BIOLOGY

The Search For Better Health: Second Hand Research

Question 1

Discuss the role of quarantine in preventing the spread of disease in plants and animals into Australia or across regions of Australia. Use examples in your response

Due to its geographic isolation, Australia has frequently been privileged in preventing the spread of plant and animal disease from other disease prone countries. This isolation lessened as international travel and trade increased which, in turn, led to a need for a further sophisticated and comprehensive system to prevent the admission of pests and diseases into Australia. Thus, quarantine measures play an extensive role in preventing the spread of disease in plants and animals into Australia and across regions of Australia. Quarantine is often defined as the controlling of the import and export of animals and plants for the purpose of preventing the spread of disease.

AQIS
AUSTRALIAN QUARANTINE AND INSPECTION SERVICE

Fig 1.1

The Australian Quarantine and Inspection Service (AQIS) (Fig 1.1 & 1.2) are extensively responsible for maintaining quarantine in Australia. Australia exports more than $30 diseases that are extremely frequent in disease prone countries. If pests and diseases were to enter Australia, the agricultural industry would be immensely affected, which, in turn, will tremendously affect Australia's economy, native animals and plants. Therefore, the role of AQIS in preventing the spread of disease in plants and animals into and across regions of Australia is to minimise the risk of exotic pests and diseases entering in order to protect Australia's unique and native flora and fauna, the agricultural industries, its environment and broader community.

AQIS has an extensive range of strategies in place in order to prohibit the entry of superfluous pests and diseases in Australia. These include the following:

Australian Government
Australian Quarantine and Inspection Service

Fig 1.2

- *Border control:* involves the checking of passengers and cargo at all entry points into Australia. An extensive range of techniques are utilised by quarantine officers, including detector dogs, inspection and surveillance at international airports, X-ray machines and mail exchanges and container depots. Tourists entering Australia may not bring in prohibited items such as plants seeds, egg products, fresh foods, meat and dairy products and soil since all of these items may contain a variety of hazardous plant and animal diseases. If such items are smuggled in, jail terms and heave fines are consequential.

- *Animal quarantine:* involves every animal spending time in quarantine stations for a number of weeks to make certain that they are liberated of disease prior to being discharged into Australia. These measures are designed to protect herds and native fauna from exotic diseases, e.g. foot and mouth.

- *Plant quarantine:* involves examining all plants and their make up (seeds, cuttings, bulbs and wood) in quarantine stations, although many of these items are automatically refused entry. Also, various plants once in Australia cannot be transported to different regions. For example, sugar cane cannot be transported form QLD to NSW in order to prevent the spread of Fiji gall and leaf scald.

- *Human quarantine:* AQIS are notified if passengers or crew members of entering ships exhibit several symptoms associated to the prohibited diseases, thus, quarantining humans aims to isolate human diseases such as Cholera, Yellow fever and SARS. All of Australia's international airports have mosquito-trapping programs to enable a rapid detection of mosquitoes entering Australia as they act as vectors for infectious diseases such as Malaria.

During the history of Australian quarantine there have been a few incidents that are considered as "failures" in the quarantine system. For example, in 2007, a devastating outbreak of equine influenza eventuated and infected horses, which, in turn, cost the horse racing industry $1 billion. The former High Court judge, Ian Callinan found that "…errors and failures at all levels of these agencies contributed to the failure to enforce decontamination requirements at the quarantine station..."

Therefore, overall quarantine is considerably effective in preventing the spread of disease in plants and animals into Australia or across regions of Australia. Thus, AQIS are currently effective as there have been no disease outbreaks since 2007.

Question 2

Evaluate the effectiveness of the campaign in achieving its' goal of eradicating Equine Influenza.

At several occasions, the rigorous quarantine measures fall short to prevent the entry of various diseases into Australia. In such cases stringent response strategies are implemented. These emergency preparations are previously in place, only to be implemented when a disease or pest breaks through Australia's quarantine barrier. The rationale of these response strategies is to prevent the further spread of the disease across Australia and thus, eradicate it. In most cases these policies engage in the following strict procedures:

1. Quarantine and controls are placed on and around the movement of animals.
2. Quarantine inspectors either vaccinate or slaughter and dispose of the infected animal.
3. Infected areas are decontaminated.
4. Observing various animals (via surveillance and monitoring) that may well expected to be at risk of contracting the disease.
5. Halting all activities in order to manage the spread of the disease.
6. Establishing regions that are disease-free.

On 24 August 2007, a veterinarian explained to NSW Department of Primary Industries (NSW DPI) that he had examined ill horses at Centennial Park in Sydney. The report pursued after an epidemic of equine influenza (EI) occurred in Japan, the import of breeding stallions from Japan into quarantine and statements illustrate that several of these stallions at the Eastern Creek Quarantine Station were demonstrating signs of EI. This eventually led to, in 2007, a devastating outbreak of equine influenza which infected horses.

