amnesia for the occurrence of a trauma. Intense distress may be experienced, when reminders such as anniversaries are unavoidable or on exposure to events or objects that may symbolize some aspect of the traumatic experience."[49]

The criteria for the diagnosis of PTSD laid down in DSM-III (the US Diagnostic and Statistics Manual which aims to define and categorise psychiatric disorders) recently revised in DSM-III-R include the following:

> (1) The person has experienced a stressful event that is outside the range of normal human experience and would be markedly distressing to almost any one.
> (2) The event is being re-experienced in vivid dreams, intrusive recollections and flashbacks, usually in response to some triggering stimulus. Illusions and short lived hallucinations may also occur.
> (3) The person avoids stimuli which could be reminiscent of the disaster leading to numbness, unresponsiveness and withdrawal.
> (4) The person experiences increased arousal which was not present before the event. This includes difficulty in going to sleep or staying asleep; irritability or outbursts of anger; difficulty in concentrating, hypervigilance and an exaggerated startle response. Guilt about survival and memory impairment may also be present.

DSM-III-R also distinguishes between an acute PTSD of early onset that clears up within six months of the trauma and the chronic syndrome whose onset may be delayed and from which the person may never fully recover. It also has to be remembered that PTSD can co exist with other symptoms such as those of depression and grief, if the individual has lost family and friends in the disaster or his physical health as a result of injuries.

Since its classification in 1980 it has come to be recognized that other traumata, though apparently less severe than a natural disaster can also cause something similar.[50] There are many similarities between post-rape syndrome and the PTSD of war veterans including physical symptoms of headache, insomnia, poor appetite and increased startle reactions.[51]

Although compensation had been paid for "nervous shock" as early as 1970, in 1976 the US Supreme court ruled for the first time that a disaster could cause a psychological disorder for which compensation could be paid. This followed on from the Buffalo creek disaster in which a dam broke and flooded 1200 homes. The court ruled that the event had left a significant number of survivors psychologically disturbed and the Tennessee Water Authority had to pay compensation for this also over and above the compensation paid out for loss of

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[49] DSM-III quoted in *Images of Trauma: from Hysteria to Post Traumatic Stress Disorder* Healy, D 1993
[50] ibid
[51] *Images of War* Healy D 1993

life and property.[52] In this country the comparable landmark judgment concerned the sinking of the Herald of Free Enterprise in 1988. In a more recent ruling on the Hillsborough disaster, the courts decided an individual may be financially compensated for PTSD even without being present at a disaster-in this case if they had watched disaster befall their relatives on television.[53]

Though not a psychosomatic illness, PTSD sufferers, and those suffering from other psychiatric complaints such as depression may experience somatic symptoms as a result of their psychiatric problems. It is unfortunate that the use of the term "psychosomatic" illness has become rather pejorative, and in common usage has come to be associated with ideas of the illness being somehow "not real" or "all in the mind" whereas strictly it means that the physical symptoms are caused by the effects of the psyche and are none the less *real* for all that.

## E. Depleted uranium (DU)

Depleted uranium (DU) is the material that remains after the more radioactive components of natural uranium have been removed for use as radioactive fuels. Its use in munitions stems from its ability to penetrate all known armour. It is also an effective shielding material against all forms of penetrating munitions including tungsten[54]. It is also used as ballast in aeroplane wings and as counter weights for large cranes.[55]

DU presents a possible hazard to health as:

1. a radioactive substance, and
2. as a heavy metal poison

Exposure to DU may occur either *externally*, where the DU is not taken into the body or *internally* in cases where the DU is internalised by inhalation, ingestion, contamination of wounds or by a DU shrapnel wound.

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[52] ibid p108
[53] ibid
[54] *Fact Sheet: Health Effects of Depleted Uranium* Office of Assistant Secretary of Defense June 11th 1993
[55] *US Department of Defense Information Paper. Tanks and armoured vehicles with DU damage* 9th October 1991

**1. possible health hazards arising from external exposure to DU**

In this case the hazards are thought to be extremely low. The Defence Radiological Protection Service (DRPS) have conducted studies which have shown that personnel would need to be in a fully DU loaded tank for 1500 hours before they would reach the current annual whole body dose limit of 50 mSv.[56] For those working with or exposed to DU ammunition in armament depots or stores 5000 hours of exposure to DU would be required before the current dose limit for exposure of the whole body (above) were exceeded. The main external radiation hazard from DU is from contact with bare skin. The current dose limit to the skin would only be exceeded if the skin remained *in contact* continuously with DU for more than 250 hours per year.[57]

**2. possible health hazards arising from internal exposure to DU**

When an individual's tissues are exposed to DU internally there are 2 major concerns; the radiation hazard, and the problem of chemical toxicity.

