

JAPANESE ENCEPHALITIS



“The Great Wave off Kanagawa”, hand coloured Ukiyo-e woodblock print, c.1829-33. Katsushika Hokusai, The Metropolitan Museum of Art, New York.

“I envy the Japanese for the enormous clarity that pervades their work....In a way, all my work is founded on Japanese art”

Vincent van Gogh

It is easy to talk about death in the abstract, as the ancient philosophers discussed. But it is real death I fear, and I don't know if I can overcome the fear. Even for a short life, there are many memories. For someone who had a good life, it is very difficult to part with it. But I reached a point of no return. I must plunge into an enemy vessel...To be honest, I cannot say that the wish to die for the emperor is genuine, coming from my heart. However, it is decided for me that I die for the emperor.... I am pleased to have the

honour of having been chosen as a member of a Special Attack Force that is on its way into battle, but I cannot help crying when I think of you, Mother. When I reflect on the hopes you had for my future ... I feel so sad that I am going to die without doing anything to bring you joy....

Ichizo Hayashi, last letter home, April 1945.

There was a hypnotic fascination to the sight so alien to our Western philosophy. We watched each plunging kamikaze with the detached horror of one witnessing a terrible spectacle rather than as the intended victim. We forgot self for the moment as we groped hopelessly for the thought of that other man up there....

Vice Admiral C.R. Brown, US Navy

Out of a clear evening sky Japanese Kamikazes swooped for the second time in five days on heavy units of the British Pacific Fleet.... The first two to penetrate the fighter and flak screen made for the same ship, an aircraft carrier. Both hit the flight deck and both by some lucky chance plunged from there into the sea, blazing wrecks. A Kamikaze attack is unlike anything one has known in the Western war. At the back of one's mind continually is the thought of the pilots, fanatical, cold-blooded, whose last ambition is that death might also be glory. They wear, we are told, some kind of ceremonial uniform.

Of the death dive of a third Kamikaze I had a breath-taking view from the Admiral's bridge. Its approach was signalled as usual by the gun flashes of battleship, carrier, cruiser, destroyer, and the growing rash of smoke puffs against the clear sky. The Zeke was flying low and we could see it now speeding on level course across the Fleet, ringed round, pursued, by the bursting shells. It seemed to bear a charmed life, cutting unscathed through the murderous hail of flak. Less than a mile from us we saw it turn aft of another carrier. It was approaching its kill. The air all around was smudged and clamorous with the bursting shells, joined now by the sharper points of pom-poms firing from the carrier's decks. The Jap climbed suddenly and dived. It was all a matter of seconds. He came up the centre of the flight deck, accurate as a homing plane, and abruptly all was lost in a confusion of smoke and flame. The whole superstructure of the ship vanished behind billows of jet-black smoke shot through by flames as the tanks of aircraft ranged on the deck exploded. It seemed at the time that the ship was doomed, that nothing could survive that inferno. But within half an hour the flames were extinguished and the smoke had drifted and dispersed in the sunlight. Through glasses we could see the armour-plated deck of the carrier swarming with activity.....

*British War Correspondent, Michael Moynihan,
eye witness to a Kamikaze attack, April 1945.*

For over two and half centuries, from 1603 until 1868 the Shogun ruled Japan. They were warlords who enforced a harsh military discipline throughout the land and shunned all influence from the outside world. Travel abroad and all foreign books were banned. The only outsiders who were allowed any limited contact at all were the Dutch, who were, unlike most other great European powers of the day, more interested in commerce than empire. The Japanese were deeply suspicious of outsiders, whom they regarded as

potential invaders and destroyers of their culture. They harbored, however no fear of foreigners. Holding deep Buddhist and pantheistic beliefs they lived supremely confident and secure in the knowledge that their island was protected by the spirit of a “divine wind”. Twice in the Thirteenth century, the great Khan had sent an invasion fleet to enslave the Japanese people, firstly in 1274, and then with a far bigger force again in 1281. The divine wind, on both occasions, had sent forth terrible typhoons and tsunamis, that had utterly devastated the Mongol invasion fleets.

