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Memphis is the largest city on the Mississippi River. Memphis is the home of various American music genres, including Memphis soul, Memphis blues, gospel, and rock n’ roll. Beale Street, a center for entertainment, dining, shopping and culture, is a national historical landmark and shows the impact Memphis has had on American blues. Famous Memphis celebrities include Justin Timberlake, Elvis Presley, Johnny Cash, Aretha Franklin, Isaac Hayes, and Morgan Freeman, among others.

- Home of St. Jude Children’s Research Hospital, one of the world’s premier centers for research and treatment of catastrophic diseases in children
- Top reasons for visiting Memphis: Beale Street, music, blues, Elvis Presley’s Graceland, Southern culture and history

- Located in downtown Memphis, 20 minutes from the Memphis International Airport
- The hotel is known for the “Peabody Ducks” that make daily treks to the lobby led by a “Duckmaster.”
- Two blocks from legendary Beale Street entertainment district and Main St. trolley
- Covered guest parking adjacent to the hotel at discounted rate of $9.00/ day for AMT attendees

The Peabody Memphis
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Human Arboviruses

Humans may contract a variety of arboviruses from insects such as mosquitoes, ticks, and sandflies, with species that vary by geographic region. While some infected people may be asymptomatic, others may exhibit fatigue, fever and chills, headache, and anorexia. Few cases advance to symptoms such as lymph node swelling, nausea, vomiting, and rash, while rare cases for most arboviruses experience seizures, hemorrhages, and loss of consciousness.

Traditionally, arboviruses were subdivided into groups A through D, made up of various genera. Group A included alphaviruses, B was made up of flaviruses, C included group C serogroup of the orthobunyaviruses, and D consisted of the Guama serogroup of orthobunyaviruses. This classification is no longer used since the system has been updated using family grouping of viruses: Flaviviridae, Togaviridae, Reoviridae, Orthomyxoviridae, and Bunyaviridae.

Flaviviridae

Yellow fever was the first arbovirus known to be spread by mosquitoes as opposed to human contact. It is one of many viruses belonging to the Flaviviridae, all of which are single-stranded (ss) RNA viruses. Yellow fever occurs in Africa and tropical South America, with higher vaccination rates in Africa. Seroconversion rates from vaccines, which now use the live attenuated 17D strain, are around 95% and its recipients are immune for about 10 years. Even without vaccination, some patients improve after experiencing mild symptoms while others end up with jaundice, hemorrhage, and even death. The mortality rate is around 20% for those who experience severe symptoms.

The mosquito that passes Yellow fever, *Aedes aegypti*, is also the primary vector for Dengue fever, which is present in over 100 tropical countries. Dengue virus is also in the Flaviviridae family, with a mortality rate ranging from 1% to 20% depending on availability of medical care. There are four serotypes of Dengue and an individual can be infected from all four, with lifetime immunity specific to each individual serotype. The variety of serotypes is also the reason there are no approved Dengue vaccines.

In addition to Dengue, there are two other arboviruses in the Flaviviridae family that occur in the U.S. for which there are no vaccines, both of which are passed by various *Culex* mosquitoes. St. Louis encephalitis (SLE) most frequently occurs in the U.S., but there have been rare outbreaks in Central and South America. With a mortality rate of 5-15% for diagnosed cases, most SLE cases go undiagnosed. Another member of Flaviviridae with cases in the U.S., West Nile Virus was first discovered in Uganda and can now be found on most continents. Most people who become infected with West Nile virus are asymptomatic and most who do have symptoms fully recover. However, some suffer from weakness and fatigue for weeks or months, with more severe cases having been reported since 1994.

A major cause of encephalitis in Asia, Japanese encephalitis virus (JEV), is primarily passed through the mosquito *Culex tritaeniorhyncus*. The mortality rate is 20-30% in patients that develop severe symptoms including...
encephalitis. Many of these survivors have permanent psychological, cognitive, and neurological problems. Over 60,000 cases occur annually, a number that would be much higher if it weren’t for the vaccine.\textsuperscript{11} There are four types of JEV vaccines: live attenuated, live recombinant, inactivated cell-based, and inactivated mouse brain-based.\textsuperscript{12}

Several other Flaviviridae arboviruses worthy of mentioning are Kyasanur forest disease, which can be passed to humans from tick nymphs in India, tick-borne encephalitis virus (TBEV), and Murray Valley encephalitis virus (MVEV). \textit{Ixodes} ticks pass TBEV in Europe, Russia, and China, with cases increasing significantly in the last 30 years in Europe.\textsuperscript{25,26} Mortality depends on the strain and has reached 20% in some outbreaks. Fortunately, a vaccine is available, which has helped keep the disease under some control. Interestingly, there have been outbreaks reported in Europe through ingesting goat cheese and milk.\textsuperscript{27,28} MVEV is carried primarily by the mosquito \textit{Culex annulirostris} in Australia and New Guinea, with most people not showing symptoms and few having severe cases.\textsuperscript{23,24} The virus was believed to have caused “Australian X” outbreaks of the early 1900s and was shown to cause outbreaks in 1951, 1954, and 1974, with 58 cases of encephalitis from the latter. Most cases since 1974 have occurred in northwestern Australia.

