CHAPTER V

THE OREGON TRAIL AND ASIATIC CHOLERA

The Oregon Trail extends from the western border of Missouri to Oregon City, Oregon (Figure 15). Approximately 1900 miles in length, it passes through Western territory now defined as the states of Nebraska, Wyoming, Utah, and Idaho. This trail is traversed by several major geographic regions. It begins by making its way across the fairly level Great Plains, crossing and paralleling the flood plains of the Platte River and its numerous tributaries until Fort Laramie is reached. After Fort Laramie, this trail begins its ascent of the Rocky Mountains. This portion of the trail brings pioneer through rugged terrain, characterized by high altitude climates and scarce amounts of potable drinking water. Following the several week journey through what is now Wyoming, the trail descends into the Snake and Columbia River valleys of the Pacific Northwest.

The first significant populations traveling this route in 1843 ranged from a single person to several families in the form of a wagon train. The total number of wagons per train ranged from 20 to 300, with each wagon bearing about five people (Meyers 1960). By 1846, this population grew to as many as two to three thousand heading west to Oregon. In 1849, more than 30,000 people attempted this journey, the majority of whom were Gold Rush pioneers (Mattes 1969) (Figures 16 and 17).
Figure 15. The Oregon Trail (Artist unknown ("Bier"), no date. Vertical File: Overland Journeys / Oregon Trail/Maps and Routes, Oregon Historical Society, Portland, Oregon)
Figure 16. The Overland Migration Populations from 1836 to 1860 (Unruh 1993)
Figure 17. Migrations to each State by Overland Routes, by Year (Unruh 1993)
The largest wagon trains formed in 1850 and 1852 and were estimated to have as many as one thousand wagons making up a single company, each wagon averaging about four to six pioneers. As many as 55,000 emigrants made their way to the Far West per year in 1850 and 1852; one-fifth this population size migrated to the Far West in 1851. According to Trail historians Mattes (1969) and Unruh (1993), just under half of these emigrants headed to Oregon. The remaining half went to California and Utah. According to 1853 statistics kept about emigrants passing through Umatilla Pass in north central Oregon, most wagons bore just a couple and a child, but as many as twelve pioneers may have accompanied a single wagon, including children, parents, grandparents, relatives, and friends (See Appendix E for more demographic information).

Throughout the migration years, people and livestock suffered from the increasingly unhealthy living conditions of the Oregon Trail environment. In some places, unsanitary living conditions were induced by human waste disposal and numerous animal carcasses littering the Trail, a condition not new to Midwestern history. In 1844, well before any sizable migrations took place, trappers and travelers killed many of the buffalo in the Midwest, leaving their skinned carcasses to rot and setting the stage for certain diseases to erupt. Additional evidence shows that an abandoned Indian encampment may have contributed to some of the unhealthy trail conditions in eastern Nebraska. Following a battle with the Sioux, Pawnee Indians left behind animal parts in land subsequently traveled by pioneers. Evidence linking these carcasses to "cholera" appear in two 1844 trail diaries (Webber 1988, Rumer 1990). In an 1846 diary kept by another pioneer and republished along with his reminiscences about Oregon history (Thornton 1849),
animal carcasses along Platte River fork caused another epidemic to erupt due to buffalo carcasses and/or a contaminated water supply.

In 1849, these cholera-like diarrhea endemics suddenly worsened as Asiatic cholera penetrated the United States. As concerns for the potential for mortality due to "cholera" in the Midwest were heightened, the Oregon Trail rapidly formed into two epidemic regions with "cholera" as their chief malady. An Asiatic cholera epidemic region formed along the Platte River flood plain and extended as far west as Fort Laramie, Wyoming. The dysentery "cholera" region moved to that portion of the Trail west of Fort Laramie.

The Asiatic Cholera Region

The Asiatic cholera epidemic region of the Oregon Trail is an extension of a diffusion pattern already formed in the United States beginning in 1832 and revived from 1848 to 1854 when *Vibrio cholerae* returned to this country and for the first time became a part of Trail history (cf. Figure 13). By traveling slowly across the Great Plains, this epidemic ultimately reached its final destination along the Northwest Oregon trail route just west of Fort Laramie. As other emigrants attempted to reach the Far West by way of the California Trail, Asiatic cholera made its way to San Francisco and Sacramento only after two Asiatic cholera epidemic years had passed.

Relating this disease diffusion pattern to the Oregon Trail migration, Asiatic cholera began its diffusion westward from the various jump-off towns in Western Missouri. Due to its distance from the Gulf of Mexico, vibrio ecology could no longer play an important role in the disease diffusion process. Further
west along the trail, climatic differences brought on by changes in latitude and elevation prevented vibrio from being able to survive for long periods of time between cholera victims. For a short time, this vibrio sustained itself along the Platte River Valley, by residing in specific aquifers, wells and latrines during the warmer days of the year. Further west, however, these vibrio-supporting physiographic and climatic features became less dominant making human population density important to sustaining the migration of this epidemic westward.

Two types of epidemic patterns developed along the Trail during this time. A radially spreading contagious diffusion of the disease occurred at popular campgrounds and fort locations. Along the Oregon Trail, a linear Type I diffusion pattern developed, with its peak occurring just a few days after Fort Kearney was departed or passed. Smaller epidemics then followed near popular camping areas like Ash Hollow, Chimney Rock and Independence Rock. The last deaths occurred near Fort Laramie, after which, rapid changes in topography, hydrologic features and climate prevented a further diffusion of Asiatic cholera westward.

