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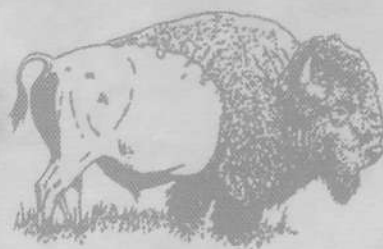
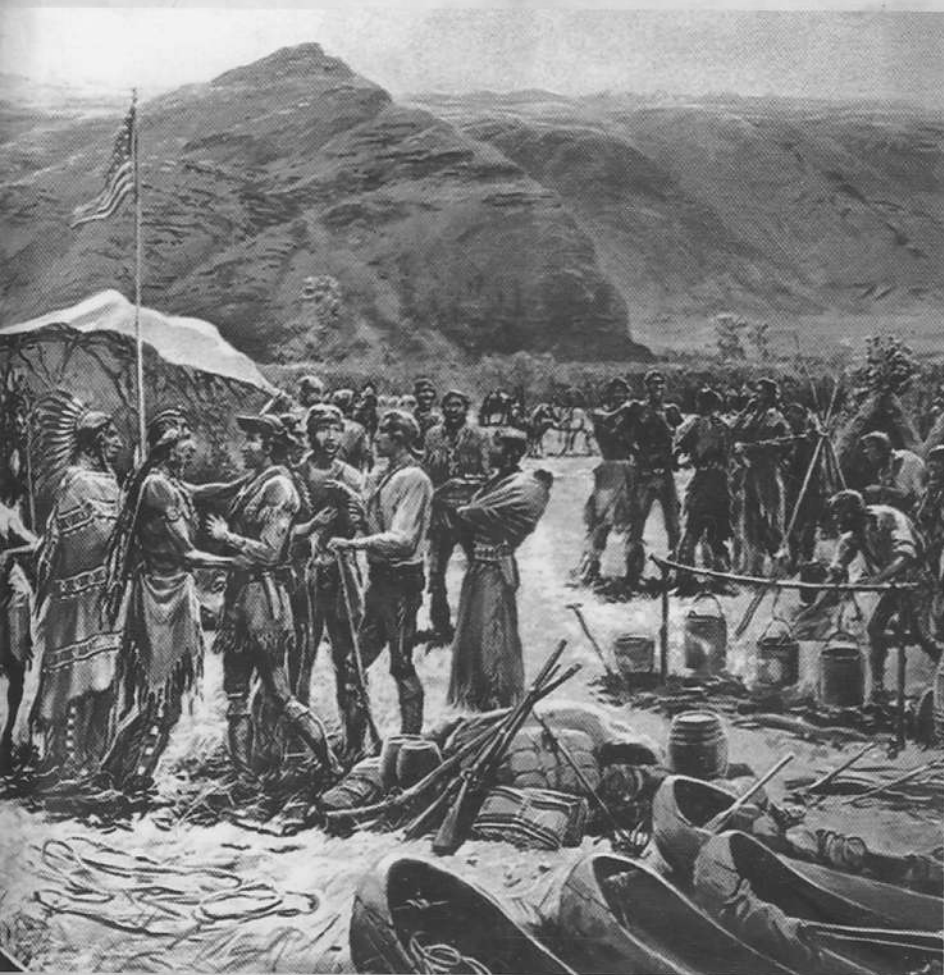
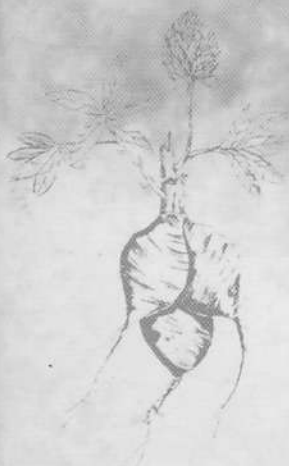


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Feasting and Fasting

WITH LEWIS & CLARK

A Food and Social History
of the Early 1800s



Leandra Zim Holland



R. L. Richards - courtesy: Richards Western Art

"Lining a canoe" is the process of raising or lowering a canoe through rapids with ropes – a very exhausting and dangerous process.