\textbf{Togaviridae}

The ss-RNA Togaviridae family contains a group of arboviruses in the alphavirus genus. Like MVEV, Ross River Virus (RRV) is endemic to Australia and New Guinea. It is carried by the Aedes mosquitoes and primarily causes joint pain.\textsuperscript{16} A recent outbreak in May of 2015 was labeled the worst outbreak of RRV in 20 years and was blamed on the extremely wet weather.\textsuperscript{17} Chikungunya is an alphavirus that had once been a major problem in Asia and Africa and has now become a global issue, primarily due to a change in the vector from \textit{Aedes aegypti} to \textit{A. albopictus}.\textsuperscript{18} The virus has recently had cases documented in Florida.\textsuperscript{19}

There are three equine encephalitis viruses that belong to the alpha virus genus — Venezuelan, Western, and Eastern. Venezuelan equine encephalitis (VEE) virus has caused disease in all of the Americas, including Texas, and is primarily passed to humans by the \textit{Ochlerotatus taeniorhyncus} mosquito.\textsuperscript{41} There are a few vaccines available for VEE virus, which in the U.S. are mostly used for those in the military. Overall, mortality is low, with about 14% experiencing severe symptoms; most of those are in children.\textsuperscript{42} Western equine encephalitis, though relatively rare, is found in the western U.S. and Canada. Passed to humans mostly by \textit{Culex} mosquitos, it has a low mortality rate, but has caused serious problems in infants, children, and older adults.\textsuperscript{43} The worst of the equine encephalitis viruses is Eastern equine encephalitis (EEE). It can be passed to humans in the eastern U.S. by the \textit{Culiseta melanura} mosquito.\textsuperscript{44} Though there are only a few symptomatic cases each year in the U.S., the mortality is about one-third, with most survivors having some degree of neurological damage.

\textbf{Reoviridae}

Members of the Reoviridae family are double-stranded RNA viruses with only two arboviruses in this family affecting humans — Banna virus and Coltivirus. Banna virus contains 12 segments of nucleic acid and was first found in China in 1987.\textsuperscript{21} It is an emerging pathogen that may have caused undiagnosed and misdiagnosed cases of encephalitis. It has been isolated from \textit{Aedes}, \textit{Anopheles}, and \textit{Culex} mosquitos. Coltivirus, also known as Colorado tick fever virus, is passed by the Rocky Mountain wood tick, \textit{Dermacentor andersonii}.\textsuperscript{22} Most cases tend to appear in older adults and more than twice as many in males than females, as with many tick-borne viruses. Although cases that involve hemorrhage and meningitis have occurred, fatalities from the Coltivirus are rare.\textsuperscript{20}

\textbf{Orthomyxoviridae}

Only the genus thogotovirus contains arboviruses in the Orthomyxoviridae family, all ss-RNA and tick-borne. Viruses that have caused human disease are the rare Dhori, Thogoto, and Bourbon viruses. Dhori is passed by \textit{Hyalomma} ticks to humans and was isolated from laboratory workers trying to culture it in the 1980s.\textsuperscript{30} Two people were known to be infected with Thogoto in the 1960s in Nigeria, while the Bourbon virus recently killed a man in Kansas.\textsuperscript{31} These are rare arboviruses, but important to keep in mind.

\textbf{Bunyaviridae}

There are an extensive number of arboviruses in the trisegmented ss-RNA Bunyaviridae family, many of which only occur rarely. Heartland virus is an example of a new member that was first isolated in 2009 from \textit{Amblyomma americanum}, the Lone Star tick. This disease caused the hospitalization of two men over the age of 50 in northwestern Missouri.\textsuperscript{32} Another rare but serious member of this
When it comes to urinary crystals, there is a prescient aspect to them. We look at urinary crystals to divine a patient’s clinical situation. Not only can crystals help diagnose the patient’s current state, they can provide insight into the potential for kidney stones or the presence of undiagnosed disease. They also may help clinicians detect certain types of substance abuse. The precipitation of salts and other solutes as crystals can reflect a change in kidney health and function, and some crystals traditionally thought to be insignificant may have deeper meaning for the patient. An understanding of kidney function and urine formation can help you discern one crystal type from another, so you can provide the clinician with an effective “prediction” of the patient’s urinary future.

It starts in the kidney...
Since crystal formation starts in the kidney, it is helpful to review the basic functionality of the kidney as a primer for understanding how crystals are formed. The primary function of the kidneys is to maintain a stable internal environment (homeostasis) for optimal cell and tissue metabolism. They do this by separating urea, mineral salts, toxins, and other waste products from the blood, and they affect plasma volume by con-