The shogun enforced many oppressive laws, especially in areas regarded as frivolous pleasures. The people were expected to lead an obedient and strict Spartan-like existence. And yet, the Shogun did allow for a designated quarter of the great city of Edo, (which was to become Tokyo), for some entertainment of the people. The great celebrities of the Edo period, famous courtesans, geishas, sumo wrestlers, kabuki actors look up pleasure quarters there. To the ordinary people the leisure sector, mainly for the rich, was a dream-like, or as they called it “Ukiyo” world. Ukiyo is a Buddhist word meaning “floating” which originally meant the “transience of life”. With time however, the word came to mean, what can be loosely translated as “calm” or “serene” and it came to be associated in particular with the great Edo pleasure quarter, a heavenly realm that most peasants could only dream of, but never be a part of. It was as if in their dreams they could “float” over serene and beautiful scenes in their mind and for a short while escape the hard brutal reality of their daily lives. Ukiyo was to float above and observe as a detached spirit an idealized and tranquil world.

Ukiyo became the subject matter of popular “zoshi” or stories, and so “ukiyo-zoshi” - tales of the floating world. Artists next began to depict Ukiyo in their “e” or pictures and the genre “Ukiyo-e” became very popular. Originally Artists depicted glamorous Ukiyo celebrities, but in time many preferred the more realistic appeal of nature, depicting Ukiyo animals, birds, plants and simple peasants working in idealized landscapes of blooming cherry blossoms and beautiful waterfalls, rivers and lakes. These scenes proved immensely popular among the ordinary people, who came to see, through them, that there was much that was in fact beautiful about their own lives without having to wish to be somewhere or someone else. Ukiyo-e Art makes use of simple harmonized flowing lines, that give beautiful visual impressions rather than depicting any photographic reality. Ukiyo-e uplifted the emotions and the heart. The only problem was that most peasants could not afford expensive paintings. But around 1670 Hishikawa Moronobu, now known to history as the father of Ukiyo-e, began to produce monochrome woodblock prints. Prints from woodblock templates could be mass produced, and suddenly everyone could own a beautiful piece of Art work. Just near a century later in 1765, Suzuki Harunobu developed a complicated technique that resulted in full colour prints. Though the pigments used did not always provide for lasting colour, Ukiyo-e soared again in popularity, over the ensuing century. Then something extraordinary happened. The Shogun fell, and Imperial Rule was reestablished.

Emperor Meiji had a radically different outlook to the Shogun. He saw that Japan through centuries of total isolation had dropped far behind the West, in the sciences and in industry. Japan, he decided, had to be brought in the modern world, and to achieve this its isolation from the rest of the world, and the West in particular, had to come to an end. Within a short while, trade and commerce between the West and Japan exploded.

Europe could not get enough of exotic Japanese luxuries, while Japan could not get enough of the West's modern industrial processes. It was the beginning of the globalization of Japan. Both Japan and the West saw immense mutual opportunity before them. In the visual Arts, the Japanese were introduced to the majestic works of European Romanic, Academic and Neoclassical Art. They began to look at their own Ukiyo-e Art as backward, primitive and essentially an embarrassment. The prints became worthless, and much of them were simply used as wrapping paper for exported goods to Europe. Then a second extraordinary thing happened. Europeans were immediately struck by the simple emotional beauty of Ukiyo-e. They began to see in Ukiyo-e a whole new way in which Art could be done, and the people loved it! Tired of the traditional academic tyranny of the great Salons, Artists inspired by Ukiyo-e began to experiment with completely novel concepts - a few simple lines could impart a thousand words! Not well appreciated today is that Ukiyo-e was the embryonic inspiration to the great age of Impressionism. Even after Impressionism had become firmly established the influence of Ukiyo-e continued on into the works of the Post Impressionists. Vincent van Gogh himself, wrote; "I envy the Japanese for the enormous clarity that pervades their work....In a way, all my work is founded on Japanese art". The European craze for Ukiyo-e and all thing Japanese in general, became known in France as, Le Japonisme, style, and its influence would continue on till the last decade of the Nineteenth century in the haunting genre of Art Nouveau.

But the cultural exchange did not go one way only. Japanese blue pigment during the early Ukiyo-e period was largely based on indigo plants, and these pigments were very light sensitive and so quickly faded. Ukiyo-e works were not ones that lasted. Europeans however had long been using a brilliant synthetic pigment for blue, known as Prussian Blue, which provided for an iridescent and much more light resistant pigment. The Japanese began using this pigment for Ukiyo-e works and the results were stunning. Ukiyo-e underwent a renaissance in Japan by dint of modern synthetic pigments such as Prussian Blue, and in turn it became more popular in Europe than ever.