The Platte River Flood Plain Epidemics. A summary of trail deaths by Trail geographer and historian Rieck (1991) defined nearly fifty percent of the known causes for trails deaths to be some form of “cholera” (Table VII). Of these deaths, most took place within the first week, followed by a second wave one to two weeks later. About 91 percent of these “cholera” deaths ensued by the time Fort Laramie was reached, and 96 percent by the time South Pass was reached (Rieck 1991). The remaining four percent were most likely not due to Asiatic cholera, but rather dysentery.
TABLE VII
OREGON TRAIL DEATHS (RIECK 1991, 14)

<table>
<thead>
<tr>
<th>DISEASE TYPE</th>
<th>TOTAL</th>
<th>CASES</th>
<th>PERCENT OF KNOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFECTIOUS</td>
<td>468</td>
<td>50.2</td>
<td></td>
</tr>
<tr>
<td>Cholera</td>
<td>367</td>
<td>39.4</td>
<td></td>
</tr>
<tr>
<td>&quot;Fever&quot;</td>
<td>60</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>41</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>INDIAN</td>
<td>123</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>STARVATION/FREEZING</td>
<td>111</td>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>DROWNING</td>
<td>69</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>ACCIDENT</td>
<td>65</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Gunshot</td>
<td>27</td>
<td>2.9</td>
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<tr>
<td>Run over</td>
<td>17</td>
<td>1.8</td>
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<tr>
<td>Stampede</td>
<td>13</td>
<td>1.4</td>
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<td>Lightning</td>
<td>4</td>
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<tr>
<td>Other</td>
<td>6</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>HOMICIDE/CRIMINAL JUSTICE</td>
<td>41</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>Murder</td>
<td>30</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>hanged</td>
<td>8</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Firing Squad</td>
<td>3</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>MISCELLANEOUS</td>
<td>56</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TOTAL KNOWN CAUSES</td>
<td>931</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>TOTAL UNKNOWN CAUSES</td>
<td>1609</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL BOTH GROUPS</td>
<td>2540</td>
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</table>
The possible reasons for these cholera deaths, especially around the forts includes (1) contact with carriers and disease victims, (2) contact with the belongings of recently deceased pioneers sold in the fort setting or by local traders, (3) contamination of the local water due to the concentration of victims in and around the Fort along with the contamination of the various water holes dug on this portion of the trail, and (4) the placement of this Fort on a flood plain enabling vibrio to travel from one water system to the next and diffuse through a highly porous alluvial flood plain setting with vibrio supporting alkaline waters nearby.

**Fort Laramie and the Rocky Mountains.** The region around Fort Laramie was the last to be infected by Asiatic cholera. Some evidence suggests that both dysentery and Asiatic cholera may have prevailed, leading to a significant amount of confusion about what form of diarrhea was erupting. For example, as Stout passed through an area near Fort Laramie which he called “Pine Woods,” he was taken ill with “a severe attack of the cholera,” but did not die suggesting instead that this illness could have been dysentery (Stout 1852).

Most of the diary evidence suggests that topographic changes west of Fort Laramie prevented the diffusion of Asiatic cholera further west due to climatic changes. One-hundred miles west of Fort Laramie, the Trail became very arid and lacked the grass needed by livestock due to its predominantly sagebrush environment and sandy soil. As noted by Stout, “we are in a miserable country now.” Some contentment was probably felt by Stout though due to this changing scenery, for with it came a rapid reduction in graves.

Stout’s diary also suggests that a sudden onset of cold temperatures might have greatly reduced the ability of vibrio to survive outside of the human body or
remain virulent as he continued heading west from Laramie, for he noted the tendency for nocturnal temperatures to go below freezing, causing local swamps to form ice and unmelted snow to remain on the ground. By the time he reached Devil’s Gate in early July, the air temperatures were very cold, accompanied by recurring hail storms and winds (Stout 1852).

Detailed observations about this impact of elevation change on local climate is best documented by Captain John C. Fremont, who, during his exploration of the overland routes to the Pacific Northwest in 1842 and 1843, recorded daily weather conditions and temperatures four times per day during the spring and summer months. From June 10, 1842 to August 3, 1842 Fremont traveled from Missouri to a turnaround point just west of the Sweetwater River-Cherry Creek junction, after which he returned to the East Coast. The following year, he recommenced his study of the Rocky Mountain region on August 9th, logging the same climate data until he reached Walla Walla near the Oregon-Washington-Idaho border on October 26, 1843 (Preuse 1846) (Figure 18). Fremont’s temperatures were combined and then related to his published description of encampments to produce a description of the weather conditions he faced during his journey westward, information directly applicable to later migrations along the same overland route by other pioneers crossing the Rocky Mountains (Figures 19 and 20).
Figure 18. Fremont's Exploration of the Far West, 1842 and 1843 (Goetzmann 1959, 71)
Figure 19. Changes in Summer Temperatures Relative to Elevation as Recorded by Fremont in 1842 and 1843 (Fremont 1848).
Figure 20. Changes in Sunset Temperatures Relative to Elevation as Recorded by Fremont in 1842 and 1843 (Fremont 1988).
Fremont's records note a significant drop in temperature during his overnight stay in Wyoming, in spite of summer-like daytime temperatures from late July to mid-August. Whereas daytime temperatures were perhaps warm enough to favor vibrio activity outside the body, the nocturnal thermal pattern mimics the activity of a much cooler region which cause tropically-borne diseases like Asiatic cholera to lose much of their virulence (Jusatz 1977).

Interpreting this disease behavior in an ecological sense, the surrounding environment and local ecology would be non-supporting of *Vibrio cholerae* outside the human body. For these reasons, the climate and environment of Wyoming forced vibrio to infect one victim after another by way of direct contact if it were to successfully make its way through this region. However, due to the reduction in trail population induced by earlier deaths and the division of the trail into numerous alternative routes and cut-offs, person-to-person transmission of Asiatic cholera was unlikely to continue once the Platte River valley was departed.