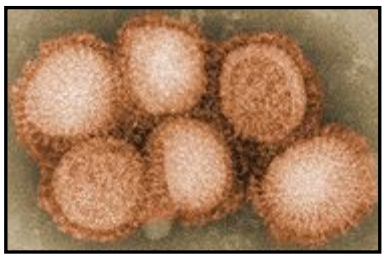

Fig.2.1: Equine Influenza (Pathogenic virus "Influenza A")

(Background Information extracted from assessment question) While the virus was successfully contained and Australia has returned to its equine influenza-free status, the outbreak had significant effects to the country's racing industry and economy including a total cost of $1 billion on the horse racing industry.

Equine Influenza is a disease caused by strains of "Influenza A" (Fig 2.1) that are enzootic in horse species. Equine influenza occurs globally, and caused by two main strains of virus: equine-1 (H7N7) and equine-2 (H3N8). The disease has approximately a 100% infection rate in an unvaccinated

horse population. Therefore, EI is a vastly contagious, viral disease and exotic to Australia which can spread rapidly causing outbreaks of respiratory disease in horses. Thus, an outbreak of EI would immensely affect the Australian horse industry.

The outbreak that eventuated was the most severe disaster animal disease Australia has experienced in modern record. At its climax, horse owners and industry workers were facing gloomy times with major impacts on their livelihood and lifestyle as 47,000 horses were contaminated in NSW on 5943 properties.

A response and campaign implemented by the NSW Department of Primary Industries (NSW DPI) was immensely effective in preventing, controlling and eradicating the spread of EI. This effective strategy utilised the latest laboratory, vaccine, surveillance, mapping and communication technologies and engaged in the following strict procedures:

1. A 10 km quarantine zone was declared around Eastern Creek Quarantine Station and the Centennial Parklands Equestrian Centre and the movement of horses and probable infected horses were halted for a lengthy time frame.

2. Immediately on the 25th of August 2007, the Agriculture Minister Peter McGauran ordered a 72-hour nationwide ban on all horse and harness racing.

3. All equipment and facilities, shoes, clothes and other various items were decontaminated to prevent the spread of EI, in order to uphold strict hygiene practices.

4. All infected horses were tracked and observed extensively in order to determine the extent of the infection.

5. The NSW DPI rallied an awareness campaign (Fig 2.2)

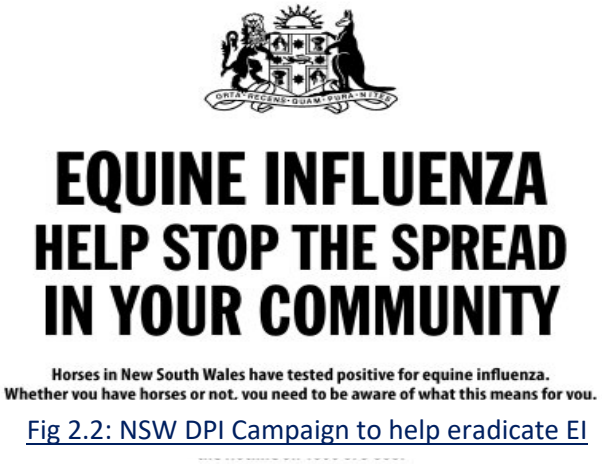

Fig 2.2: NSW DPI Campaign to help eradicate EI

6. All infected and susceptible horses were vaccinated (ATCvet codes: *QI05AA01* inactivated, *QI05AD02* live, plus various combinations) followed by a booster shot.

A major downfall from the campaign and strategies put in place to eradicate EI was the effect on the horse industry and economy, with a total cost of $1 billion. Furthermore, due to extent of the EI outbreaks, a variety of festive events were immediately cancelled, including; the Parkes Show due to several horses in the area that were diagnosed with EI and the showground was quarantined. Also, for the second time in its 125 year history, the Birdsville Races were called off as Queensland Racing Minister Andrew Fraser cancelled all horse racing in the state and the outbreak also forced the cancellation of a 3-day qualifying event for the 2008 Summer Olympics scheduled to be held in Sydney on 13 September.

The effectiveness of these vigorous strategies to prevent the spread of Equine flu across Australia was immensely effective as New South Wales was declared free of equine influenza by the state Primary Industries Minister, Ian Macdonald on 29 February 2008 and Queensland, the only other state affected by the outbreak, was declared EI free, thus, the disease was eradicated entirely. Also, through the use of latest communication technologies, such as, computer surveillance, EI was successfully contained and eradicated and thus, through the campaign led by NSW DPI, the broader community was extensively aware and pursued strict hygiene practices.

Question 3:

Discuss *the changing methods of dealing with plant and animal diseases, including the shift in emphasis from treatment and control to management or prevention of disease. In your answer make reference to* ***technologies*** *that have been developed to assist in the management and/or prevention of named diseases.*

Fig 3.1: Smallpox vaccines

In past history, when drugs, for example, penicillin were revealed, the emphasis when dealing with diseases was on their treatment and control. However, more recently, as problems such as antibiotic resistance eventuated, the emphasis thus, shifted to the importance and effectiveness of preventing and managing diseases instead. This change in emphasis eventuated only when society gained an increase in the understanding of the functioning of the immune system and the development of further advanced technologies. These preventative measures were further lengthened when society increased their understanding of genetics and the ability to manipulate genetic information.