The internal radiation hazard during normal inspection and handling of DU ammunition is negligible as the DU is covered by a protective coating. However, when DU burns in air it forms highly insoluble oxides, some of which when inhaled might be retained in lung tissue. Over a period of time this could damage lung tissue. The inhalation of 80mg of such insoluble DU would result in the dose limit to the whole body being exceeded.

As to its chemical toxicity, uranium is a heavy metal and when inhaled or ingested in soluble form is about as chemically toxic as lead.[58] It is known that acute high exposure to soluble uranium compounds can result in kidney damage which is usually reversible[59]. Occupational limits for exposure to soluble forms of uranium are based on consideration of the amount which fails to injure the kidney, the organ which is most sensitive to it.

**3. Risk of DU in combat**

In a combat situation the main exposures to DU are as follows:

a) inhalation of uranium contaminated smoke following the penetration of armour by a large calibre DU round. The DPRS calculated that unprotected personnel standing 100 metres

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[56] *Radiological and Chemical Hazards of Depleted Uranium* Defence Radiological Protection Service Report 13/93 October 1993 Dep 9706
[57] DRPS Report 13/93 p2
[58] Office of the Surgeon General, Department of the Army Information sheet. *Is there any chemical or radiological health risk associated with DU exposures* 14th June 1993
[59] DRPS Report 13/93

directly downwind would inhale approximately less than 0.2mg of DU (the occupational exposure limit set by the Health and Safety Executive equates to the inhalation of 0.2mg of DU per hour).

b) radiation hazards in vehicles penetrated by DU rounds. It is thought these are unlikely to be of any significance unless any one person enters or any single unit repairs a large number of damaged vehicles. The most significant radiation hazard in vehicles penetrated by DU rounds arises from the inhalation of radioactive material. Under post combat conditions personnel could inhale 1.6mg of DU per hour and in 50 Hours the dose limit for the whole body would be exceeded.[60]

The US troops considered to be at greatest risk from exposure to DU were the 27 soldiers of the 144th Supply and Services Company who prepared damaged battlefield vehicles for repair. Half of these soldiers have since undergone examination at the Boston Veterans Affairs Center. The results of the tests showed no effects of uranium toxicity and no uranium residues of by-products were detected. Another group of US veterans may have experienced another atypical exposure to DU when they were aboard battlefield vehicles struck by US-fired DU penetrators. 22 of the soldiers suffered fragmentation injuries with some of the fragments being embedded in their tissues. Those identified as retaining fragments of DU will each receive a minimum of 5 years' medical evaluation, though as far as the US Surgeon General is aware none of the soldiers with possible DU shrapnel fragments in their bodies has demonstrated the symptoms associated with other reports of GWS[61]. The US army entered into an agreement with the Department of Veterans Affairs to perform a long term follow up of individuals who were injured by DU shrapnel[62] while stating that:

> "While the symptoms of some Desert Storm veterans cannot be explained at the present time it is highly unlikely that depleted uranium exposures either internal or external are related."[63]

In the UK a link between GWS and DU exposure has been consistently denied:

> "None of the individuals coming forward with concerns about their health as a result of service in the Gulf who have so far been examined have displayed symptoms consistent with exposure to depleted uranium."[64]

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[60] DRPS report 13/93
[61] Office of Assistant Secretary of Defense Fact sheet *Health Effects of DU* June 11th 1993
[62] *Health Effects of DU* 1993
[63] ibid
[64] HL Deb 6th December 1994 WA 77