Nutrition in Extreme Environments

Under certain conditions, such as work performed in extreme environments, the physical demands of performing military duties approach, or may even exceed the physical demands of training that endurance athletes experience.

— UNITED STATES ARMY

FEEDING HUNGRY MEN IS REWARDED by seeing them continue, alive and well, to the next day, the next round of life.^a These basic needs are then pushed to their limits by extreme environments.

Three different climates and terrains are considered here as extreme: hot, cold, and high mountain elevations. Hot climates for the Corps include the muggy, humid areas along the Missouri and the hot, dry climes of the West. Freezing-cold occurs in the northern climatic zones and up in the mountains. Going to altitude is a stress because the Corps is going up and down mountains, and their bodies must make more serious adjustments than if, for instance, they were based in a mountainous region and had become adapted. In order to assess the Corps' nutritional needs in stress situations, a contemporary Army manual, *Nutritional Guidance for Military Operations in Temperate and Extreme Environments*, is compared for reference.^b

Heat

Heat is a factor that cannot be avoided. Clark writes on June 30, 1804, "rested three hours, the [sun or day?] being hot the men become very feeble." Again, "the men were very much overpowered with the heat."^{J2:338} The major solution to heat stress is to stop and rest, and have plenty to drink. Because they are on the water most of the time, this need rather nat-

urally takes care of itself. But not all the time. In August, 1805, Lewis, too, becomes dehydrated. He is "exposed to the intense heat of the sun without shade or scarcely a breath of air," as well as having taken a dose of purgatives and then walked eleven miles. No wonder he feels the need for water. It is a virulent combination, all bad. "We then hurried to the river and allayed our thirst."^{J5:26} Another time the men "were suffocated nearly with the intense heat of the midday sun" and in the expected desert thermal shifts they find, "the nights are so cold that two blankets are not more than sufficient covering."^{J5:30}

Heat and Nutrition

Heat increases the sweat rate. As the body literally drips precious fluid out from within, vital minerals and salts wash away. Working in exceptionally tough conditions, "maximum sweat rates can exceed the body's ability to absorb fluids. In hot environments, sweat rates of 1.5 quarts per hour or more are not unusual." Furthermore, the normal thirst mechanism doesn't kick in, and the body continues to deplete its supplies. And that isn't all – the appetite fails as well. "Soldiers typically reduce their food intake by as much as 40% during active operations." The manual continues, "military personnel living and working in temperatures ranging from 86° to 104°F (30° to 40°C) may require up to 10% more calories to do the same amount of work as they would under more temperate conditions." The body needs more but stalls out and takes in less.

The weather diaries alone show us that these conditions are continuing and even disabling at times, but the Corps

^a Fundamental food requirements are examined in detail in Appendix C: Food Requirements.

^b All quotations and data in this chapter come from this Army manual.

simply toughs it out. The Captains do their best to minimize the men's discomforts whenever possible, but of course they must proceed on.

Cold

The winter of 1805 and the trek over the Bitterroots are particularly vicious. In North Dakota, men's body parts freeze, and conditions in the mountains of Idaho and Montana are not much better. In between these two horrible spells of frozen wasteland are the mountain-fed streams and rivers. Capsizing in cold water in the midst of a terrible storm with rain and extreme wind chill or towing canoes up icy mountain streams are also body-rattling and require greater energy than simply being dry and paddling a canoe in cold weather.

The Canoe and White Water states that if you are well fed and happen to capsize in 48° to 56°F (10° to 15°C) water, you can survive for up to two hours. It goes on to note that "Hypothermia is particularly dangerous to white water canoeists in the early spring when the water is close to the temperature of melting snow."⁵⁰ Of course, this is exactly the time that the Corps' flotilla is on the water in all three years.