An important argument against this reasoning for the prevention of cholera diffusion through the Rocky Mountains is the possibility that even though the virulence of vibrio outside of the human body was reduced by cold temperatures, these same temperatures might have also had the affect of increasing the longevity of vibrio in its inactive state, such as within soil, within an adequate water-based environment, or while residing on infected clothing and food. Furthermore, the cold climatic conditions might have also increased the likelihood that any vibrio unknowingly carried in the form of contaminated clothing and personal belongings could have infected an unsuspecting victim who used these materials to stay warm in the colder high elevation reasons, a reason the first migration of Asiatic cholera
into the United States from Europe was successful during the early nineteenth century (Peters 1875, 635) (see Appendix B, second part for Oregon Trail food and supplies lists). Throughout the diary readings, however, no evidence for such a reason for the re-emergence of Asiatic cholera within or west of Wyoming can be found. This suggests that any contact with contaminated clothing would have been made quite early in the migration, such as where the near freezing temperatures began to force pioneers to put these belongings to good use.

**Trail Deaths in the Diaries.** Final support for the claim that a reduction in Asiatic cholera deaths took place near the Continental Divide of the Oregon Trail appears in trail diaries detailing the numbers of graves passed per day. This data also provides a second reason for the lack of cholera diffusion westward as well: the rapid fatality of Asiatic cholera victims leading to the cessation of this westward diffusion by killing all or most of the highly susceptible trail pioneers.

In general, when reviewing grave markers as possible Asiatic cholera death indicators, it is important to realize that Asiatic cholera wasn’t the only cause for deaths along the Trail. In fact, according to Rieck’s data (Rieck 1991, 1993, 1999), Asiatic cholera may have only been responsible for as little as one third to one half of the trail deaths. But if we assume the percent of graves passed per day to be proportional to the percent of all deaths induced by cholera in that region, then cholera prone regions can be identified and the various reasons for these events better understood.

In a diary kept by Cecelia Adams and Parthenia Blank in 1852 the number of human graves passed per day were noted (Webber 1997). A graphical depiction of these suggest the first peak in deaths to be near the junction of Platte River and
its tributary, a place where various jump off trails at Platte River converge (Figure 21). This was followed by second peak near a popular camp ground at the junction of two creeks. The greatest number of graves were recorded near Fort Kearney, where the increase in fatalities was most likely due to the spread of Asiatic cholera between wagon trains as people approached others near the fort and unknowingly purchased contaminated goods once owned by emigrants, and/or made contact with vibrio-contaminated water. Other peaks in deaths occurred along Platte River flood plain, and near Ash Hollow and Independence Rock, two popular campgrounds frequented by pioneers one week prior to reaching Fort Laramie. Just west of Fort Laramie is a small number of graves, a brief resurgence in fatalities, due either to Asiatic cholera or dysentery. The cessation of this epidemic began with the ascent and passage through the Rocky Mountains, making Fort Laramie the last place where this disease could be successfully spread to new victims. The portion of the Trail between Fort Laramie and Willow Springs or Sweetwater River therefore behaved much like a disease transition region, where deaths due to Asiatic cholera decreased as deaths due to dysentery increased.
Figure 21. Number of Human Graves passed each day along the Oregon Trail by Cecelia Adams and Parthenia Blank in 1852 (Webber 1997)
The stretch of the Oregon Trail leading from Fort Laramie to Snake River passed through some of the coldest environments and most irregular terrain that has to be traveled. According to Mattes and Unruh, this migration through the cold climates of Wyoming traversed about 375 miles of upper desert region, a distance which would normally take emigrants about three weeks to complete before descending into much drier and warmer climates along the Snake River valley in Idaho. Thus the likelihood for *Vibrio cholerae* survival within an infected person is greatly reduced by its inability to remain pathogenic during the two to three week migration to Snake River. Further support for the claim that Asiatic cholera didn’t cross the Rocky Mountains is a lack of adequate descriptions of Asiatic cholera fecal discharges and the reduction in population density of the Overland route due to its division into numerous alternative routes. Together these changes in trail geography suggest that for the first time the Oregon Trail was free of Asiatic cholera once the Continental Divide was reached.

Summary

The most important physical geographic features supporting the diffusion of Asiatic cholera along the Great Plains portion of the Oregon Trail were: 1) climate and weather conditions, 2) the elevation of the trail on the flood plain above local river level, 3) local water chemistry, and 4) Platte River ecology. West of the Great Plains, the ability of Asiatic cholera to continue its migration westward was ceased due to the mountain climate of the trail west of Fort Laramie along with a number of physical geographic and human population features.
CHAPTER VI

OREGON TRAIL DYSENTERY

Years before the Asiatic cholera epidemic struck the Platte River flood plain, dysentery developed along several parts of the Trail in eastern Nebraska and near the Fork of the Platte River in middle Nebraska. Pioneers who passed through the Great Plains without succumbing to disease in turn ascended the Rocky Mountains, often with the hope of leaving their fears of this “cholera” behind them. Quite soon into this part of the journey, however, a significant number of oxen succumbed to this portion of the Trail due to rapid elevation changes. In short time, this led to the development of a dysentery epidemic which ultimately spread along the entire length of this route over the next three years. Once this disease reached Portland, Oregon in January 1853, it was referred to it simply as “cholera.” The geography of this “cholera” indicates it was due to one or more forms of dysentery brought on by opportunistic organisms borne by animal carcasses which in turn infected Trail emigrants. The same geographic features which prevented the diffusion of Vibrio cholerae and Asiatic cholera from the Great Plains to the Rocky Mountains, were in turn responsible for a new dysentery epidemic.

