

Cholera: Man versus Microbe

The original exhibit entitled “*Cholera: Man versus Microbe*” was created as an in-house exhibit in Dana Medical Library in support of the 2013 UVM First Year Read, *The Ghost Map*, by Steven Johnson.

This web page is an adaptation of the original exhibit, and was created for use on Dana Medical Library’s website.

Curated by Frances Delwiche, Library Associate Professor, Dana Medical Library, University of Vermont, the original exhibit was on display in Dana Library from 08-26-13 through the 2013 fall semester.

In the nineteenth century, no disease was so terrifying, or dealt so swift a blow, as cholera.

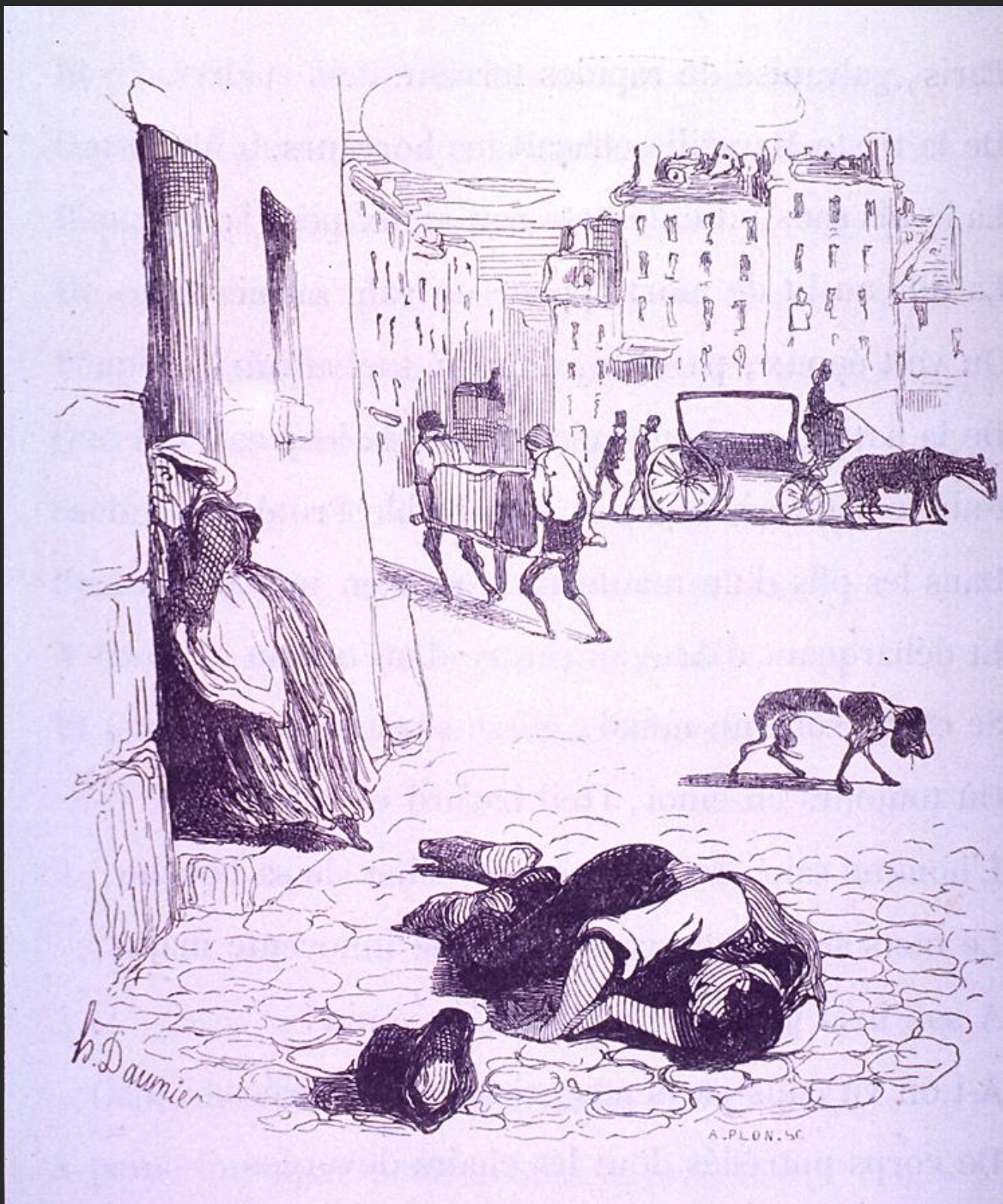


Image from [National Library of Medicine \(NLM\) Cholera Online](http://www.nlm.nih.gov/exhibition/cholera/index.html):
<http://www.nlm.nih.gov/exhibition/cholera/index.html>