## F. Exposure to chemical agents

Other factors which have been mooted as causes for the health problems suffered by veterans of the Gulf War include exposure to *environmental chemicals.* It is known that individuals may report poor concentration and fatigue after exposure to various common substances. Service personnel in the Gulf were exposed to many potentially harmful chemical agents such as organo-chlorine pesticides, and the fumes from burning oil wells. For example, *malathion* was used in dusting powders to prevent lice infestation. It is a common ingredient in various proprietary preparations used in this country to treat lice (eg head lice) and scabies.[65] Insecticides available for use included *permethrin* used on some desert issue combat clothing, *bendiocarb* used to spay one tented camp and *pyrethrum*, available but little used. All the above are relatively common household insecticdes, had Health and Safety Executive approval and were said to be used only by trained and competent personnel. A range of proprietary fungicides (e.g. creams) were available to treat fungal infections, and canvas tenting is treated during manufacture with pentachlorophenyl laureate to inhibit fungal decay.[66]

A researcher at a US Department of Agriculture research station reported to the Senate Veterans' Affairs Committee an observation that the insect repellant diethyl toluamide (DEET) available to US and UK troops, when mixed with pyridostigmine became 10 times more toxic to cockroaches. It is not known how valid this observation is or even how it was made: DEET is usually applied only to the skin and is not ingested, and is said to have a toxicity comparable to many other common chemicals such as salt and acetic acid (vinegar)[67].

## G. Exposure to chemical weapons

There has also been concern from the US (following a Czech government report that their troops had detected chemical residues 3 times during the War)[68] and UK[69] veterans that they were unknowingly exposed to nerve gas or agents of chemical warfare. The Americans in particular have been mindful of the US government's persistent denials of the adverse effects of Agent Orange after Vietnam. In this country the Ministry of Defence, providing oral and written information to scientific panels in the US investigating GWS has consistently denied that there were any detections of chemical agents during the Gulf War and no evidence that UK troops were exposed to such agents.[70]

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[65] British National Formulary September 1993 p 425
[66] HL Deb 21st July 1994 WA 50
[67] HL Deb 21st July 1994 WA47-48
[68] "Poison gas not to blame for Gulf War sickness." *New Scientist* 20th November 1993
[69] HC Deb 20th December 1994 c1170
[70] HC Deb 11th March 1994 c419w

This is in contrast to the anecdotal reports from US service personnel themselves many of whom are convinced they were the victims of chemical attack. In the early hours of 17th January 1991 Staff Sergeant Hicks of the 644th Ordinance Company, heard a loud explosion which was followed by the sounding of alarms. As he ran to the bunker his face "began to burn" and 2 to 3 days later, he fell ill and noticed blood in his urine. Petty Officer Sterling Symms of the Naval Reserve Construction Battalion 24, stationed south of the Kuwaiti border has testified before a Senate Committee that in the early hours of the 20th January 1991 there was a loud explosion overhead which triggered the alarms. When the members of the unit were running to their bunkers Petty Officer Symms alleges that there was a sharp odour of ammonia in the air. His eyes burned and his skin stung. He also alleged that members of the unit were advised that what they had heard was a sonic boom and that they were ordered not to discuss the incident. On the same night, members of a unit stationed near the port city of al-Jubayl in Saudi Arabia heard an explosion which caused them to seek their bomb shelters. One of the members of the unit said:

> "All of my exposed skin was like it was on fire. It was burning like crazy. I couldn't breathe. I had to take my mask off and clear my nose. I immediately thought we got gassed."[71]

### H. Multiple interaction

It remains possible that some of the symptoms suffered by those returning from the Gulf may be due to a hitherto undiscovered interaction between any of the above. The only way this question will be answered, if ever, is by research. In the recent review of the literature carried out by the US Institute of Medicine one of the avenues for future research which they suggested was into the field of Multiple Chemical Interaction (see section VII).

## V. Effects on spouses and their children

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[71] *Gulf War Syndrome: The Case for Multiple Origin Mixed Chemical/Biotoxin Warfare Related Disorders* Staff Report to US Senator Donald W. Riegle Jr., 9th September 1993

In October 1994, 400 preliminary responses to a survey of over 1000 of those on the US register showed that 78% of their spouses and 65% of their children born since the Gulf War had suffered some sort of unusual symptom, according to a spokesperson for Senator Donald Riegle who has led congressional investigations into the reports.

