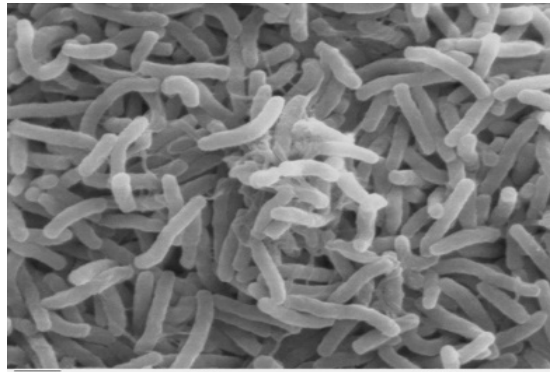


MicroRogue: *Vibrio* (*Vibrio cholerae*)

(M. Ulbrich and M. Dziejman)



Scanning electron microscope image of *Vibrio*

Claim to fame: causes pandemics of the diarrheal disease cholera

Meet the bacteria. Under a microscope, *Vibrio* looks comma-shaped with one long, tail-like flagellum that acts like a motor to help bacteria swim. *Vibrio* is part of the natural ecosystem of marine environments, and typically lives in waters that are salty and warm, such as oceans and estuaries. Estuaries are bodies of water where fresh water meets seawater, and the bacteria can easily be found in regions such as the Ganges-Brahmaputra-Meghna Delta in Bangladesh, the Mississippi Delta along the Gulf of Mexico, and along coastal regions of Africa and South America.

Vibrio can attach to the chitin-containing shells of crabs, shrimps, and other marine organisms such as plankton. The close association with aquatic organisms is complex, and significantly impacts different aspects of the bacterial lifecycle, including nutrient availability, tolerance to stress, and protection from predators.

What is cholera? Cholera is an infectious disease caused by *Vibrio*. Infection occurs when drinking water or food is contaminated by the bacteria, which can colonize the small intestine. People who get cholera often have mild symptoms or no symptoms, but some cases of cholera can be severe, especially in infants and young children.

Approximately 10% of people who get sick will develop severe symptoms such as voluminous diarrhea and vomiting. Such rapid fluid loss can lead to life-threatening dehydration and circulatory failure. If lost fluids and electrolytes are not replaced, death can occur within hours. A single diarrheal episode can release over a trillion bacteria per milliliter back into the environment, where the infectious cycle can begin again.

A brief history of the disease through time. Ancient texts including the Sushruta Samhita in the 5th century B.C. and Hippocrates in 4th century B.C. Greece describe cholera-like illness. It wasn't until the spring of 1543, however, when the first pandemic was recorded in India, on the bank of the Ganges River Delta. The infection, which was traced to contaminated rice, spread across Bangladesh and Indonesia, and reached China and Japan. The pandemic lasted only one

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year but claimed hundreds of thousands of lives. Since then, six additional pandemics occurred during the 19th and 20th centuries, the last of which began in the 1960's and is still ongoing. By 1991, cases spread from Asia across Africa and to the Americas. In 2022, 29 countries reported cholera outbreaks, with many occurring in Africa and the Eastern Mediterranean.



Illustration of victims of the cholera epidemic.
Published in 1832.



Cholera patients at a Haitian treatment center in
2011

Can cholera be treated? Cholera can be treated simply and successfully by replacing the fluids and salts that are lost through diarrhea. Symptomatic individuals often receive oral rehydration solution (ORS), a mixture of salts and glucose in water. More severe cases of dehydration may also require intravenous fluid replacement. Antibiotics can shorten the course of infection and diminish the severity of the illness, but they are not as important as rehydration. Antibiotic use is not recommended during a cholera outbreak because it has no proven effect on the spread of cholera and may contribute to antimicrobial resistance.

Who gets cholera? Mainly kids and the elderly. Children under the age of five are most susceptible to disease in endemic countries. An estimated 1.3 to 4 million people around the world get cholera each year. At-risk populations include those who live in areas that have experienced natural disasters, poverty-stricken dense neighborhoods, camps for refugees, as well as those traveling to endemic countries. These groups often do not have consistent access to clean drinking water and/or medical care.

If you are traveling in these areas and want to avoid coming into contact with *Vibrio*, you should drink only bottled or chemically treated water. Make sure to use treated water to wash dishes, brush teeth, wash and prepare food, and even to make ice. Eat foods that are packaged and avoid raw or undercooked meats and seafood. Make sure to wash your hands often.

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Vibrio is beastly MicroRogue!

Is there a vaccine? Unfortunately, efforts to develop an easily distributable vaccine with long-lasting immunity have proven to be very difficult. There are currently three oral cholera vaccines (OCV) pre-qualified by the World Health Organization (WHO). All three vaccines require two doses for full protection and protection does not last longer than three years. Due to current outbreaks and limited vaccine supplies, the WHO was forced to recommend single doses of available vaccines to stretch the current supplies. WHO also focuses on prevention through an educational campaign called “WASH”, which stands for Water, Sanitation, and Hygiene.

Three not-so-Fun Facts about Vibrio:

1. Disease-causing strains of *Vibrio* use a sticky arm called a “pilus” to attach to intestinal cells, then release a protein called “cholera toxin” that causes the characteristic watery diarrhea.
2. *Vibrio* was discovered twice: first by the Italian physician Filippo Pacini during an outbreak in Florence, Italy, in 1854, and then independently by Robert Koch in India in 1883.
3. Before *Vibrio* was identified, it was believed that cholera was caused by noxious air called “miasma.” Miasma was thought to be a disease-causing toxic vapor that arose from decomposing matter. Germ theory dispelled this belief in the late 19th century.