Dysentery and “Cholera”

To differentiate Asiatic cholera from the more common forms of dysentery mentioned in the trail diaries, the description of the disease, its place of eruption, and its tendency to erupt without fatality provide the best evidence for arguing
against any possible continuation of the Asiatic cholera epidemic into the Northwest. Other supporting evidence is the atypical behavior of the dysentery epidemic which erupted along the trail. Since it often occurred a day or two after animal carcasses were passed, this suggested the disease was either related to the carcasses themselves or the unsanitary conditions their deterioration produced. In addition, recent Asiatic cholera deaths and the formation of numerous cut-offs of the trail caused a significant reduction in trail population density. This in turn greatly reduced the likelihood that any other form of dysentery dependent on person-to-person transmission, such as shigellic or amoebic dysentery, could have made its way westward instead of the population dependent Asiatic cholera. Due to the ability of opportunistic dysentery to occur in areas devoid of people for significant periods of time, such as between disease cases, a form of opportunistic dysentery primarily of environmental origin was the cause for this Trail epidemic.

The results of this study indicate that this opportunistic form of dysentery developed along the trail due to common organisms taking advantage of fatigued emigrants, a conclusion based largely on the descriptions of diarrhea in the trail diaries relative to trail geography and their forced proximity to carcasses produced by the drastic changes in trail topography. Once the infection commenced, a prolonged diarrhea problem ensued, which was rarely as fatal as the "Plains cholera" due to *Vibrio cholerae*.

**The Eastern Nebraska Epidemic.** A number of the prerequisites needed for a dysentery epidemic to develop had already taken place in eastern Nebraska just prior to the first migration of Oregon Trail pioneers in 1843. Pawnee Indians left their encampment on the North Fork of Loup River following a territorial dispute
with Sioux Indians, leaving behind numerous animal parts strewn about in close proximity to the river bed. In addition, certain portions of the overland route served as wallowing sites for buffalo, which in some cases led to the death of these buffalo, either naturally by living out the final moments of their life or as a result of recreational hunting. As these animal parts and carcasses decayed, they infected the aquifers used by pioneers for drinking water and perhaps exposed these pioneers to insects which served as vehicles for the bacteria responsible for the development of the first severe diarrhea, dysentery or “cholera” cases.

Jacob Hammer’s diary of 1844 provides some of the earliest evidence linking this unsanitary condition of the Platte River flood plain to the development of a diarrhea epidemic. Passing the North Fork of Loup River in mid-June, Hammer noted numerous buffalo parts along the trail, leading him to write on June 14th: “We camped near the old Pawnee village which is now left desolate on the account of the Sioux fighting them so much that they abandoned the place . . . .” (Rumer 1990, 82). After providing a detailed description of the remaining village site, he added “We have seen Buffalow bones in several places” (ibid 83).

The following day, Hammer’s team crossed Loup River, passed by another Pawnee village on June 15th, and then three days later, came upon more “Buffalow bones” along the south shore of Loup River. Quite soon after, Hammer’s friend John Murphy developed a fever. By the time they reached the Platte River on June 21st Hammer wrote: “Thomas Vance very sick and has been for several days.” Several others in Hammer’s train were also taken ill by this time. One week later, as this disease continued, this led Hammer to make an entry on June 28th
concerning Thomas Vance’s death along the north shore of the fork of North and South Platte Rivers (ibid 86).

This possible relationship between buffalo parts and carcasses and trail dysentery was again suggested, but not directly proven, by a note about the same encampment in 1846 by Virgil Pringle, who gave a more detailed account of the commonness of buffalo deaths along this part of the trail. After passing through the Pawnee encampment, he wrote on June 7th “Buffalo sign is now plenty and we see occasionally a dead one in the bottom” (Pringle 1923, 287). By June 9th, as the fork of the Platte was reached, he made the following journal entry: “Buffalo plenty, two being killed and several wounded” (ibid). It is important to note, however, that throughout Pringle’s migration, no illness was noted following his pass through this region west of the old Pawnee encampment in 1846.

In 1847, an early identification of another case of dysentery as “cholera” was made by Loren Hastings. After passing through the same abandoned encampment in eastern Nebraska, Hastings used the term “cholera” to describe the diarrhea epidemic this region was known for. A few days later, as members of Hastings’ train camped along the Platte River, they apparently came in contact with the bacteria responsible for this diarrhea, for on June 7th, various members of his train experienced the onset of illness and “[a] sick many died” (Hastings 1926, 14). By the end of the summer of 1847, Hastings noted that enough “cholera” cases had developed along the trail between North Loup River and Platte River to spread this epidemic to places further west along the trail.

The Platte River Fork Epidemic. Evidence for the development of a second dysentery epidemic region further west at Platte River Fork appears in William
Thornton’s diary penned in 1846 (1849). According to Thornton, the portion of the trail leading from South Platte River to North Platte River was a popular recreational buffalo hunting site where his friends actively engaged themselves in a buffalo hunt on the North and South Platte Rivers on June 16, 1846 (Thornton 1849, I: 80-83). Soon after this hunt, members of his train experienced their first cases of dysentery. Thornton’s notes suggest that the most likely causes for the development of dysentery in this region included (1) contact made with the rotting of already dead buffalo strewn about, (2) insect vehicles, (3) the natural contamination of live buffalo just before they were slaughtered with bacteria capable of causing dysentery, or (4) by drinking river water contaminated by these carcasses.

Two days after passing through the buffalo hunt site at Platte River fork, both Thornton and his wife became ill by eating the freshly prepared buffalo meat (ibid 85). This illness continued for several days and by June 22nd had spread to others in the train (ibid 91). Evidence that this dysentery was continuing to infect Thornton’s team appeared the following week when still more people became ill without fatalities. On June 26th, ten days into this illness, Thornton noted that he was still suffering from the diarrhea once Chimney Rock was passed 100 miles north-northwest of the fork of the Platte River (ibid 110). He made no more comments about this diarrhea spell until Fort Hall was reached, when members of his team were once again taken ill (ibid 163), this time due to their exposure to poor sanitary conditions in and around the fort.