The following month the *Los Angeles Times* reported anecdotal evidence of a greater than expected number of birth defects among children born to families living at Fort Bragg, home of the US Army's 82nd Airborne Division, an elite unit that served in the Gulf. The newspaper also reported that infant mortality had risen near military installations in Mississippi, Kentucky, Tennessee, Georgia and Texas. In Mississippi 13 of 15 children born to veterans of the Gulf war had suffered serious birth defects. The local department of health is said to have studied these reports and to have concluded the rate of defects to be normal for that area. The Pentagon has consistently denied that any evidence exists that ill effects have been transmitted to spouses and children.

In the UK as of the 6th December 1994 no request had been received by the Government on behalf of civilian wives or pre-war children of UK forces personnel for medical assessment nor had the government received reports of any unusual illness amongst service dependents:

> "We have no evidence to suggest that the evidence of miscarriage, genetic defects or infant morbidity among the spouses or children of United Kingdom Gulf Veterans is higher than that experienced in the general population, or that further research is required, although we shall continue to monitor developments..."[72]

## VI. The US Government response

In their efforts to determine whether GWS was a single illness and if so the possible cause, an advisory panel to the US National Institutes for Health (NIH) held a three- day workshop in April 1994. This meeting was partly prompted by the anger of the Gulf War Veterans' Association, who wished for some- even imperfect- definition of Gulf related illness which would enable some of their members to claim disability allowance.

The advisory panel, while acknowledging that the illnesses were real, concluded that the:

> "...complex biological, chemical, physical, and psychological environment of the Desert Shield/Desert Storm theatre of operations appears to have produced complex

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[72] HL Deb 6th December WA 76-77

> health effects in the primary military personnel.....There is no single disease or syndrome apparent, but rather multiple illnesses with overlapping symptoms and causes."[73]

and again:

> "no one disease or syndrome has been identified as the sole cause of these symptoms being experienced by Gulf War veterans."[74]

The NIH panel certainly thought that PTSD was a component of GWS.[75] The meeting also highlighted the paucity of records of exposure and the lack of detailed knowledge as to the exposure record of any particular individual.[76]

Though the NIH panel concluded that GWS probably did not exist as a single disease per se the House of Representatives approved a measure in August of this year to pay compensation to those affected by symptoms even though the Pentagon and the US medical advisers cannot define what is wrong with them[77] leaving the USA to depend on future scientific research to resolve the scientific debate over whether GWS is one or many illnesses.[78]

# VII. The UK Government Response

## A. The Gulf War Medical Assessment Programme

All those present and former service personnel who believe that they have suffered illnesses as a result of their service in the Gulf have been encouraged to come forward for medical assessment. Individuals are seen initially by Wing Commander WJ Coker OBE BA BSc MB ChB FRCP, consultant physician at Princess Alexandra's RAF Hospital Wroughton. Depending on the outcome of the initial assessment the patient may then be referred to an appropriate military or civilian specialist for further investigations.[79]

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[73] Conclusion of the NIH panel quoted in the *Lancet* 7th May 1994 p1150 "Persian Gulf Syndrome puzzle."
[74] Nature 5th May 1994
[75] *The Lancet* 7th May 1994
[76] ibid
[77] "US forces to get pay-outs for Gulf War syndrome." *Daily Telegraph* 9th August 1994
[78] "US to compensate Gulf veterans." *Guardian* 10th June 1994
[79] HC Deb 21st November 1994 cc58-59w

At the time a letter was written to the *British Medical Journal* by the Surgeon General to the Ministry of Defence in June 1994 only 33 Gulf veterans had been referred to the Ministry of Defence for assessment.[80] The symptoms they described had been diverse and no consistent symptom pattern had emerged; fatigue and weakness were the two commonest complaints. Both are non-specific and occur commonly in the general population.[81]

> "Consistent findings have been an absence of physical signs and no abnormality on examination."

Rather similarly to the NIH panel in the USA the Surgeon General concluded:

> "...we have no evidence to support the claim that a medical condition exists that is peculiar to those who served in the Gulf conflict.....There is no doubt that the symptoms reported are real; what is in doubt is whether the non-specific symptoms of Gulf illness have a higher prevalence in Gulf veterans than in the general population."