The powerful enterotoxin secreted by *Vibrio cholerae* causes excessive secretion of electrolytes and water into the intestine, resulting in the rapid loss of enormous volumes of fluid.

In modern times, cholera is readily treated through oral and intravenous rehydration.

But in the 1800's, cholera often meant a swift and gruesome death from severe dehydration and shock.

“Asiatic cholera” has been endemic to the Ganges River valley of India since the dawn of recorded history. In 1817, the first cholera pandemic began with the spread of the disease along trade routes, reaching as far as southern Russia. Over the course of the next two centuries, the world would be ravaged by seven major pandemics: 1817-1823, 1829-1851, 1852-1859, 1863-1879, 1881-1896, 1899-1923, and 1961-present.

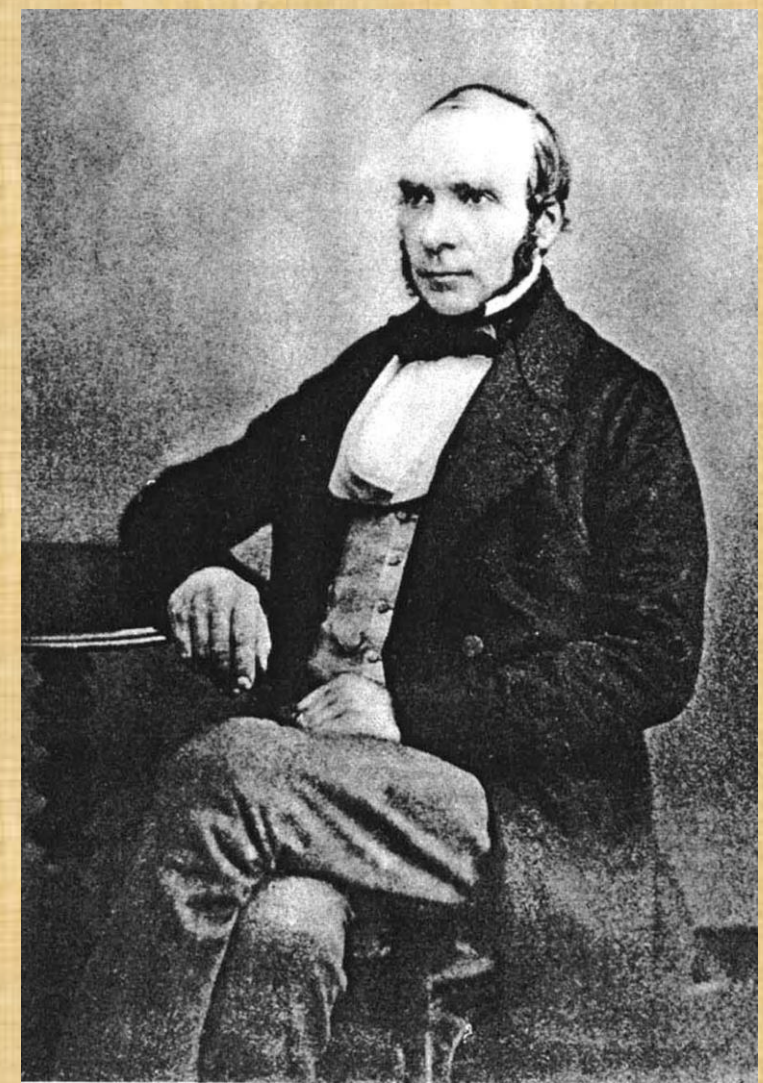
Though never endemic in this country, the United States experienced several cholera outbreaks, most notably in 1832, 1849, and 1866.

