EPISODE 106: SCIENCE IN THE AGE OF DISCOVERY

Peter Coyote: Welcome to “Unfinished Journey: The Lewis and Clark Expedition” from PRI, Public Radio International. I’m Peter Coyote. In this hour, the scientific mission of the expedition.

Dayton Duncan: Jefferson was seeking to learn, to know, to discover. That is what is at the core of his being and the Lewis and Clark expedition is just one expression of that.

Peter Coyote: Join me as we find out how the Age of Enlightenment influenced the roots of America’s scientific establishment, after the day’s news.

Allison Frost: Hello and welcome to this edition of the Latest Tidings, produced in cooperation with the National Intelligencer. In 1805, celebrating five years as America’s Newspaper. I’m Allison Frost.

Last year, President Thomas Jefferson sent Captains Meriwether Lewis and William Clark on a perilous journey to explore the vast territory of the Louisiana Purchase. The Latest Tidings has learned of an unusual shipment he just received from the explorers. We are told it contains scores of specimens from the outer reaches of the heretofore undiscovered land: minerals, plants, skins and skeletons, and even two live animals that have not been seen in the United States.

President Jefferson was at his home in Monticello when he was informed of the arrival of the packages, including the animals, by the head butler at the Presidential mansion, Etienne Lemaire, who hails from France.

Etienne Lemaire: Incroyable, incroyable!

Allison Frost: We convinced Mr. Lemaire to take a short respite from planning his next culinary feast to speak with us about the package he received.

Etienne Lemaire: Package! Not just one package. So many boxes, four boxes, and in addition, a large—how do you say, round and tall—a barrel. And yes, animals in cages, not all of them smelling so well since they were indeed quite dead. (But of course, not fit to eat certainly.)

Allison Frost: But, Mr. Lemaire, there were two animals that survived, correct?
Etienne Lemaire: Oh, oui, oui, oui.

Allison Frost: A bird of some kind, and a barking squirrel?

Etienne Lemaire: Oui. (sighs) The bird looks like a common European magpie, nothing that seems to me to warrant sending a great distance in a cage, but that is not for me to say. As for the squirrel, yes, it barks. It is dirty. Some of the servants have called it “cute” but this is not my description.

Allison Frost: I understand President Jefferson learned of this shipment from Captains Meriwether Lewis and William Clark from you?

Etienne Lemaire: Oui. I wrote him immediately that we had these things waiting for him. And then because I did not know what to do with all of these, most particularly the alive animals, I told him that I would put them where the President receives guests.

Allison Frost: What was President Jefferson's reaction to news of the package? The Latest Tidings has heard that since the explorers left St. Louis in May last year, he has not had any word from them.

Etienne Lemaire: I would not know about that business. I am a butler and keep the Presidential mansion. I only know the letter he sent to me was very precise and I think I can say that he cares very much about these things. And he said that I must handle the “specimens”, as he called them, with an extreme care. And if they should die, I should be certain that their skeletons be preserved. Monsieur was very happy to examine all of the items, including the animals when he arrived. I think he was more eager to talk to that barking squirrel and the magpie than he was in fact to me.

Allison Frost: Before you go, Mr. Lemaire, I must ask—the meals at the Presidential mansion are said to be the best to be had anywhere in the country. What is your secret?

Etienne Lemaire: (chuckles) No secret, ma cher. It is the wine, of course. It is not just for drinking. It also brings out the flavor in meat. The French have not kept this a secret, but your people, your cooks, may have been un peu slow to catch on.

Allison Frost: That was Etienne Lemaire, President Thomas Jefferson’s head butler at the Presidential mansion. He spoke with us about the President’s first package from the explorers Meriwether Lewis and William Clark. The party set out more than a year ago from St. Louis to chart the Louisiana Purchase. And finally we have news that France and her ally Spain have suffered a stunning defeat by the British at Cape Trafalgar. Colin Fogarty has our report.

Colin Fogarty: Napoleon’s ships outnumbered the Royal Navy by six, but were no match for the forces under the command of British Admiral Lord Nelson. The French lost eighteen ships; Spain fifteen. Britain lost not a one of her twenty-seven vessels.

The French have been suffering from a blockade by the Royal Navy, which has significantly impeded its ability to conduct trade. This defeat is a crushing blow to Napoleon who had successfully evaded the blockade on a few occasions.

The battle of Cape Trafalgar is being hailed by Britain as a decisive victory in the war with France that broke out two years ago. I’m Colin Fogarty.
Allison Frost: And that report provides a decisive conclusion to this edition of the Latest Tidings. I'm Allison Frost. Our program is produced in cooperation with the National Intelligencer, celebrating five years as America's Newspaper, since 1800.