This diary evidence indicates that several regions developed along the Trail by 1848, one year before the return of Asiatic cholera, which were prone to a form
of dysentery referred to as "cholera." It also suggests that certain human behavioral and human population features enabled a fairly endemic form of bacterial disease to develop within this natural setting well before emigrants arrived. With the establishment of more permanent settlements in this region such as forts, parts of the Oregon Trail became prone to this diarrhea disease due to physioanthropic changes in the environment. Between 1849 and 1850, one or more disease foci developed. According to Meyer's sequent occupancy model for disease development, the development of this opportunistic form of dysentery was more likely than a shigellic and amoebic form of the disease.

The Wyoming Epidemic. Between South Pass and the Columbia River, a new dysentery epidemic developed in 1849. The rapid increase in human and animal migrations caused numerous deaths of oxen west of Fort Laramie. As this dysentery slowly diffused westward over the next three years, it developed more virulent forms with each passing of the migration season. By the time it reached the eastern edge of the current Oregon boundary in late Autumn of 1852, this epidemic was compared with "Plains cholera" due to its highly debilitating nature.

The first significant concentration of dysentery cases in a single region west of Fort Laramie took place near Sweetwater River just east of South Pass in 1850. Until then, most of Platte River was traveled without much incidence of dysentery due to the Asiatic cholera epidemic underway. Immediately after passing Fort Laramie, the Trail began its steep ascent into the heart of the Rocky Mountains, leading in turn to the rapid death of oxen and cattle and the development of numerous dysentery niduses due to their carcasses. The remaining requirement for this potential epidemic region--disease susceptible people--was introduced to this
part of the overland migration during the later years as trail populations increased in size and density. During the peak migrations of 1852, the diminished supply of fort provisions for these travelers added further to the malnutrition suffered by these pioneers.

Oregon Trail pioneer and naturalist Bruce McKinstry of 1850 provided some of the most detailed descriptions of the epidemic environment. Noting in his diary the possible topographic causes for the development of these unsanitary conditions, McKinstry correctly linked the intake of alkali waters and the crystallization of alkali on local forage materials as possible causes for oxen and cattle deaths near Chimney Rock and Independence Rock (McKinstry 1975, 150-157). He also correctly deduced that these carcasses were more than likely cause for the local dysentery cases.

After traveling without incidence of illness throughout the entire the month of June, McKinstry reached Willow Springs on June 30th and wrote: “We passed numerous dead cattle in the vicinity of Alkali Springs, and some left not dead” (ibid 150). The next day he passed through “Alkali Country . . . [where] “the grass as well as the water was poisenous . . . the dead carcasses confirming this” (ibid 151) Upon reaching Sweetwater River, he noted yet another region rich in “tons of Seleraetus.” Continuing past Independence Rock through Devil’s Gate, he was subsequently forced to camp on a river “strongly impregnated with alkali” (ibid 157), leading him to pen the following description of cattle deaths on July 4th: “Many cattle die from eating the grass, but there is no other chance for them. The road is well lined with carcasses and the smell anything but agreeable, we can
scarcely find a ground clear of the stench" (ibid 157). McKinstry had yet to see or experience any dysentery or diarrhea problems.

The following day (July 5th), during their pass through Sweetwater valley, members of McKinstry's train suddenly became ill with diarrhea. McKinstry blamed this diarrhea on the dead cattle, referring to its fatality as if it were related to the more deadly Asiatic cholera:

"Hibbard continues very sick--we do not expect that he can live long. Half the wagons have sick men with them. We would lie by altogether, but H. will not consent to it. It might be the death to us all, it is getting late and the feed is nearly gone, and every day growing worse, and thousands just behind us." (ibid 160)

The following day (July 6th), two more members from his train were taken ill as well, as Hibbard's condition slightly improved. According to McKinstry, dead cattle continued to litter the trail along with "live ones that have been left unable to proceed" (ibid 167). Soon after, Hibbard's illness once again worsened and lasted another week, by which time Bruce McKinstry himself was taken ill and wrote: "I passed a disagreeable night owing to a severe toothache also diarrhea" (ibid 170). According to McKinstry, his people were by then traveling at about 7300 elevation above sea level near Burnt Ranch.

Once McKinstry passed Fort Bridger and Ham's Fork he came upon a French mountaineer's trading post, where he spent the night on July 19th. The following day, his train ascended a summit overlooking Ham's Fork and Bear River valleys, a portion of the trail which was highly fatal to livestock due to the rapid
changes in elevation. During his ascent, McKinstry commented “Dead animals all the way up, the stench intolerable.” As McKinstry provided detailed descriptions of the dead animals strewn about this region, he also described their bloated, rotting carcasses and the maggots and swarms of insects flying about. These observations led him to deduce that the causes for subsequent livestock deaths and the sickness his fellow pioneers were experiencing was simply due to the carcasses lying about, “strewed on every hill and in every valley, poising the otherwise pure air” (McKinstry 1975, 194-195). The following day, members of his train again became ill and complained of colicky symptoms (ibid 199).

In the days that followed, as McKinstry’s train reached the trading posts of the Far West, he engaged in several activities capable of furthering his team’s problems with diarrhea. In need of food, McKinstry purchased an “Elk carcass” from Natives (ibid 218). A short while later he passed through the Bear and Green River valleys where he again noted numerous animal parts strewn about (ibid 222).

Trading Post- and Fort-generated Epidemics. McKinstry’s detailed notes not only provide us with an explanation as to why dysentery epidemics continued to develop along the trail—the numerous animal deaths which occurred—it also provides us with insights into how particular human geographic features may have allowed this disease to spread from central Wyoming to rapidly growing communities further west in Oregon. Trading posts and forts bore many of the same environmental features as the “old Pawnee” settlement noted in eastern Nebraska and much older Fort Hall settlement referred to by Thornton. Along with increased population density came the increased likelihood for contact with others carrying or suffering from these and numerous other diseases, thereby increasing
the likelihood for their further spread. In addition, many inhabitants of this region most likely suffered from poor living conditions and poor nutrition, making them more susceptible to various infectious diseases.