Entering through port cities such as New York and New Orleans, the disease caused widespread panic as it touched nearly every part of the country. Though more lives were claimed by malaria and tuberculosis, Americans were terrified by the abrupt onset and apparently random nature of cholera.

Man versus Microbe

The cause of cholera was hotly debated in the mid-1800's, with most opinions falling into one of two camps. The “miasmatisists” held that cholera was caused by polluted air arising from decayed organic matter (*miasma*), while the “contagionists” claimed that it was caused by some unknown contagious agent. Meanwhile, enterprising pharmacists and charlatans proffered all manner of quack remedies for cholera, ranging from mustard poultices and laudanum to rhubarb juice and blackberry balsam.

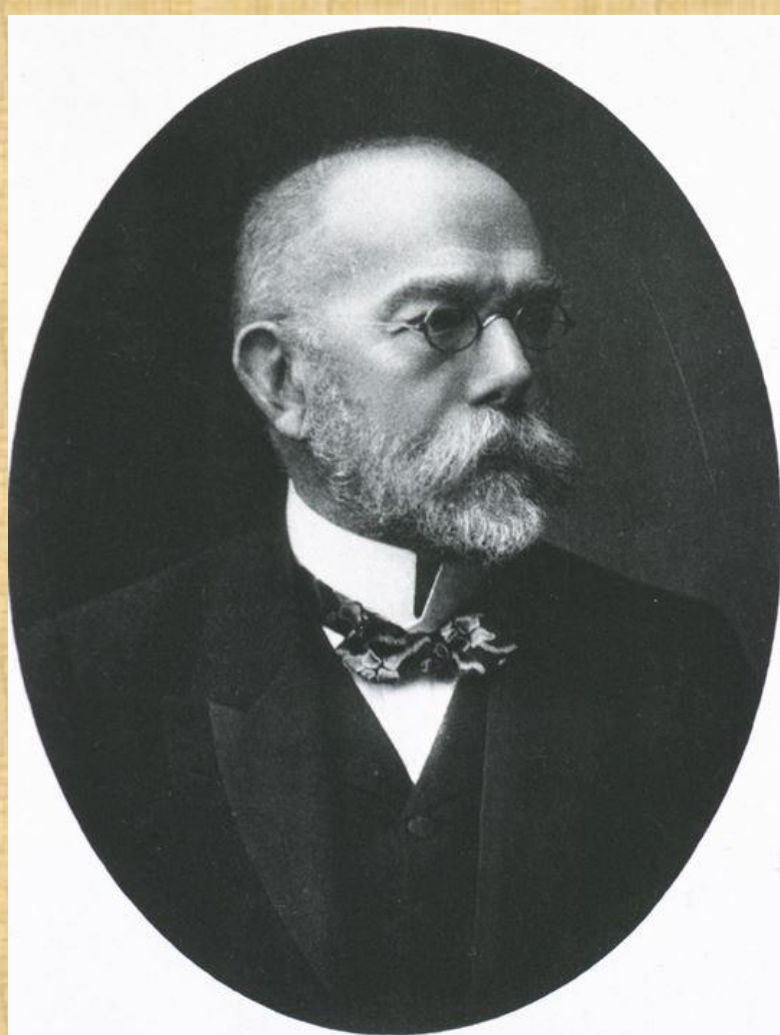
Ultimately, the germ theory of disease prevailed, led in part by London physician **John Snow** whose 1854 epidemiological study demonstrated an association of cholera with contaminated drinking water, even before the causative agent was identified.