The visual Arts were one aspect of Japan's globalization that brought immense beauty and enrichment to the wider world, but this globalization would also have another sinister consequence that could not have been anticipated a century before this came to bear - the astonishing development of Japanese industrial power. Japan had modernized so quickly that by the early 20th century it had begun to rival the West. By the 1930s a new military cast - a modern Shogun - once again held sway over the Emperor and the result would be played out in the Pacific theater of the greatest and most destructive conflict in human history. In the last months of the Second World War, the Japanese people faced imminent invasion from a very powerful enemy. As his ancestors had done, The Emperor called on the spirit of the Divine wind for deliverance - "divine wind" in Japanese is "kamikaze".

Today globalization continues apace, much good comes of this, but nonetheless there are also some challenges. In the medical arena, one such challenge is the ever spreading threat of arthropod borne disease. Out of Japan has come the Japanese Encephalitis virus.

JAPANESE ENCEPHALITIS



Culex annulirostris is one of the most important nuisance-biting pests and vectors of mosquito-borne pathogens associated with freshwater habitats in Australia. The transparent abdomen is full of blood. (Stephen Doggett, *Medical Entomology, Pathology West - ICPMR Westmead.*)

Introduction

Japanese Encephalitis virus (JEV) is an **arbovirus**, i.e. a virus which is transmitted via the bite of an arthropod, in this case a **mosquito**.

Japanese Encephalitis virus is a **flavivirus**

Most infections are asymptomatic, however a small fraction (< 1 %) will develop clinical disease, and some of these will develop **serious neurological complications** such as **encephalitis**.

JEV is transmitted to humans, primarily via **Culex spikes** of mosquito.

It is now the principal cause of epidemic viral encephalitis on a global scale, resulting in around 50,000 clinical cases annually.

A **vaccine**, is available, and is very efficacious.

JEV is present in the **Torres Strait islands**.

History

The disease Japanese encephalitis had been described in Japan as early as 1871.

The JEV was first isolated in Japan in 1935.

Epidemiology

Since 1935 when the virus was first isolated in **Japan**, it has been found in:

- Far Eastern Russia
- South-East Asia.
- Western Pacific
- More recently, it has spread to the Indian subcontinent and Nepal.

It is now the principal cause of epidemic viral encephalitis in the world, resulting in around 50,000 clinical cases annually.

Of great concern to **Australia** was the introduction of JEV into the **Torres Strait islands** in 1995, with two fatal cases of encephalitis.

In 1998 it was found on the mainland of Australia in Cape York.

Seropositive pigs were also detected on the mainland.

The most likely source of the outbreak in the Torres Strait islands was Papua New Guinea, where the first human cases were detected in 1997.

The occurrence of JEV disease in Papua New Guinea and probable spread from there to cause disease in the Torres Strait islands poses a significant threat to Australia.

Suitable vector mosquitoes such as **Culex annulirostris** and vertebrate hosts in the form of water birds are widespread across the mainland.

There are also many wild pigs in north-eastern Australia that act as amplifiers for the virus.

There is a theoretical concern that migratory birds could carry the virus southwards in Australia, even as far as **Victoria**.

See also Appendix 2 below.

Pathology

Organism

- Japanese Encephalitis virus is an arbovirus, of the genus flavivirus.

Arboviruses are viruses that are spread by the bite of arthropods, particularly mosquitoes.

JEV is a single-stranded RNA virus that belongs to the genus Flavivirus, and is closely related to West Nile and St Louis encephalitis viruses.

See also Appendix 1 below for a classification of the arboviruses

Reservoir

- JEV is maintained in a cycle involving mosquitoes and vertebrate hosts, mainly **pigs** and **wading birds** (herons and egrets) which are the main reservoirs for disseminating the virus.

Pigs are important amplifier hosts. Pigs do not show signs of infection other than abortion and stillbirth, but have continuing viraemia, allowing transmission to humans via mosquitoes.

Humans can be infected when bitten by an infected mosquito.

- Humans (and other large vertebrates such as horses) are incidental or “dead-end hosts”, because they usually do not develop high enough concentrations of JEV in their bloodstreams to further infect feeding mosquitoes.