[Theme Music under]

Peter Coyote: Today, we take up a discussion of science on the Lewis and Clark Expedition. Lewis was primarily an explorer, not a scientist, right?

Clay Jenkinson: Actually, he was well trained in science of his day. To understand what it meant to be a scientist in the Age of the Enlightenment, you need to enter the world of Thomas Jefferson.

Peter Coyote: The Lewis and Clark Expedition left St. Charles, Missouri on May 14, 1804 and traveled 7,689 miles to the Pacific Ocean and back again. The trip took more than 28 months. The expedition was President Jefferson's brainchild, commanded by his friend and protégé Meriwether Lewis and his old Army friend, William Clark. It is considered the most successful exploration in American history.

Joining me in the studio is Clay Jenkinson, our guide to this story and humanities scholar-in-residence at Lewis & Clark College in Portland, Oregon. Clay, a moment ago, you said we had to enter the world of Thomas Jefferson. What did you mean by that?

Clay Jenkinson: Well, I mean just that. Let's attend a famous dinner party that Thomas Jefferson hosted for John Adams and Alexander Hamilton in New York City in 1790. We know about the party from a letter Jefferson wrote to Benjamin Rush in 1811.

[Sound of dinner party]

Clay Jenkinson: (in low voice) That man over there is Alexander Hamilton, a favorite of President Washington. He's the Secretary of the Treasury, and an impassioned Federalist. And over there is the host, Thomas Jefferson. He is not yet the President of the United States. Hamilton is looking up at the wall and noticing portraits.

Alexander Hamilton: Mr. Jefferson, who are the three men whose portraits hang before us?

Thomas Jefferson: My trinity of the three greatest men the world has ever produced: Newton, Bacon and Locke.

Alexander Hamilton: The greatest man that ever lived was Julius Caesar! [laughter, conversation fades]

Peter Coyote: Sir Isaac Newton, the mathematician who developed the fundamental theory of gravity; Francis Bacon, proponent of the scientific method and deductive reasoning; and John Locke, the empiricist philosopher and political scientist. Not a bad list.

Clay Jenkinson: Yes, notice that Thomas Jefferson's heroes are all intellectual giants. They are exemplars of what we call the Enlightenment, a new age of science, good sense, justice, philanthropy and reformist thinking in all areas of life. The Lewis and Clark Expedition can't be understood without understanding Thomas Jefferson and the Enlightenment. Let's turn to some of our own enlightened experts for insight into this: Dayton Duncan is one of the producers of the Ken Burns documentary on Lewis and Clark and a leading expert on the subject; Stephen Dow
Beckham is a professor of history at Lewis & Clark College; and James Ronda, the noted Lewis and Clark historian at the University of Tulsa.

Dayton Duncan: They were men of the Enlightenment. They believed in progress. They believed that the march of history was a march of enlightenment, that things were going to get better because of greater knowledge, because of technology.

Stephen Dow Beckham: In many respects, I think the Enlightenment both in England and France shaped the climate of opinion that surrounded the Lewis and Clark Expedition. In particular, there was a fascinating comment of Francis Bacon in his book Novum Organum, published in 1620, wherein Bacon observed: “I found that I was fitted for nothing so well as the study of truth, as having a mind nimble and versatile enough to catch the resemblance of things and at the same steady enough to fix and distinguish their subtler differences.” Bacon championed observation and, of course, out of that eventually comes the quest for experimental observation, the development of a scientific method: the positing of a hypothesis, the gathering of evidence, the testing of things and then ultimately the drawing of conclusions, and then sharing that information with the candid world.

James Ronda: I think the Enlightenment discovered the power of the printed page and what the printed page could do to profoundly alter human experience and that it could change the course, the destiny of nations and empires, that there was a power of print. Lewis and Clark explore a world of print. They venture into an ocean of ink. This is a journey that is sparked by a book, shaped by books, and then it’s a journey that produces books.

Peter Coyote: How did Lewis and Clark measure up to this rising standard of knowledge? Were they up to the task of gathering the kind of information Jefferson wanted?

Clay Jenkinson: Given the constraints of their time, they did very well indeed. It’s important to remember that there were no professional scientists in the age of Thomas Jefferson. This was still a period of gentlemen amateurs, of gentlemen who dabbled on the side in meteorology or paleontology or library classification or the study of rare plants and animals. Jefferson himself was an exemplar of that sort of amateur love of science. He later said that Meriwether Lewis was “not regularly educated,” by which he meant that Lewis didn’t have any formal training in the hard sciences and yet Jefferson said that Lewis had keen powers of observation of nature.

John Logan Allen: If you view Lewis and Clark in the science of their time, as Enlightenment scientists whose job it is to go out and catalog and to come back with descriptions of what they had seen, what they had gathered, what they had collected, what they had observed, they did a truly remarkable job.