John Snow

Image from [National Library of Medicine \(NLM\) Cholera Online:](http://www.nlm.nih.gov/exhibition/cholera/index.html)
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Also in 1854, Italian pathologist **Filippo Pacini** described the microscopic observation of “a large number of vibrions”, which he named *Vibrio cholerae*, in the intestinal fluids of cholera victims. Unfortunately, this important discovery was completely ignored by the scientific community until the mid-1880's.



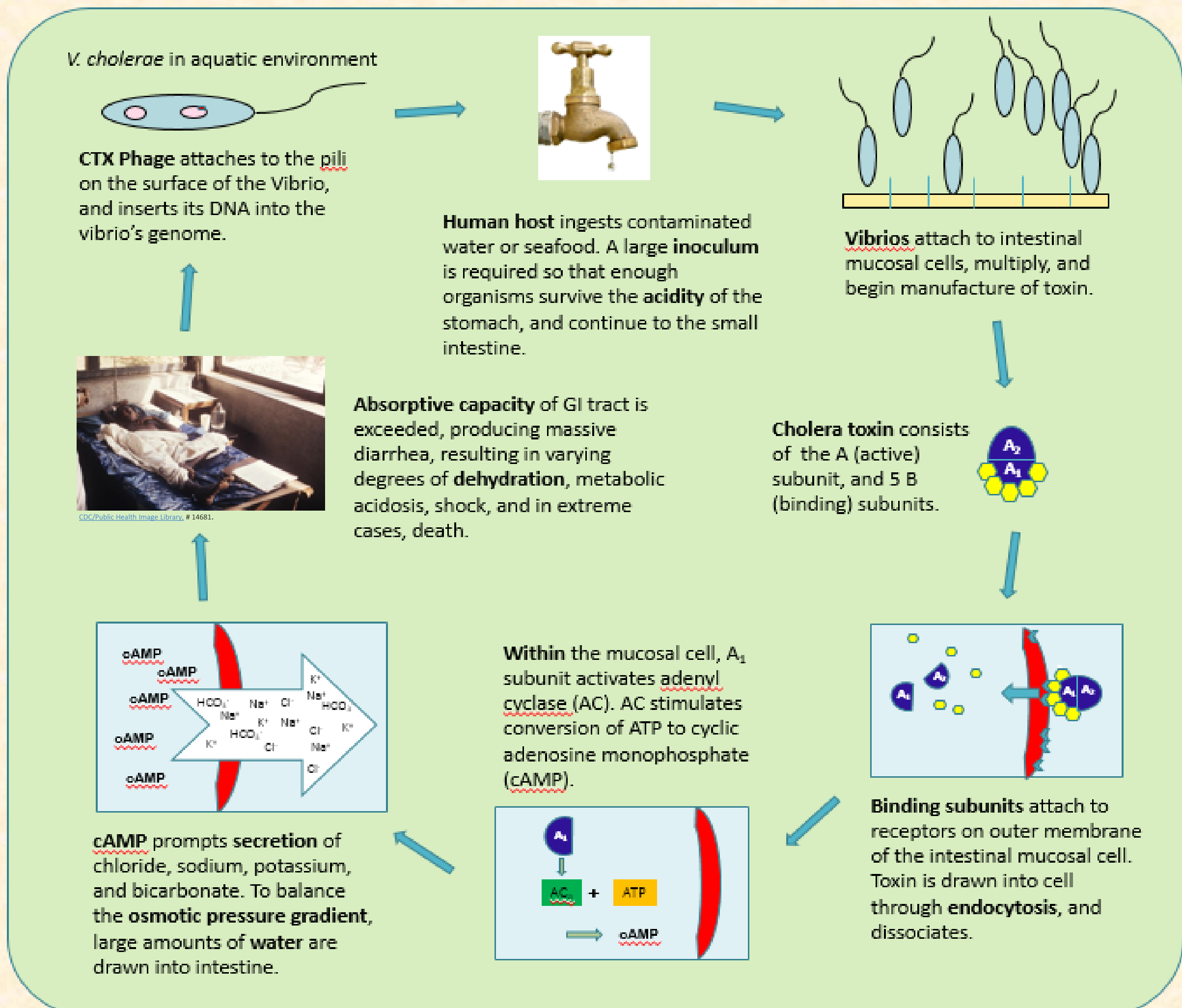
R. Koch

Image from [National Library of Medicine \(NLM\) Cholera Online:](http://www.nlm.nih.gov/exhibition/cholera/index.html)
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During the 1884 cholera epidemic in India, German physician **Robert Koch** successfully isolated the cholera bacterium in pure culture. With the acceptance of his findings by the scientific community, Koch was widely credited with the discovery of the cholera organism.

Vibrio cholerae: the bacterium

Vibrio cholerae is a Gram-negative rod, with a single polar flagellum and many long filamentous pili. Like many other bacteria, it is a facultative anaerobe that naturally occurs in aquatic environments. **But it's what goes on inside that gives this otherwise ordinary bacterium the ability to inflict a fatal blow to its human host.**



Vibrio cholerae causes disease through secretion of the **cholera toxin**. The genetic code for the toxin is not native to the bacterium, but is acquired through infection with a **bacteriophage** called **CTX ϕ** . Of over 200 distinct **serogroups** of *V. cholerae*, only **O1** and **O139** are susceptible to the CTX bacteriophage and are associated with epidemics of cholera.

Laboratory Identification of *Vibrio cholerae*

- Motility on wet mounts
- Gram stain
- Oxidase positive
- Growth on TCBS agar
- Antigen typing to identify O1 or O139 serotypes
- Rapid tests available for use in field settings
- Molecular testing on municipal water samples

Treatment of Cholera

- Rehydration in proportion to volume of fluids lost