Winter arrives early, on September 16, 1805, and the Expedition awakens covered in two inches of snow. Clark must have been awake even earlier for he notes that it has been snowing for at least three hours before daybreak. Whitehouse writes that those without moccasins wrap their feet in rags, and the whole party continues "not having anything for to eat,"^{J11:318} through the endless ridges of snow-covered mountains. At noon, Clark calls a halt to feed the horses (at least) and "worm & dry our Selves a little ..." It is so horribly bad, the tough army man confides, "we are continually covered with Snow, I have been wet and as cold in every part as I ever was in my life, indeed I was at one time fearfull my feet would freeze ..." ^{J5:209} He no doubt remembers the bad day of January 9, 1804, when the ice broke as he started to cross a pond. "my feet, which were wet had frozed to my Shoes ... exceedingly Cold day." He probably also remembers he was "verry unwell" the next two days.

Whitehouse probably remembers the prior May 1 and being forced to sleep out on the shore of the Missouri River, where he and another man were "obleged to lay out all night without any blanket."^{J4:100n1} as Lewis reports. Whitehouse himself is a little more frank, "it being verry cold I Suffered verry much,"^{J11:142} all this a consequence of extremely strong winds preventing them from returning to camp. Flying, wind-driven spray may have left the two men in damp clothing, another disagreeable, dangerous factor. It was 36°F (2°C) after sunrise the next morning, and there is no way of

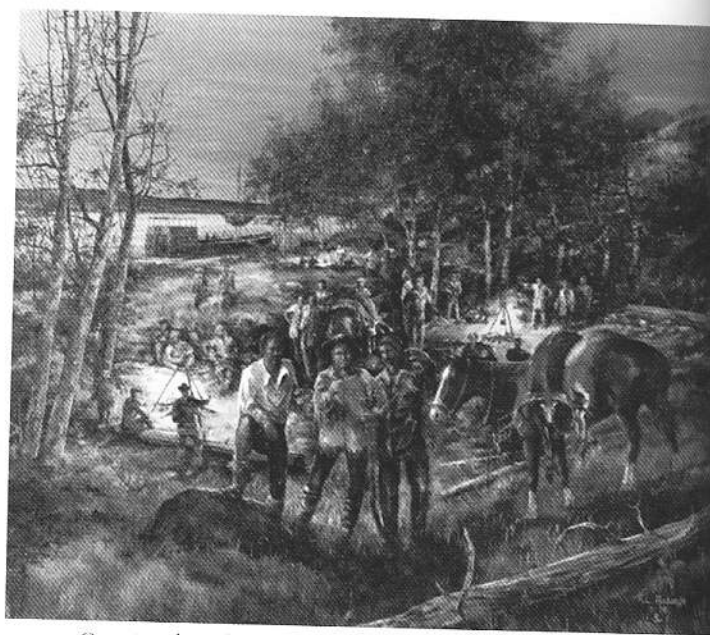
knowing how far the wind chill dropped the temperature during the night.

On June 17, 1806, during the first attempt at a return trip through Lolo Pass, Lewis pauses at 6,000 feet elevation and, totally deflated and discouraged, declares that "we found ourselves inveloped in snow from 12 to 15 feet deep ... my hands and feet were benumbed."

Arctic Nutrition, Preventing Hypothermia – "Food is an ally."

The greatest risk in extreme cold is freezing to death. Nature builds in one preventative – shivering – as a warning and a means of keeping the human engine humming along. Shivering helps keep the blood flowing and muscles warm. High caloric intake helps keep the body warm in the first place. Dense fatty foods that sustain energy and high carbohydrates for quick energy are needed. After shivering comes the dangerous condition of hypothermia, when the body can no longer manufacture enough heat to keep the engine turning, when normal mechanisms for fending off cold are overwhelmed in the face of severe and dangerous environmental conditions. The current Army guidelines stolidly state, "food is an ally often overlooked against the cold. Remember that food ultimately fuels the heat-generating shivering response. A lack of critical metabolic fuels limits shivering."⁵¹

What are the contemporary Army Guidelines? And how did the Corps do compared to them?