Finally, due to the possible infection of livestock exchanged at the trading posts for refreshed more vigorous livestock, the stage was set for the contamination of numerous foods sold at these places by bacteria. Such bacteria-contaminated livestock may have even, in some cases, become the sources for contaminated food as well. For example, at the Sioux-French Canadian trading post between Fort Kearney and Fort Laramie, jerky products were often prepared and then sold to pioneers, with poor sanitation practices and poor food preparation techniques (i.e. undersmoked, partially dried meats) as the most likely causes for food contamination.

Together, these features increased the likelihood that popular gathering places could have developed into localized epidemic regions thereby facilitating the diffusion of the opportunistic dysentery epidemic problem further westward. Since forts were places where people tended to congregate along the Oregon Trail to set up large encampments, these fort environments added to the likelihood that previously uninfected pioneers would be infected by unsanitary fort waste and other pioneers already experiencing dysentery. Older forts in particular were a problem due to their old garbage sites and outhouses built in close proximity to each other and on the same watershed as drinking wells. At Fort Laramie for example, in his letter written on June 20, 1850, Dr. Reuben Knox described a non-fatal “cholera” which began soon after passing an Indian trading post: “Joseph was unwell with diarrhea and Henry and myself were on the move on horseback
and off most of the time” A short time later he wrote: “Have had some 15 or 20 cases in my train, none of whom have proved fatal except Mason who was relying upon his favorite Hom[e]opathic remedies until [he] perfectly collapsed” to which he added: “Have had two slight attacks myself, --Joseph and Henry also, but all are well now . . .” (Turner 1974, 52, 53).

Another way for dysentery to spread was by the mishandling of human bodies and/or the belongings of the deceased. The re-exposure of the buried bodies of victims by wolves was a possible problem. The common practice of unloading personal belongings on the trail to improve mobility had the probability of increasing disease spread. In 1850, for example, Dowell most likely helped to spread this disease by trading the belongings of a deceased emigrant with a merchant at Fort Hall (Dowell 1850, 35).

Since the migration of 1851 was considerably less than that of neighboring years, little diary evidence was uncovered mentioning the development of dysentery epidemics along the trail. Nevertheless, the numerous deaths of livestock the year before had already set the stage for a more serious dysentery epidemic to ensue in the years to come, Most likely the 1851 trail migration added to the growing animal carcass problem along the Oregon Trail and made the 1852 migration one of the worst in Oregon Trail history due to the two epidemic regions which had developed along the Great Plains and in the Northwest.

In 1852, dysentery infected much of the Oregon Trail between Wyoming and Oregon. As before, bacteria responsible for this epidemic survived on dead animal carcasses, but in due time passed from animal carcasses to emigrants in a state of fatigue and malnourishment in axenotic, anthropo-zoonotic fashion. The
local geological features responsible for the deaths of oxen, cattle and horse
included the fatal alkali water or alkali-contaminated forage grasses consumed by
livestock. Various landform features were also linked to their deaths such as hilly
or rough cobbled terrain with wide streams to cross. Likewise, as food and water
scarcity continued to take its toll on the pioneers, trail topography continued to be
fatal to livestock and oxen populations.

The spread of bacteria from these decaying carcasses into drinking water
worsened in 1852 due to the forced encampment of people next to carcasses and
the increased prevalence of each along the Trail. This problem was at its worst
near Fort Hall, where human behaviors responsible for dysentery, poor sanitation,
crowding, and various unsanitary trade activities were at their worst. In Reverend
John McAllister’s description of Fort Hall dated August 1852 he wrote: “the fort is
situated on a slough of snake river a plane of many miles surrounding it a bad
slough on a slough right of road is good grass Camped there” (McAllister 1925).
Other gathering places where pioneers spent the night waiting to ford a stream were
also, relatively speaking, densely populated, and at times so heavily contaminated
with animal carcasses that camping next to them often became an inevitable cause
for pioneers to be exposed to the right diarrhea-inducing conditions.

An additional problem in 1852 was the development of malnutrition
problems along the western part of the trail due to inadequate food stores at the
forts and trading posts. With the high Trail population of 1852, fort provisions
failed to meet the needs and demands of pioneers. In a letter written by Christian
Kauffman to his parents in 1852, he described the fort as a place where livestock
were greatly weakened by the scarcity of grass to forage, then adding: “A great
many had to kill their poor cattle to keep from starving, but the beef gives them the diarrhea, and that is why so many die on the latter end of the road” (Kauffman 1852, 35-36). The infection of livestock and the malnutrition suffered by pioneers increased their susceptibility to dysentery brought on by eating contaminated meats, not only by forcing pioneers to consume their own livestock, but also due to the tendency for their malnutrition to induce low stomach acidity, a condition necessary for opportunistic bacteria to successfully infect people. The effects of this more fatal form of diarrhea on trail emigrants is best demonstrated by diaries detailing animal deaths in relation to human gravesite counts and personal notes added about the dysentery experience.

