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REVIEWS

Sex & Death on the Western Immigrant Trail: The Biology of Three American Tragedies

Donald K. Grayson,
Salt Lake City: University of Utah Press, 2018,
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In 2004, I participated in an excavation led by archaeologists Kelly Dixon and Julie Schablitsky of the Alder Creek site, the lesser known of the two sites associated with the infamous Donner Party. Although my mentor Christy Turner pioneered the taphonomy of cannibalism in the American Southwest, I only had a layman's knowledge of the Donner Party. To come up to speed on this incident, I bought and read most books devoted to this tale of hardship and cannibalism. This is a story that has been told many times by mostly historians and journalists. Researchers have approached the subject in a myriad of ways, but as one might imagine, there is a great deal of overlap. To set up the background, Grayson covers some "Donner Party" familiar ground that serves as a prelude to viewing three American tragedies from a different perspective—one provided by human biology and demography.

The book is broken down into seven chapters, with three chapters on the Donner Party and one each on the Willie and Martin Handcart Companies, sandwiched between an introduction and a concluding chapter on "Gendered Death." Many are familiar with the broad outlines of the Donner Party tragedy, given the number of books and television specials devoted to the subject. I would guess fewer are familiar with the handcart companies, even though they involved more deaths in absolute terms but lacked the titillating element of cannibalism. All three mid-nineteenth century tragedies involved desperation, deprivation, struggle, and death. Rather than providing an overview of each chapter, I outline what I perceive as the primary similarities and differences between the Donner Party and the two

handcart companies, in the context of how humans adapt to desperate circumstances.

Regarding similarities, the Donner Party and the handcart companies were both seeking the 'promised land,' albeit with different motivations. The Donner Party, whose members hailed from the Midwest, were seeking a new start in the moderate climate of California, while the goal of the handcart companies was to reach the newly established Mormon mecca of Salt Lake City. All three groups were tardy as they moved across the landscape, with movement halted or slowed by snow and bitterly cold temperatures. The Donners were late because they took a promised shortcut (Hasting's cutoff) that did not work out. Other handcart companies made it to Salt Lake in 1856, but the Willie and Martin companies were slowed by a lack of preparation in Iowa City that delayed departure until mid-July. The timing is significant given the potential weather risks in traversing South Pass in Wyoming in the fall. All three groups suffered from severe nutritional deprivation. All were drawn from lowland populations (sea level <1,000 ft.) in the Midwest U.S. and Europe. Finally, all the parties were saved by multiple relief efforts; without these, many more individuals would have died.

Beyond a handful of similarities between the Donner Party and the handcart companies, there are noteworthy differences. The core of the Donner party, numbering 87 individuals, was made up of well-to-do farmers relocating to California with their families. The demographic profile of the party closely paralleled the age-sex profile of Illinois in the 1840s. The handcart companies were comprised of less fortunate immigrants from Europe. To save money from their Perpetual Immigrating Fund, the Mormon Church decided wagons and draught animals were too expensive, so they provided handcarts that were propelled by human labor. These companies, which numbered 442 and 618 individuals respectively, were much larger than the Donner Party. The age-sex profiles of the handcart companies were unlike the general populations from which they were drawn, including more elderly and women in the 20–40 age range traveling without male partners.

The Donner Party was stopped in their tracks near the modern town of Truckee. Efforts to seek help (e.g., the

Forlorn Hope) were attempted on several occasions by a subset of the whole group, with more men than women involved in these efforts. The handcart companies, despite running into bad weather, icy rivers, and rough terrain, kept pushing on. They never set up a winter camp to wait until spring to move on to Salt Lake City. Food availability among members of the Donner Party was variable, dependent in part on family resources. For the handcart companies, food was strictly but equally rationed. Flour rations went from 1 lb./adult/day to 4 oz./adult/day, wholly insufficient for the heavy labor of pulling or pushing handcarts, but they were never completely out of food. In contrast to the Donner Party, the handcart companies never resorted to cannibalism.

Forty (46.0%) of the Donner party's 87 individuals died. In absolute terms, many more individuals in the handcart companies died (71/442, or 16.1% for the Willie Handcart Company and 113/618, or 18.3% for the Martin Handcart Company), but the proportion of deaths was less than half that of the Donner Party. The Donner party suffered nutritional and cold stress for several months (110 days) while the handcart companies were stressed for shorter periods of time (ca. 70 days from first to last death for the Willie Handcart party). Despite the cold, frostbite is rarely mentioned in association with the Donner Party. Given their continued march and prolonged exposure to bitterly cold temperatures, many individuals in the handcart companies suffered from frostbite, with some losing limbs in the process. The relief efforts to save the Donner Party were often driven by familial concerns (e.g., James Reed). Members of the handcart companies had no relatives in Salt Lake City, so relief efforts were driven by Brigham Young and the Mormon church, who were funding the relocation of these poverty-stricken converts from Europe.