Camping along the Missouri. Eating together improves digestion.

Eat together. A time of sociability and relaxation increases food intake.

Eating with their regular mess buddies is something the Corps does. At Fort Mandan, mealtime was a pleasant time for all. In the Bitterroots they have no shelter, but they sit around their campfires trying to get the portable soup down. The mess units are probably even more critical at this point when gathering firewood requires more hands, and they need multiple fires for the more than thirty people wanting to huddle around for warmth.

Provide hot, palatable food. Hot food and hot beverages provide a warming sensation and taste better than cold provisions. This improves morale and satisfies appetites. Adequate rations at the garrison become inadequate when the troops are exposed to the cold, and men should increase their intake from 3200 Cal up to 4500–5000 Cal, while a woman's ration should go from 2400 to 3500 Cal.^c Sacagawea, probably still nursing, would have required far more than 3500. The Army's suggested caloric increase for cold is 25–50%.

This standard for human satisfaction, hot and palatable food, is something that comes and goes in the annals of the journey. Feasting and fasting. During the winter of 1803–04 there is plenty of food at Camp River Dubois. The next winter at the Mandan villages alternates between meat and no meat, but there is always an underlying security blanket of corn. By the time winter storms arrive in 1805–06, food is in short supply and sometimes is nonexistent. Would the privates count hot portable soup as palatable? No. Colt? Yes.

Eat regular meals, and hearty snacks at 2-hour intervals. Eat before going to sleep. Whenever possible the Corps eats regular meals, which seemingly are huge. Pemican or jerky are the snacks of choice. Fruit is picked if available, but this would only be when marching or paddling in the right season and in the right locale.

Consume no excess caffeine and avoid alcohol. The Captains are carrying fifty pounds of coffee, but the *Journals* don't mention its use. Clark views it as a treat rather than a daily habit. During the winters of 1803–04 and 1804–05 liquor is handed out regularly, part of the daily

ration and also as anti-freeze once an afflicted man makes it back to camp. By the Fourth of July, 1805, the liquor is gone.

Lower salt intake. Salt increases body's water requirements. If the Corps has salt, they salt their meat. Why would they do anything different? Nutritionists point out that salt, if not accompanied by adequate water, may lead to dehydration. The extra water is needed for the body to flush out excess salts.

At Altitude

Nothing has prepared the Corps for the vastness and height of the mountains and the sheer physical toll these towering obstacles take on the body. Red blood cells and the transport of oxygen to muscles and the brain become important, the Army advises, "Red blood cell count increases at altitude so that the blood can carry more oxygen." Proceeding to higher elevations successively diminishes the amount of oxygen available, and this can make for measurable short-term and long-term memory disruptions. Good thinking goes askew; there is a lack of clarity, a poor quality of rational thinking.

Cautions for Operations at Elevation

Weight Loss. Today's Army warns, "Almost all persons going to altitude lose weight. This weight loss is a combination of body fat and lean tissue, and at very high altitudes the weight loss is incapacitating. The loss of insulating fat decreases tolerance to cold temperatures. Accompanying the weight loss are fatigue, loss of strength, and psychological changes such as decreased mental alertness and morale. All these can contribute to accidents and failure to accomplish the mission."

Furthermore, the human energy requirement goes up by 15–50%. As the men wander in the wilderness and use up their provisions, their food supplies diminish by the day. A host of other food-related problems crop up. In an unusual paradox, as gross bodily activity increases the appetite decreases. According to environmental medicine research, "many mountaineers report an aversion to fat and a preference for carbohydrates." If this is the case, the men may have had trouble with Lewis' last-chance provisions: bear grease and tallow candles.

