Zika Virus: Current Outbreak and Ongoing Research Efforts
February 2016 Update

What is the Zika Virus?

The Zika virus is a tropical, mosquito-borne illness that is transmitted after being bitten by the *Aedes* mosquito – the same type of mosquito that spreads Dengue, Chikungunya, and Yellow Fever. Symptoms of the disease are usually mild, including fever, joint pain, rashes, and viral conjunctivitis (red/itchy eyes), and appear within a week of being exposed. However, because only 1 in 5 people infected with the disease will exhibit symptoms, many will not realize they are infected.

While the main mechanism of Zika virus transmission is mosquitoes, the virus can also be transmitted from a pregnant mother to her baby during pregnancy or around the time of birth. In recent months, there have been reports of microcephaly in babies of mothers who were infected with the Zika virus, but researchers are still working to characterize the relationship between the two. Microcephaly is a serious birth defect of the brain, where the baby’s head is smaller than expected when compared to babies of the same age and sex. There have also been an increased number of people with Zika in Brazil who also have Guillain-Barré syndrome, a rare illness of the nervous system where a person’s own immune system damages nerve cells. Scientists are continuing to investigate the association between this syndrome and the Zika virus.

Researchers at the Centers for Disease Control and Prevention (CDC) also recently confirmed that the virus can be transmitted through sexual contact. While the virus is known to linger in the blood for about a week, research is being conducted to determine how long the virus may linger in semen.

When was Zika discovered?

According to the NIH, Zika was discovered in Uganda in the 1940s and while the virus has circulated in various African and Southeast Asian countries over time, it was not until 2015 that Brazil experienced a major outbreak that has since expanded quickly and dramatically to other countries in Central and South America, as well as the Caribbean (including Puerto Rico and the U.S. Virgin Islands). As a result of the outbreak in 2015, scientists have learned the virus was much more harmful than previously thought, with the potential to damage the brains of fetuses and potentially cause a range of health and cognitive challenges. The World Health Organization officially declared a public health emergency in February 2016.

Are there any current treatment options?

Currently there are no vaccines to prevent transmission of, or medicines to treat, the Zika virus. Some of the known symptoms of the disease can be treated with common pain and fever medicines. However, researchers are still assessing the potential link between Zika infection and microcephaly, a serious birth defect of the brain, among babies born to mothers infected with Zika virus during pregnancy. Microcephaly is a condition in which a baby’s head is abnormally small and can be associated with incomplete brain development. As a result of these uncertainties, including uncertainties in terms of a causal link, there are not currently medications or other treatments available.
What can be done to prevent the spread of the virus?

Because the potential mechanisms by which the virus spreads are still being explored, authorities are recommending special precautions for women who are pregnant and may become pregnant, including the use of condoms to prevent spread sexually transmitted infections. In addition, the CDC has issued recommendations for travelers and those who reside in infected areas to prevent the spread of the virus by preventing mosquito bites. These include wearing long-sleeved shirts and long pants, staying indoors and using window/door screens, using Environmental Protection Agency (EPA)-approved insect repellants, pre-treating clothing and gear with permethrin (an insecticide), and sleeping under a mosquito net.

As information on Zika is being updated rapidly, for the most up to date information, please see the CDC website (http://www.cdc.gov/zika/index.html).

What types of treatments are being developed?

Developing effective treatments for Zika is particularly challenging given how little is currently known. However, researchers are drawing on their experiences in responding to the Ebola epidemic as well as in examining vaccines and other treatments previously developed for viruses that are in the same family as Zika. An overview of selected areas of research by innovative biopharmaceutical companies is provided below.

Researchers are working on a number of vaccine candidates to prevent transmission of the Zika virus that generally fall into two main categories:

- **Live, attenuated vaccine**: A live version of the microbe that has been weakened, so it can’t cause disease, but will elicit a strong immune response. This is the typical platform for common viral vaccines, such as measles, mumps, and chicken pox, for example.

- **DNA-based vaccine**: A synthetic DNA-sequence of the virus’ antigens is created that, when injected into the body, elicits a strong immune response.

Examples of some of the research initiatives underway by innovative biopharmaceutical companies include the following:

**GlaxoSmithKline**: Researchers are conducting feasibility studies to evaluate whether their existing technology platforms may be suitable for working on a Zika virus vaccine.

**Inovio**: Building on their Dengue research program, Inovio is developing a DNA-based vaccine against the Zika virus. The vaccine is currently in preclinical studies and recently demonstrated a robust and durable immune response in mice and researchers expect to move into primate testing soon. Pending confirmation of safety, Inovio expects to move into Phase I clinical testing by the end of 2016.
Inovio CEO J. Joseph Kim noted that, “The beauty of this technological platform is that the vaccine is simply a DNA sequence developed in water,” said Kim. “It cuts through all the difficult handling and complex development times of traditional vaccine approaches.”

Inovio researchers are exploring whether lessons learned from their Middle East Respiratory Syndrome (MERS) vaccine development program can inform vaccine development in this space. Inovio has a MERS vaccine for which it is currently recruiting patients for a Phase I study.

**Sanofi Pasteur.**

Researchers at Sanofi Pasteur, the vaccines division of Sanofi, are hoping to build on the success of their vaccine programs for viruses that are in the same family as Zika, including Yellow Fever, Japanese Encephalitis and, most recently, Dengue (Denvaxia®, the first ever Dengue vaccine). The company expects that knowledge gained from Denvaxia®, as well as established R&D and manufacturing infrastructure, will help accelerate work towards a vaccine.

“Our invaluable collaborations with scientific and public health experts, both globally and in the regions affected by the outbreaks of ZIKV, together with the mobilization of our best experts will expedite efforts to research and develop a vaccine for this disease,” said Dr. John Shiver, Global Head of R&D, Sanofi Pasteur.

**Takeda.**

Takeda has assembled an internal team to investigate how it can share its existing knowledge and infrastructure and work collaboratively to help advance the effort to develop a vaccine for Zika.

Takeda currently has products in development for Dengue and Chikungunya, which may provide useful in informing Zika vaccine development.

Dr. Rajeev Venkayya, President of Takeda Vaccines, said: “We have manufacturing platforms that we use for other similar vaccines that are likely to be applicable here. We would want to work with global and national health organizations working in this space, so that we essentially are part of a consortium.”

Several other biopharmaceutical companies are in the early stages of research, including Johnson & Johnson, Pfizer, and Merck, examining whether their technologies or existing vaccines have the potential to inform development of a Zika vaccine. At least three additional vaccine candidates are in development by other biopharmaceutical companies and efforts to develop molecular tests to identify the virus are also under way.
16. Direct correspondence with Takeda.