James Ronda: Jefferson was so intent as were expedition planners like Sir Joseph Banks that there be a written record, not just one written record but in multiple copies, and that there would be multiple journal keepers as well, not necessarily to get different perspectives—that’s a kind of modern notion—but rather to make sure that the records survive.

Peter Coyote: Geographer John Logan Allen at the University of Wyoming and historian James Ronda. Jefferson prepared his protégé Lewis for the scientific role he would play on the journey by sending him to Philadelphia for training. University of Tulsa history professor Andrew Burstein explains why that was the best place for Lewis’s intensive scientific apprenticeship.
Andrew Burstein: Jefferson had connections to the brightest minds of that generation. So he would have his grandson, as well as Meriwether Lewis, study in Philadelphia with the professor of anatomy, the professor of botany at the University of Pennsylvania, which was the center for scientific, philosophical, medical investigation in early America.

Peter Coyote: Martin Levitt is the librarian at the American Philosophical Society in Philadelphia and a professor of history at Temple University. The APS was founded by Benjamin Franklin to rival Britain’s Royal Society as a center of scientific inquiry. Levitt says Meriwether Lewis directly benefited from the concentration of intellectual resources in Philadelphia, which was then known as “the Athens of the west.”

Martin Levitt: In Philadelphia, Lewis met with people like Robert Patterson who was a mathematician at Penn. He met with Benjamin Rush who was the premier physician of the era. Rush gave advice about medicine and about general health. Lewis also met with Benjamin Smith Barton who was the premier botanist of his day, wrote the first American textbook on American botany. Jefferson knew that by going to Philadelphia, Lewis could find this critical mass of knowledge and sort of take a crash course in everything that Jefferson held dear to his heart—navigation, astronomy, meteorology, ethnology, mapmaking.

Clay Jenkinson: When you read through all of the journals you can see how deeply Lewis was committed to the lessons that he learned from those Philadelphia intellectuals and how seriously he took his mission of describing scientifically everything around him on the trail. Towards the end of the expedition, Lewis was accidentally shot in the buttocks by one of his own men and he was clearly in a great deal of pain. But in spite of that injury, in the last journal entry that he would ever write, he maintained his scientific observation.

As wrighting in my present situation is extreemly painfull to me I shall desist untill I recover and leave to my frind captain C. the continuation of our journal. However, I must notice a singular cherry which is found on the Missouri in the bottom lands about the beaverbends and some little distance below the white earth river. This production is not very abundant even in the small tract of country to which it seems to be confined... the stem is compound erect and subdivided or branching without any regular order.

Meriwether Lewis, August 12, 1806

Peter Coyote: So, what did the world look like from a scientific point of view in 1804? We asked University of Wyoming geographer John Logan Allen to give us a picture of the world as Jefferson knew it.

John Logan Allen: Geology was a science really in its infancy at that point. The great English geologists hadn’t really begun to publish until the 1780’s. There is really not much of a science of mineralogy that either one of them could have had access to. Nobody really understood what caused precipitation. There was no way that either Clark or Lewis could assess why the Pacific Northwest was so abundant in vegetation and so wet whereas the interior was so dry. They made commentary and they did really pretty adequate descriptions of animals, but there was no taxonomic classification. They had to make that up as they went along.

Peter Coyote: Two hundred years of scientific progress have made a big difference! OK, Clay, if Jefferson was alive today, which great scientists’ portraits (or photographs) would he have hanging on his wall?

Clay Jenkinson: He might very well keep Newton, Bacon and Locke. They hold up pretty well over time. In fact, they’re still part of our scientific pantheon. But nowadays it’s impossible to imagine modern science without, say, Albert Einstein’s theory of relativity or Freud’s insights into the workings of the mind and the power of the
unconscious; without Watson and Crick’s cracking of the DNA code. If you believe that the gentleman amateur or the generalist is the acme of science, Jefferson would have liked someone like Carl Sagan. He might have been fascinated by the quantum theorist Niels Bohr and Robert Oppenheimer, but he would have been troubled by the uncertainty principle and the idea of a probabilistic universe. John Kennedy once said that when he was hosting Nobel prize laureates at the White House that it was the largest collection of talent and brain power that had ever been in the White House except when Thomas Jefferson dined alone. Jefferson didn’t dine alone much and he probably today would still want to surround himself with artists and intellectuals, and particularly men and women of science.

Peter Coyote: Now let’s test your knowledge of the Lewis and Clark Expedition. One of the plants Meriwether Lewis brought back with him was named in his honor—the Lewisia rediviva. Can you provide its common name? And for extra credit, name the state that made it an official flower. Coming up next, measuring the ability of these explorers to put themselves on the map.