Low Carbohydrate Intake. Military nutritionists count low carbs as a dietary danger. Having their corn or flour provisions in the mountains might have saved the troops and their commanders from tumbling down the mountain like sticks in a bag of skin. The glucose from the carbohydrates does two things: 1) it replaces depleted

^c The unit Cal (capital "C") is used in this book in accordance with nutritional convention, and is equivalent to the more scientific unit 'kcal', or 1000 calories (the heat required to raise 1 kg of water 1°C). Everyday usage (on packages, etc.), confuses these units, specifying "calories" when what is actually meant is kcals. This book will only use "calorie" (lower case "c") when the generic meaning of "food energy" is intended; not as a measurement.

glycogen stores in the muscles and 2) prevents those muscles (protein) from being internally cannibalized for energy. Lastly, sugars are easier to digest than protein.

Low Blood Sugar. Related to the former problem is what may be the most relevant issue confronting the men as they struggle along: low blood sugar. Army nutritional orders follow this dictum: "A low carbohydrate diet can result in low blood sugar. Low blood sugar causes confusion, disorientation, and lack of coordination; these conditions can be extremely dangerous when combined with oxygen deficiency." What the starving men are eating is a diet devoid of carbohydrates – portable soup and horseflesh. The recommended balance is about 70% of the calories being carbohydrates. The Corps has none to speak of in the Bitterroots and must wait until they get to the other side of the Rockies before native roots come into their diet.

From Environmental to Physical Extremes

Such hugely disparate environments are serious factors as the Corps progresses, but the physical extremes to which the men are pushed cannot be underestimated. A list of their energy-burning, calorie-consuming activities would fill a whole page, single spaced. However, the major physical stresses, those endured over the entire trip are walking, weight-lifting and hauling, and canoeing.

Marching, Walking, Moving Along

Walking at 2 mph burns 160 Cal/hour. The Corps travels fast, and walkers cover a minimum of 15 and a maximum of 30 miles a day. Ten hours covers 20 miles and burns 1600 Cal. This is over and above the basal metabolism. Bear in mind that a good portion of the journey from St. Louis to the Pacific Coast and back is walked. The Corps has access to only a few horses during the winter spent with the Mandans. They hunt on foot, walk beside canoes when they can't paddle, walk from the Lemhi Shoshone territory to other side of the Rockies, and then hunt on foot all through the winter of 1805–06. The time spent on land is considerable, especially considering the daily work of setting up camp, chopping and hauling in firewood, and dragging in the hunters' kills.

Weight Lifting and Hauling

At least one of the Captains and one hunter are usually walking, carrying guns and then meat back to their camp or canoes. A forequarter of elk might weigh 40 pounds, a buffalo hump around 30–35 pounds. Transporting 600 or 800

pounds of meat or finished jerky is not inconsequential. During all of the portages until they are in the Rockies, the Expedition is carrying, pushing or pulling a huge weight (tons, in fact). A dugout weighs about 500 pounds for a small, thin 27-foot canoe to 1000 pounds for a longer, thicker version.

Extreme lifting burns about 400 Cal per hour. The portages often take a full day, several days, or in the case of the portage at Great Falls, almost two weeks, working all day. When portaging, the men are probably lifting and carrying for a minimum of 8 hours, for an approximate caloric burn of 3200 Cal, plus 10% specific dynamic action to process the food, plus 1700 Cal basal metabolism, which equals a daily total of 5220 Cal.

Canoeing and Boating

Analysis showed that the members of the Corps needed about 5115 Cal/day to meet their strenuous activities. And, "les voyageurs," the Expedition's engagés, are not accustomed to being hungry and out of fuel. Very early in the Expedition, "the French higherlins Complain for the want of Provisions, Saying they are accustomed to eat 5 & 6 times a day ..." ^{12:306} These boatmen are nutritionally correct: the Army currently advises that best results come if you can "maximize glycogen replenishment by consuming carbohydrates withing 30 minutes of completing intense activity.



Foul weather on the Columbia north shore near the Pacific. Energy needs are pushed to the extreme by both temperature and fatigue.