Martha Read's Diary Notes. Martha Read’s (1852) diary provides the most convincing evidence for the association between animal deaths and human fatality along the Northwest portion of the Oregon Trail (Figure 22). Read documented the number of animal carcasses and human graves passed each day. By converting her data into spatial-temporal graphs of graves and animal carcasses passed per mile per day on the trail, differences between the dysentery and cholera regions become apparent. In particular, Read’s data shows a fairly regular wave of Asiatic cholera graves both temporally and spatially along the Great Plains, a pattern which contrasts greatly with the irregular spacing noted for the Northwest regions where trail deaths due to dysentery were recorded. Read’s figures demonstrate a wave-like pattern for Asiatic cholera deaths along the Trail, i.e. the further away from the disease nest one travels, the less likely one will be infected and pass it on to new victims due to the deaths of highly susceptible people and/or ecological and environmental changes.
Figure 22. Graves and Animal Carcasses per mile traveled along the Oregon Trail, Martha Read, 1852.
Unlike Asiatic cholera, dysentery lacked the much larger temporal-spatial relationship seen with Asiatic cholera. By remaining active along the entire length of the trail, this dysentery showed a tendency to erupt at certain locations due to specific well-localized geographic features related to animal deaths. These epidemics were of multiple causes, but as the trail headed further westward, human population features became the primary feature determining how aggressive future dysentery problems might become.

The Snake River Epidemic. Along Snake River, the various geographic features which contributed to the deaths of livestock were at their worst. Alkali water caused numerous oxen deaths between American and Cascade Falls. Kerns for example noted 17 recent livestock deaths in 5 days of travel across 95 miles of trail, the chief reason he gave for these deaths was the lack of potable water (Kerns 1917, 175-176). One week later, Kerns again noted cattle deaths accompanied by a sudden increase in human graves. Soon after, members of his train became ill, leading him to write on August 17, 1852: "Mr. Stone's wife was taken sick last evening with cholera and died this evening after camping" (ibid 177). As this illness continued, it peaked in severity just before reaching Fort Boise. Delazon Smith blamed the deaths in the fort region (including Native Americans as well) on water contamination by carcasses, noting at least 5000 of the 14,000 to 15,000 horses chancing this journey had been left dead or nearly-dead by pioneers trying hastily to complete the final miles of trail migration (Smith 1852, Letter 1, 7).

As Kerns's wagons reached this carcass-ridden region, his team camped on the Owyhee River just south of Fort Boise on August 21st, and Kerns made the following entry "we have taken several sick persons in the train this evening,
mostly scurvy” (Kerns 1917, 178). At this point all we can tell is their illness resembled scurvy, an illness due to Vitamin C deficiency, in which the chief symptoms include diarrhea and/or a reddening of the skin, two symptoms also typical of dysentery and typhoid fever. Kerns’s subsequent entry suggests this condition was non-fatal, reducing the possibility that a highly fatal typhoid fever epidemic was developing. Scurvy is further ruled out by an entry made the following day by Kerns in which he described in more detail the illness his team was suffering: “Some of our train severely afflicted with a bloody diarrhea, the mountain fever, and the scurvy which begin to make us think we are treading the elephant’s tail.” (ibid 179).

The Dalles-Umatilla Epidemic. By the time the emigrants reached the western Blue Mountains, they were more susceptible to dysentery than ever due to malnutrition. In Mrs. L. A. Bozarth’s recollection of her 1852 migration, she recalled the nutritional deficits her family suffered as they passed Fort Boise: “our provisions were running low, in fact, we were in danger of starving” (Bozarth 1852). Likewise, Sila Miller and his wife noted the same problem in a letter about the journey from Ft. Hall to Burnt River: “It is certainly one of the most God-forsaken countrys in the world. Here we suffered -- here our Cattle died -- here we gave out . . . here we were sick -- here we run out of provisions . . .” (Miller and Miller 1852, 6).

The most concrete evidence that these diarrhea spells were linked to malnutrition and length of migration appears in Martha Read’s diary. During the last weeks of her journey through Grande Ronde and Umatilla Valley, dysentery led several members of her train to experience these problems daily (Figure 23).
Figure 23. Trail Sickness Relative to Graves and Carcasses, Martha Read, 1852.
Dysentery and Mountain Fever.

The microorganisms responsible for dysentery were not only responsible for diarrhea epidemics but also the "mountain fever" common to this portion of the Trail. In some cases, this fever accompanied dysentery. In other cases it occurred as a single symptom related to an infection in which neither simple diarrhea nor the more contagious dysentery ensued. This "mountain fever" epidemic serves as the final proof that a bacterial disease of ubiquitous nature had taken hold of the Oregon Trail in 1852.

The "Mountain Fever" of Oregon Trail history is typically interpreted as Rocky Mountain Spotted Fever or Colorado Tick Fever, a metaxenotic, zoonotic disease with a disease pattern geographically-definable based on the spatial distribution of its vector, the Western Pacific Tick, and the numerous reservoirs or animal hosts for this tick. A recent cartographic impression of the Rocky Mountain Spotted Fever epidemic region shows it to be well distributed throughout Wyoming, bearing a spatial distribution pattern defined by the living environments of its vector, the tick, and the various mammals infected by this tick (Appendix F). The fact that a sizable portion of the Oregon Trail passes through this region is strongly supportive of the possibility of Rocky Mountain Spotted Fever as a possible Trail epidemic.

This association of Rocky Mountain Spotted Fever cases with many of the "mountain fever" cases noted in the diaries however seems unlikely. Supporting this argument is the ability of a typical Rocky Mountain Spotted Fever case to resolve itself fairly quickly. Had a pioneer developed this illness several weeks before reaching Oregon City, the end of the Trail, this condition should have
lessened during the remaining days of overland migration, rather than erupt much later near the more heavily populated regions in and around The Dalles.

This review shows that many if not all of the cases of “mountain fever” experienced by pioneers in Idaho and Oregon, since they often continued throughout the remaining weeks of the migration, were induced by one or more bacteria capable of inducing cases of diarrhea, dysentery and fever as combined or as separate illnesses. The first evidence supporting this link between mountain fever and dysentery once again appears in the statistics about trail deaths tabulated by historical geographer Rieck (Rieck 1993). As already demonstrated, the “cholera” Rieck noted west of the Continental Divide and which struck Snake River was not Asiatic cholera but in fact the “cholera morbus” or dysentery defined earlier in this thesis. According to Rieck, the Asiatic cholera fatalities far outnumbered the dysentery fatalities on the Trail at least six fold. However, assuming the Trail deaths west of the Continental Divide due to dysentery could have been interpreted as either “cholera” or “fever” cases, we find that these combined fatalities are superseded only by freezing and malnutrition. In essence, the opportunistic form of dysentery responsible for the “cholera” of the Northwest was also responsible for the numerous cases of “mountain fever” noted along the same portion of the trail, rather than Rocky Mountain Spotted Fever.