See also Appendix 3 below

Transmission

- JEV is transmitted to humans through the bite of an infected mosquito, primarily **Culex species**.

In Asia, the rice-field breeding mosquitoes, mainly **C. tritaeniorhynchus**, usually transmit JEV.

In the **Torres Strait islands** outbreak, virus was isolated from **C. annulirostris** mosquitoes, which were considered to be the main vector involved.

C. gelidus is a new potential vector in Australia if introduced from Asia.

Incubation Period

- The incubation period is usually around 6 - 16 days.

Period of communicability

- There is no evidence for direct transmission from person to person.

Susceptibility & resistance

- Infection with JEV confers subsequent lifelong immunity.

Clinical Features

Most infections are asymptomatic, however a small fraction (< 1 %) will develop clinical disease, and some of these will develop **serious neurological complications** such as **encephalitis**.

Clinical manifestations include:

1. Subclinical:

- More than 90 % of JEV infections are subclinical and asymptomatic.

Less than 1 % of people infected with JEV develop clinical disease.

2. Non-specific constitutional symptoms:

- Fever
- Headache
- Anorexia/ nausea/ vomiting
- Lethargy/ malaise

3. Neurological complications:

Rarely serious and life-threatening neurological complications can develop.

Neurological complications include:

- **Encephalitis:**

Acute encephalitis is the most commonly recognized clinical manifestation of JEV infection.

- ♥ Encephalitis is the most serious manifestation.

- ♥♥ Confusion / altered conscious state.
- ♥ This is clinically indistinguishable from other viral encephalitides.
- ♥ It has a high mortality of around 20 - 30 %.
- ♥ Among survivors, 30 - 50 % may be left with permanent neurological sequelae.
- **Meningitis:**
 - ♥ A milder meningitis can also occur in isolation.

Less commonly other neurological complications may be seen, including:

- Recurrent seizures
- A Parkinsonian type syndrome:
 - ♥ This results from resulting from extrapyramidal involvement and is a very distinctive clinical presentation of JEV infection.
- Acute flaccid paralysis:
 - ♥ There are clinical and pathological features similar to poliomyelitis

Investigations

1. Serology:

IgM:

- Japanese Encephalitis Virus specific IgM detected in serum or CSF in the absence of in the absence of IgM to Murray Valley encephalitis, Kunjin and dengue viruses, with no history of recent Japanese encephalitis or yellow fever vaccination.

IgG:

- A fourfold serum rise in titre of Japanese Encephalitis Virus over 7 - 10 days, without a history of recent Japanese encephalitis or yellow fever vaccination

2. PCR testing:

- A nucleic acid test is available for Japanese Encephalitis Virus.

3. Viral culture

Confirmation by a second arbovirus reference laboratory is required if the case appears to have been acquired in Australia.

Management

Prevention:

Japanese Encephalitis virus infection can be prevented by:

Mosquito control measures:

- Personal protection measures, such as long sleeves
- Using personal repellents containing diethyltoluamide (DEET) or picaridin
- Avoidance of mosquito-prone areas and vector biting times at dusk and dawn.

Vaccination:

- With few exceptions, vaccination is recommended for all travellers to countries or areas where there is a risk of JEV transmission, including the Torres Strait islands.

There are 2 vaccines currently available in Australia.

Vaccine	Type	Notes
Jespect	Inactivated 2 doses 28 days apart	A single booster dose is advised from 1-3 years after the initial course if needed. Currently only licensed for those above 17 yrs age
Imojev	Live-attenuated 1 dose	Induces long term immunity Being a live vaccine Imojev cannot be given to pregnant women or to persons with immune suppressive states.

See latest Australian Immunization Handbook for full prescribing details.

Japanese encephalitis vaccination is not part of the National Immunization Program schedule.

Treatment:

There is no specific treatment for JEV and so treatment is entirely supportive.

Note that **infected patients** should be protected from *further* exposure to mosquitoes until fever has subsided. This is to prevent increased numbers of local mosquitoes becoming vectors for the disease.

Notification:

Japanese encephalitis is a Group A disease and so must be notified immediately by telephone or fax, followed by written notification within 5 days.

This is a Victorian statutory requirement.