To the 8th of February 1995 of the 233 veterans who had come forward for assessment roughly one third had been seen and examined. Of these 25% had been diagnosed as suffering from psychological conditions, 20% from recognised medical conditions unrelated to service in the Gulf, 10% from chronic fatigue syndrome and the remainder from a variety of "minor physical ailments".

> "None of the conditions has been found to be peculiar to service in the Gulf. There is no single illness, major or minor, common to those examined and no evidence to suggest the existence of a Gulf War syndrome....."

Rejecting an independent enquiry, the Government has instead asked the Royal College of Physicians (RCP) to perform an independent clinical audit on its work so far, the terms of reference and the membership of the overseeing panel to be set by the RCP.[82] Furthermore when 100 assessments have been made preliminary findings will be made public probably in another letter from the Surgeon General to the BMJ.[83]

The Defence Select Committee is also undertaking a short enquiry into aspects of the MoD's response to allegations of the existence of a Gulf war syndrome.

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[80] "Gulf illness." letter to the *British Medical Journal* 11th June 1994
[81] "Gulf illness." letter to the *British Medical Journal* 11th June 1994
[82] HC Deb 17th February 1995 c883-4w
[83] HC Deb 8th February 1995 c 331w

### B. Medical discharges

According to central medical records, to the 8th December 1994, 1 Royal Navy, 44 Army and 3 Royal Air Force personnel had been discharged on medical grounds as a result of injuries or illnesses during Operation Granby . All were discharged for recognised medical conditions.[84] No war pensions have been made in respect of alleged Gulf War Syndrome. 11 awards have been made to ex service personnel making claims but in all these cases the awards were for recognised medical conditions .[85]

## VIII. Conclusions

No single illness peculiar to service in the Gulf has yet been identified. However in its search for possible causes of Gulf-related illness, the US government is planning to spend almost $21 million (£14 million) this year on research into Gulf-related illness.[86] In its recent review of the current research the US Institute of Medicine (IoM) made several conclusions and recommendations.

The panel recommended that small studies focusing on small military units should be abandoned as the figures cannot be relied on because of the small sample numbers. Instead, it recommended the US Government should initiate large sale epidemiological studies in a representative population and that it should focus on two possible causative agents, lead poisoning (raised lead levels have been found in some veterans) and the prospect of any interaction between the various chemicals to which US servicemen may have been exposed. The panel also recommended that further research be done into visceral leishmaniasis and that there should be more cooperation between the Veterans Administration, and other relevant government departments such as Defense and Health and Human Services, and the Army Navy and Air Forces to ensure that the studies are well designed and that they do not duplicate one another[87]. It concluded that there was no reliable evidence that soldiers had been exposed to chemical and biological weapons[88] (although this is disputed by many of the servicemen themselves[89]) and that there was no evidence of any link to the vaccinations the troops had been given. The IoM will monitor the progress of its recommendations and report

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[84] HC Deb 8th December 1994 c 306 w
[85] HC Deb 2nd February 1995 c825w
[86] *BMJ* 14th January 1995 p77
[87] "Call for more co-ordination of Gulf war syndrome research." *Nature* 373 January 1995
[88] "Jury still out on Gulf syndrome." *Science* 13th January 1995
[89] "Jury still out on Gulf War syndrome." *Science* Vol 267 13th January 1995

to Congress again at the end of 1996. In that report it will consider mental health, women's health, multiple chemical sensitivity, toxicological exposures and nutrition.[90]

Whether the UK Government amends its strategy as a result of the RCP audit remains to be seen.

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[90] *British Medical Journal* "gulf war Syndrome needs co-ordinated study." 14th January 1995

# Further reading.

*Images of Trauma : From Hysteria to Post Traumatic Stress Disorder* David Healy 1993

HC Deb 20th December 1994 cc 1568-1576 Gulf War syndrome-adjournment debate

Gulf War Syndrome-fact or fiction? *The Soldier* 23rd January 1995

Post War Battle *Nursing Times* 7th September 1994

## Helpful organisations

TACT is a charity which exists to help those who have survived traumas and disasters and who are suffering from mid to long-term psychological effects.

Buttfield,
The Farthings,
Withington,
Gloucestershire.
GL54 4DF.
Phone 0242-890306.