They can also enhance recovery by eating small carbohydrate snacks while working."⁵² The commanders are not privy to this twenty-first century wisdom but they always try to have plenty of jerky on hand. The protein does not, however, provide instant energy like the carbohydrates will. Perhaps the native population intuitively knew this, adding berries to the road-worthy pemmican.

Energy Aspects of Boating

Moving the boats themselves is the major work of the privates, and it is useful to get some sort of grasp on sizes and tonnages carried (in addition to the weight of the men). The first flotilla consists of:

Keelboat	12 tons of cargo	27 men plus the Captains and York
Red Pirogue	9 tons of cargo	8 voyageurs
White Pirogue	8 tons of cargo	6 escort soldiers

Rowing or poling upriver, against the prevailing current, and fighting for control of overloaded rowboats occupies the party as they begin the voyage up the Missouri to the Mandan villages. At other points they are hauling the vessels upstream on rope tow lines.

Preparing to depart from Fort Mandan in the spring of 1805, the Pacific-bound crew hollows out six dugout canoes. Over the entire trip, they will make fifteen of these cumbersome but useful vessels. An early description of the Iroquois dugouts, made by roughly the same techniques as the Corps used, described them as "miserable vessels, little more than logs of pine rudely hollowed out and pointed at bow and stern. So heavy were they, so easily water-logged, and so ill-adapted for portaging ..." Manhandling these quarter-to-half-ton crafts requires a considerable amount of energy, since they lack the trim finesse of the birchbark canoes of the East or the native canoes found at the Great Rapids of the Columbia where the "Indians who arrived last evening took their Canoes on their Shoulders and Carried them below the Great Shute ..." ^{15:369} Furthermore, this doesn't consider the efforts put into subsequent bailings and ultimately the weight-lifting involved in unloading sodden goods to dry.

Yet it is not totally the size or nature of the canoe that dictates calorie expenditure. The simple size of the paddle also decrees the amount of energy plowed into paddling a canoe. Short and narrow – 4-foot long by 4-inch wide – paddles are

extremely efficient in maneuvering the canoe with as little resistance as possible. The shorter length makes the paddle lighter, and requires less energy to get from the forward pull stroke to the beginning of the next stroke.^d Along with this, the voyageurs would paddle a relatively quick cadence, avoiding the "speed up and slow down created by the slow cadence of a large paddle, which would have been extremely wasteful of energy."⁵³

Nutritional Intake Under Stressful Conditions

The French-Canadian voyageurs used small narrow paddles and paddled like crazy, very very fast, about one stroke per second. There is no journalistic evidence about the Expedition's paddling rate, but Paul Kane, a traveling artist, noted that when a rest-stop appeared, the emaciated canoeists "did little but eat and sleep. The rapidity with which they changed their appearance was astonishing. Some of them became so much improved in looks, that it was with difficulty we could recognize our voyageurs."⁵⁴ In other words, this isn't easy work or even hard work; it's "bloody hard." While the Corps didn't canoe frenetically all the time, they did spend a lot of time in the cold mountain waters of the northern rivers, towing the boats or pirogues. All of these activities are a quick means to dissipate energy, burn calories, and build up a big appetite.

If the emaciated French did nothing but eat and sleep and changed appearances so drastically in three days, weren't they eating an awe-full amount? This would tend to support the idea of gorging, of ingesting huge quantities of food when it was available. The Captains find this same tendency to eat as much as possible among their own men. On July 31, 1805, (near Three Forks, Montana) game is becoming scarce. Lewis, with some aggravation, writes, "*nothing killed today and our fresh meat is out when we have a plenty of fresh meat I find it impossible to make the men take any care of it, or use it with the least frugality.*" With a shrug of the shoulders, he finishes, "*tho' I expect that necessity will shortly teach them this art.*" The body looks out for itself, and dictates: eat when you can, for you never know when your next meal will arrive.

^d Today's paddles generally are 5 feet long or "up to your nose."