School exclusion:

Exclusion is not applicable.

Appendix 1

Classification of the Arboviruses:

Arboviruses are viruses that are spread by the bite of arthropods, particularly mosquitoes.

They are divided into:

1. Alphaviruses:

Infective alphaviruses include:

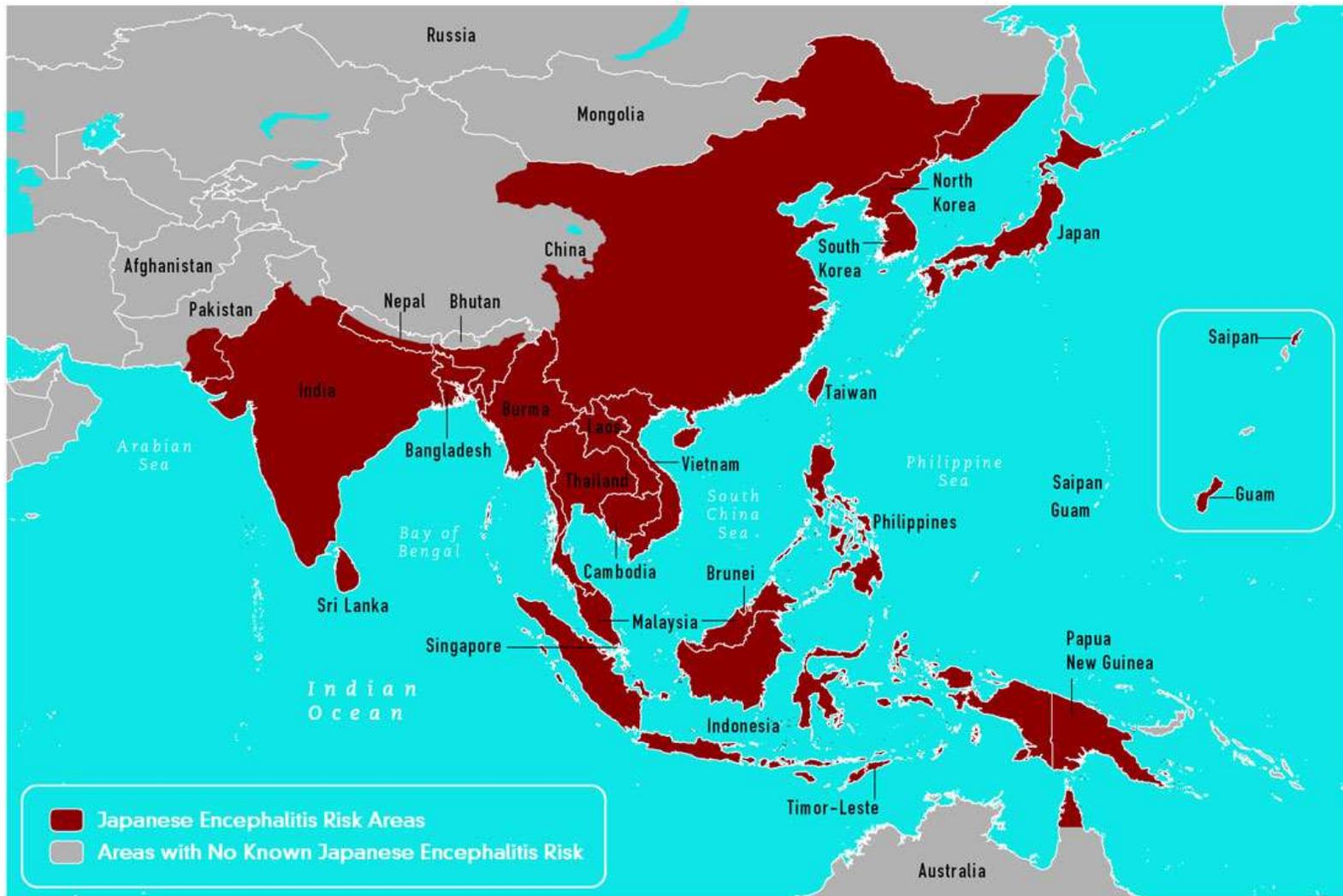
- Ross River virus
- Barmah Forest virus
- Sindbis virus
- Chikungunya virus.
- O’Nyong Nyong virus