The subtitle of Grayson's book is "the biology of three American tragedies." Human biology, or adaptability, revolves around the body's drive to maintain a steady state equilibrium (i.e., homeostasis) in response to environmental stress. The primary environmental stressors are climate, nutrition, disease, and altitude. Adaptation to stress is accomplished most quickly and efficiently through behavior. For cold stress, warm clothing, gloves, head gear, shelter, and fire are the primary behavioral adaptations. Clothing was seemingly adequate for the Donner party, but Grayson notes the

load limitations of the handcart companies often resulted in attire that was not suitable for the tasks at hand, contributing to both death and frostbite. Members of the Donner Party were fortunate to find a few cabins at the lake site which, despite crowding, were a life-saver. The Alder Creek contingent was less fortunate, surviving in makeshift lean-tos made of trees and hides. On the move day after day, the handcart companies only had temporary shelters at night in the form of tents; some found it difficult to pitch a tent after a hard day's labor. Cutting trees for fire was primarily a task for the young teamsters in the Donner groups, with their efforts contributing in no small part to their early deaths. In response to cold, if behavioral means are insufficient to restore homeostasis, physiological mechanisms are triggered (e.g., an elevated metabolic rate, shivering, piloerection [goosebumps], and extremity cooling to protect the core). When core temperatures fall below 35.0°C (95.0°F), the result is hypothermia. When extremity temperatures reach a point where the Lewis Hunting reflex breaks down, ice crystals form in subcutaneous tissues, resulting in frostbite. It is hard to gauge how hypothermia impacted mortality in any of the three groups, but it likely played a role, especially among the handcart members. For the Donners, frostbite played a minor role, but it had a significant impact on members of the handcart companies.

In response to chronic undernutrition (and ultimately starvation), the first physiological response is to burn energy stored in subcutaneous fat and glycogen in the liver. Once these reserves are depleted, the body starts consuming organs of low growth priority, including the musculo-skeletal system. The body's goal is to preserve the core and organs of high growth priority, including the heart, lungs, and the midbrain/hindbrain. Proteins are drawn from muscle mass to preserve these organs and minerals are drawn from bone to maintain homeostasis in molecules that require calcium, phosphorus, iron, zinc, etc. This is illustrated by one observer from the first relief party who noted that "[t]hey were gaunt with famine and I can never forget the horrible, ghastly sight they presented" (p. 53). For nutrition, all three groups relied on stored provisions. Finding food through hunting was difficult in the deep snows of the Sierras and the one bear shot by Eddy involves a story that has been repeated many times. While the Donners had provisions, these

eventually ran out. When their animals died, they were quickly buried in the snow. Probing snow to recover and consume these animals was the next response after food supplies failed and hunting proved largely fruitless. The final straw, of course, was when some (but not all) members of the Donner Party started to consume the flesh of their fallen comrades. In contrast to the Donner Party, the handcart companies never ran out of food, but flour rations eventually diminished to the point where caloric intake failed to match energy expenditures.

Grayson argues that survivorship is tied to fundamental aspects of human biology—age and sex—along with family ties. Males, for example, are 10–15% larger than females, while females have a higher body-mass index (a measure of fat relative to total weight). For the Donner Party, deaths that occurred between December 15 and January 30 were all of males. Except for one child and two men in their fifties, many of the individuals who died during this time were male teamsters in their 20s and 30s. Despite being young and fit, the demands of physical labor in procuring firewood took a toll, compounded by the absence of family support. By the time the first female died, fourteen males had perished. Thirty of the 40 individuals who died were male and 10 were female. This is tied, in part, to the fact that smaller females started out with more energy reserves and required fewer calories for maintenance. Grayson provides many tables and graphs to outline the age-sex profiles of mortality, but one striking observation is that between the ages of 10 and 40, 18 of 31 males (58.0%) but only two of 17 females perished (11.8%). Age also played a role, with the most vulnerable individuals being between 0–5 years and 50+ years. The lowest mortality rates were among children between five and 20 years of age. Survivorship in the handcart companies also shows a distinct difference in mortality rates between males and females. In the Willie Handcart Company, 27 of 116 males (23.2%) and 9 of 114 females (7.9%) perished. The Martin company closely mirrors these numbers, in that 75 of 279 males (26.9%) and 38 of 301 females (11.2%) died. In other words, males were two to three times more likely to die on the trail than females. Although the sex distinction in mortality is shared between the three immigrant groups, mortality relative to age differs. The handcart companies had larger contingents of individuals over 40 years of age, and percent mortality increases

dramatically from the fourth to the seventh decades. In contrast to the Donner Party, children between 0–5 years of age show the same mortality rates as other age groups up to the fourth decade.

Grayson does not consider the role of altitude and hypoxic stress, but this may have been a complicating factor for all three groups. The Donner Party came from the Midwest where the altitude of Springfield, Illinois is 558' and St. Louis at 466'. Many individuals involved in the handcart companies were from England where altitudes relative to sea level are typically under 500'. Both parties traversed the same areas at considerably higher altitudes (e.g., Laramie, 7,165', South Pass, 7,411', Fort Bridger, 6,673', Salt Lake City, 4,226'). Beyond Salt Lake City, the Donner Party reached Reno (4,506'), camped at Truckee (5,817'), and made it over Donner Pass (7,057'), before the survivors eventually went back down to almost sea level in Sacramento (30'). Given the physical demands of chopping wood or snowshoeing for the Donner Party and pulling poorly made handcarts by the Willie and Martin companies, hypoxic stress could have compounded the stresses of cold and undernutrition, a trifecta that exacerbated mortality.

I first met Don in 1970 at a pre-meeting seminar on human osteology at the Smithsonian Institution. We were both graduate students, and I assumed he was in physical anthropology since the seminar was associated with the annual meeting of the American Association of Physical Anthropologists. After the meeting, we parted company and finished our PhDs, followed by employment at the University of Washington (DKG) and University of Alaska Fairbanks (GRS). Only some time later did I catch on to the fact that Don was a zooarchaeologist, not a physical anthropologist. Moreover, over the next four decades, he became one of the world's leading zooarchaeologists. This volume illustrates his longstanding interest in human biology and adaptability, with a good dose of statistics, befitting the author of a leading text on quantitative methods in zooarchaeology. For those who like a good 'yarn' (Don is a great story-teller) and interesting interpretations that involve numbers, this is the book for you. We could never conduct experiments on the ability of humans to tolerate extreme stress, but the three examples in this book provide natural experiments and an insightful look into how adaptable humans can be under the direst of circumstances.