Early diary evidence linking mountain fever to dysentery appeared as early as 1844 in Jacob Hammer’s diary. After noting the dysentery experienced by members of his train due to the numerous buffalo carcasses along North Loup River in eastern Nebraska, he wrote “In camp today because John Murphy has the fever” (Rumer 1990, 84).
Eight years later, this association of carcasses to mountain fever and
dysentery was again made by Kerns in 1852 during his 213 mile trek from
Catherine Creek to Burnt Creek when members of his team experienced diarrhea
and fever, often together. On August 22nd, he noted “mountain fever” followed by
the another entry just four days later: “[August 26th] Saw some very sick persons
afflicted with mountain fever and flux. We saw one man taking his “last” moments
in preparing for a journey to his home above” (Kerns 1917, 179).

As James Akin’s team passed American Falls on Snake River on August
10th, 1852, Akin noted “Great numbers of dead cattle” two days after which his
mother became ill (Webber 1994, 46). Twelve days into this illness, James Akin
wrote: “mother taken worse in the morning and died about 9 o’clock in the
evening.” According to Webber, the researcher and publisher of this trail diary,
family records state Akin’s mother died of typhoid fever (ibid 48), a condition
often confused with scurvy and dysentery. Hints that typhoid could have also been
present along this portion of the trail were in fact penned by Rev. Thomas Stevens
in 1852 when he, his wife, and three children suffered “a severe attack of the camp
fever” (a term often used to infer typhoid fever), eventually causing the death of his
17 year old daughter (Henderson, Latourette and Latourette, 1916, 470). However,
this possible “typhoid” epidemic in Umatilla Valley either never continued or
resurfaced along this portion of the trail, for it was never referred to as such again
by Akin or other pioneers reviewed for this study.

A similar misidentification of mountain fever as a disease distinct from
dysentery was made by Jane Davies Kellogg. After passing through Snake, Grande
Ronde and Umatilla River valleys, Kellogg was taken ill along with her sister
following their stop in The Dalles (by then, a potential nidus for dysentery). This led her to write: "Sister Rachel and I were down with mountain fever, had taken sick coming down on the raft." Meanwhile, another woman on this raft, also taken ill by fever, had a young child who had just died due to this illness (Kellogg 1916, 94).

"Cholera" in Portland.

Final evidence for the spread of "cholera" in the form of dysentery-mountain fever from Wyoming to Portland, Oregon, is in the form of various recounts of the trail experience by pioneers immediately following their arrival. In late September, John Eldridge arrived in Oregon City from Illinois and claimed he witnessed about "one death a day at the Dalles," comments subsequently published in the newspaper Oregon Statesman on September 23, 1852 (Down 1926, 115). Two days later, the editor of Oregon Statesman received a copy of a newspaper listing the names of pioneers who suffered cholera deaths along the Oregon Trail, which he subsequently republished (Anonymous 1852), further heightening any local fear about the possible arrival of a more deadly form of "cholera" felt by the newly settled pioneers. Evidence for this local concern appears in a letter written one month later by Charles Stevens to "Brother Levi and Sister Emma Kelsey" dated "Portland, Oregon Territory 31 October 1852." As emigrants continued to arrive, they shared with others their "cholera" experiences, leading Stevens to write: "A great many died with the Cholera on the Snake from Salmon falls to this side of the river at Ft. Boyse, and with the diarhoea all the way to this place, and many of the emegrants (sic) have died since they have arived (sic)
here” (Lockwood 1936, 145-146). Two months later, in a second letter from Milwaukee dated 27 December 1852, Stevens added more to the story about the migration of "cholera" to Portland by way of the Oregon Trail: “[t]here has been some Cholera in Portland this fall. The late emigrants, or the poor people in Portland are about to starve, so we are told” (ibid 154).

Summary

An exact bacterial cause for the opportunistic dysentery epidemic along the Oregon Trail remains uncertain due to the lack of physical evidence. This Oregon Trail epidemic however appears to be directly linked to human exposure to bacteria residing on animal carcasses. Whereas some of the dysentery cases east of the Rocky Mountains could have been due to amoebic and shigellic dysentery, two diseases of tropical origin which might have tolerated Midwestern climate conditions, the limited population of the Pacific Northwest makes either of these causes for dysentery unlikely. The most likely cause for epidemics immediately west of the Great Plains is one or more species of Salmonella. Still further west into the Rocky Mountains and Pacific Northwest, a Campylobacter species could have been involved due to the inclusion of farm animals and contaminated food stuffs into this part of the epidemic history. As emigrants approached The Dalles, the development of Typhoid Fever was possible.

The recurring association of dysentery with “mountain fever” by pioneers during the final weeks of their migration is the primary support for the conclusion that most of the Oregon Trail dysentery epidemics were due to one or more species of Salmonella. Additional support for this theory comes from the mention of a
combined fever and toothache problem by McKinstry, a complaint found in other diaries as well (Mattes 1969, 83). Since numerous *Salmonella* species have fever as a primary affect and *Salmonella intermedia*, an animal-borne opportunistic bacterium, is known to cause toothaches (a condition noted by McKinstry), one or more *Salmonella* species are suspected to have caused these Trail epidemics. This behavior of *Salmonella* in relation to people and animals suggests that this problem was probably prevalent throughout Oregon Territory as well during its earliest stages of development.