2. Flaviviruses.

Infective flaviviruses include:

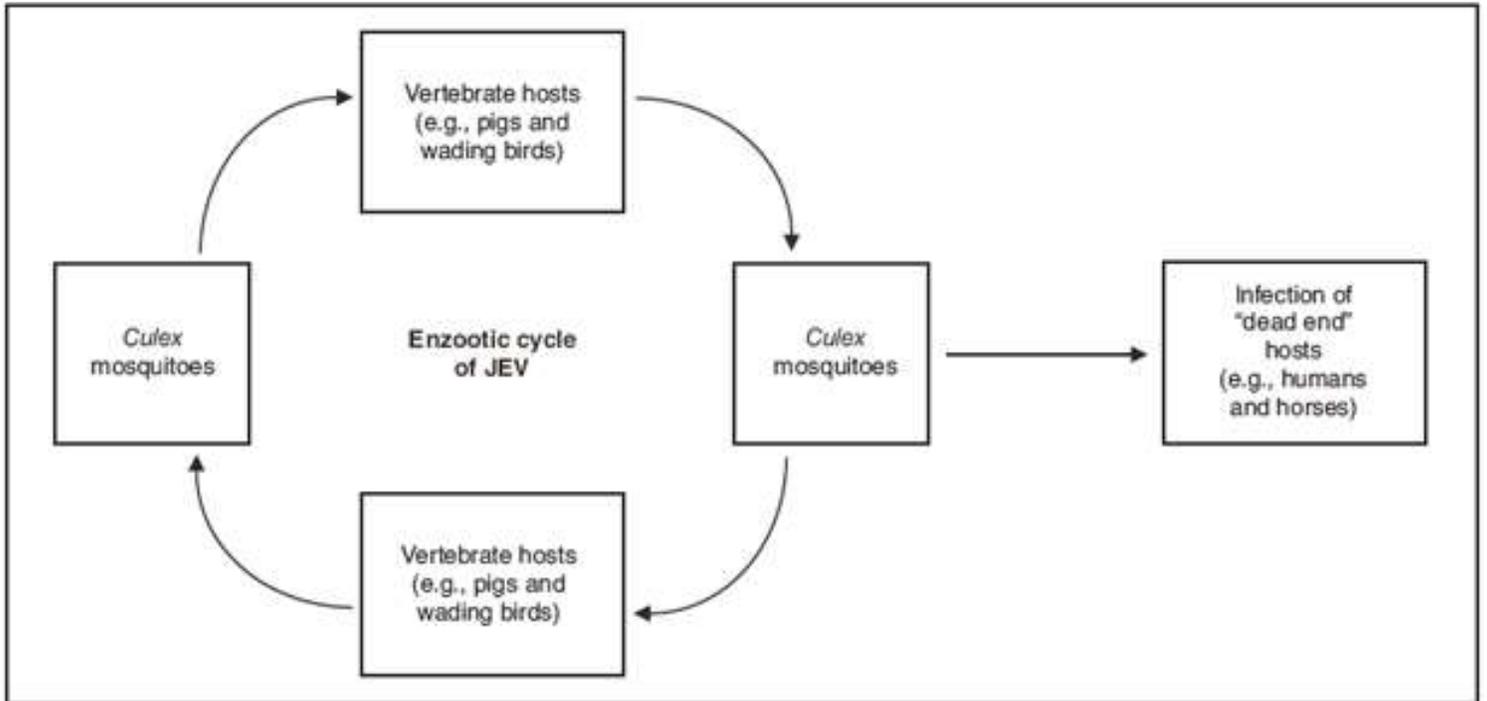
- Murray Valley encephalitis virus
- Dengue virus
- West Nile & Kunjin Virus
- **Japanese Encephalitis virus**
- Yellow Fever Virus
- Zika Virus

Appendix 2



Geographic Distribution of Japanese Encephalitis Virus (CDC).

Appendix 3



Transmission cycle of the Japanese encephalitis virus (CDC).



Mongol Invasion Fleet Destroyed in Tsunami - ink on paper, Kikuchi Yosai, 1847. Tokyo National Museum

References

1. Japanese Encephalitis Virus in Bluebook Website, Accessed July 2017
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3. Japanese Encephalitis Virus in CDC Website, Accessed August 2017.

Dr J. Hayes.
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