The following examples illustrate this shift in emphasis:

Smallpox was a widespread infectious disease that killed hundreds of million people due to its highly rapid spread. There were various treatments available, such as wound care and infection control, but were immensely ineffective as all those infected, 20–60%—and over 80% of infected children—died from the disease. Therefore, prevention came in the form of vaccination (Fig 3.1) and vaccination campaigns. Due to the extensively high success rate of the use of vaccines the WHO certified the eradication of smallpox in December 1979.

Fig 3.2: SLIP, SLOP, SLAP Campaign to help prevent Skin cancer

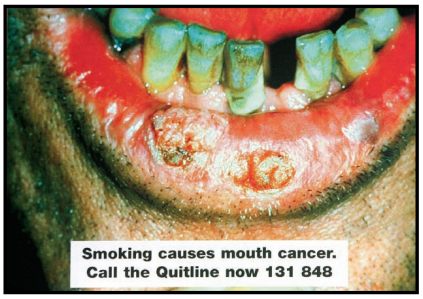

Fig 3.3: Smoking campaigns on cigarette packages to warn about the dangers of smoking

In the past, *cancer* treatment was based on the humour theory of four bodily fluids (black and yellow bile, blood and phlegm). According to the patient's humour, treatment consisted of diet, blood-letting, and/or laxatives. Through the centuries it was revealed that cancer may well occur everywhere in the body, but humour-theory based treatment remained accepted up until the 19th century with the advance discovery of cells. Modern treatments of cancer involve chemotherapy, radiotherapy and surgical removals. These treatments are quite successful, especially if detected early. However, these treatments are not 100% successful and may cause physical trauma to the body (scars), therefore, prevention campaigns (public health campaigns) were introduced. These campaigns involved educating and offering advice on proper skin care (skin cancer) for example, the SLIP, SLOP, SLAP (Fig. 3.2) campaign and quit lines (Fig. 3.3) for smoking have reduced and prevented the numbers of cancers.

- In the past, various *plant diseases*, such as *fungal root infections* and *pests* (e.g. aphids) usually were treated utilising the spraying of pesticides and insecticides. However, these measures have significantly had a detrimental effect on the environment. Therefore, preventative measures are used today (especially quarantine measures), biological control (introducing species such as the cane toad to control pests [Fig 3.4]) and genetic engineering.

Fig 3.4: The Cane Toad; an introduced species

Therefore, it is clearly evident that as society increases its understanding of the functioning of the immune system and the development of further advanced technologies, an immense shift eventuates in the emphasis from treatment and control to management or prevention of disease, thus, significantly changing the methods of treatment dealing with plant and animal diseases.

Question 4:

Identify a possible future direction in an area of biological research related to disease. Justify the benefit of this research.

Fig 4.1: Red ribbon is a symbol for solidarity with HIV-positive people and those living with AIDS

Biological research is defined as any scientific research conducted by biologists that contribute to the prevention and treatment of disease, primarily infectious diseases, through research, education, and public health activities. One such non-profit organisation that conducts this research is the Pasteur Institute.

Acquired immune deficiency syndrome (AIDS) (Fig 4.1) is an infectious disease of the human immune system caused by the human immunodeficiency virus (HIV). A possible future direction in the prevention of AIDS is an extensive and compulsory educating system that utilises all biological research.

AIDS cannot be effectively cured, and sufferers endure treatment of their symptoms for their duration of their lives. These treatments frequently engage in the exercise of different drugs, many of which have side effects that cause various problems and are extremely expensive. Thus, the quality of life of a sufferer is compromised and there is a continuing financial burden on both the individual and the health system. These problems would not exist if the disease had been prevented in the first place.

Due to the difficulty in treating HIV infection, preventing the infection is a key aim in controlling the AIDS pandemic, with health organisations in place in attempts to slow the spread of the virus. However, these measures are not efficient enough because they are not compulsory and with the growing of societies views on sexuality (e.g. homosexuals and bisexuals) there is an immense need for a government funded educating scheme compulsory for all high school students.

This educating scheme will focus on preventing the spread of AIDS in terms of personal hygiene and safe sex. This is a significantly important area of biological research and should be funded because AIDS is now a pandemic. Research shown in 2007, that it was estimated that 33.2 million people lived with the disease worldwide, and that AIDS killed an estimated 2.1 million people, including 330,000 children.

All students partaking in this educating scheme will receive packages with info guides, interactive activities, preventative measures, including the utilisation of personal hygienic products and contraceptive/ protective measures [e.g. condoms] in order to prevent the further spread of AIDS.

This scheme will be effective as it will not only prevent the spread of AIDS as all high school students will be educated but will also reduce the need in further research in finding the “miracle” cure, thus utilizing the money saved by providing similar education in 3rd world countries such as the sub-Saharan African countries where three-quarters of all AIDS deaths occurs.

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