- Oral Rehydration Solution for mild-moderate cases
- Intravenous fluids in severe cases
- Antibiotics shorten illness from 5 days to 2-3 days
- Vaccination for direct protection and herd immunity

Cholera in the 21st Century



Haiti villagers after the devastating earthquake of 2010.
[CDC Public Health Image Library, ID #15391.](#)

In developed countries, safe drinking water and good sanitation have dramatically reduced the number of deaths from cholera. However, about 1 billion people worldwide still lack safe drinking water.

Cholera is now endemic across much of Africa, and the 2010-2012 epidemic in Haiti resulted in upwards of 500,000 cases and 7000 deaths

Since global solutions to issues of water and sanitation are still decades away, researchers are exploring short to mid-term solutions as well. One of the most promising options for cholera control is vaccination. Not only can vaccination provide direct protection and herd immunity, it may be effective even after an outbreak has begun.

Researchers at UVM's Vaccine Testing Center (VTC) are taking part in a collaborative effort to develop a cholera vaccine that can be used for United States travelers and workers abroad, and for people living in developing countries. More information about the UVM Cholera Vaccine Study can be found at uvmvtc.org.

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Image Credits

Panel 1: National Library of Medicine (NLM) Cholera Online <http://www.nlm.nih.gov/exhibition/cholera/index.html>, [Cholera in Paris] / H. Daumier. 1 print: wood engraving. Illustrated in: Fabre, Antoine François Hippolyte. *Némésis médicale illustrée, recueil de satires*. Paris, Bureau de la Némésis médicale, 1840. NLM Unique ID: 57330670R.

Panel 2: Portraits of John Snow (NLM Unique ID: 101429151 and Robert Koch (NLM Unique ID: 101420766) from National Library of Medicine (NLM) Cholera Online <http://www.nlm.nih.gov/exhibition/cholera/index.html>,

Panel 3: Boy on cot. CDC/Public Health Image Library <http://phil.cdc.gov/phil> # 14681.

Panel 4: Villagers in Haiti. CDC/Public Health Image Library <http://phil.cdc.gov/phil> ID#:15391.