Stephen Tufte: In the end, the latitude coordinates they got for their trek across the country were not very accurate, typically off by 30 miles. And they rarely got useful longitudes at all.

Peter Coyote: I’m Peter Coyote. You’re listening to “Unfinished Journey” on PRI.

[Program Break: Aaron Meyer/Bill Lamb-Unfinished Journey: The Lewis and Clark Expedition Soundtrack (Hamp Old)]

Beginning at the mouth of the Missouri, you will take careful observations of latitude and longitude at all remarkable points on the river and especially at the mouths of rivers, at rapids, at islands and other places and objects distinguished by such natural marks and characters of a durable kind as that they may with certainty be recognized hereafter.

[Thomas Jefferson]

Peter Coyote: President Thomas Jefferson’s instructions to Meriwether Lewis. Dayton Duncan, University of Montana history professor Harry Fritz, and James Ronda help us understand why Jefferson was so pointed in his direction to Lewis.

Dayton Duncan: Jefferson was seeking to learn, to know, to discover. That is what is at the core of his being and the Lewis and Clark Expedition is just one expression of that.

Harry Fritz: Jefferson wanted Meriwether Lewis and William Clark to find out all that they could about the natural history of the region—its biology, its zoology, its ethnology, all of the Indian tribes. And I think the expedition fulfilled his expectations in that regard more than he could possibly have imagined.

James Ronda: In the last few years, there’s been an effort to “scientize” the expedition, to say that Lewis and Clark were scientists and to say they were representatives of a kind of benign objective Enlightenment experiment to go into the West and just to look around and to describe the face of the country and then come back and tell this Enlightenment president about it. That completely misunderstands the nature of natural history, of science and of the Enlightenment.... Sir Joseph Banks, who in so many ways exemplified and embodied Enlightenment exploration, Bank was very clear that knowledge was to be gained in the service of empire, that there was useful knowledge to be gained but knowledge was always there as the handmaiden, the servant of empire.
Peter Coyote: Jefferson’s letter of instruction to Lewis made it clear that mapping and taking observations about where the expedition traveled was a critical part of the mission.

Clay Jenkinson: It’s not the most glamorous, but it was amongst the most time consuming of all of their scientific tasks.

*Observed meridian altitude of [Sun, upper limb] with sextant by the direct observation 55 degrees 59' 15"... latitude deduced from this observation N 46 degrees 10' 16.3" by the mean of several observations found the error of the sextant to be subtractive – degrees 5' 45"
Meriwether Lewis, February 4, 1806*

Peter Coyote: Lewis and Clark brought along the latest technology available to map their route. One of the nation’s leading experts on physical aspects of the expedition is Ken Karsmizki. He’s the executive director of the Columbia Gorge Discovery Center in The Dalles, Oregon. He describes the surveying kit Lewis and Clark carried.

Ken Karsmizki: You’ve got a sextant, an octant. You do have a tripod, so that’s going to be a little bit bulkier. You have a two-pole chain. You have essentially a tape measure, but the instruments themselves are pretty compact and a small trunk would carry all of that.

Clay Jenkinson: It was highly sophisticated equipment for their time, quite primitive by our standards. The chronometer of the expedition cost 250 dollars, fully a tenth of the expedition’s budget. It was the most expensive single piece of equipment that they carried and it was critical for taking geographic readings. Unfortunately, it didn’t work as well as an inexpensive ten or 15-dollar watch that you might buy anywhere in America today.

Peter Coyote: And what else did they bring to help them complete their scientific mission?

Clay Jenkinson: Thanks in large part to Thomas Jefferson, they were carrying with them a small reference library of between ten and 20 volumes. These were not works of imaginative literature. They were designed to help them do preliminary field investigation on the trail. One of the nation’s leading experts on this subject is Stephen Dow Beckham. I asked him what sorts of books Lewis and Clark were carrying.

Stephen Dow Beckham: They carried works of botany, those of Linnaeus and Barton. They carried scientific tables, the Tables Requisite of Neville Maskelyne, the Astronomer Royal at Greenwich, as well as a work on optics by Patrick Kelly. They had in their library travel narratives with the latest foldout maps: du Pratz’s History of Louisiana that had been written in the 1750’s, Alexander McKenzie’s Voyages from Montreal. Of particular fascination to me was the eight-volume encyclopedia or dictionary—bound in four volumes—produced by William Owen in London in the 1750’s. In these eight volumes, bound in four, were more than 2,000 pages of alphabetical entries with illustrations of all sorts of information.

Peter Coyote: Exploration fed Enlightenment science’s hunger for new things to observe and categorize, measure and map. But even with all of these tools and resources, Lewis and Clark were still limited in what they could achieve, weren’t they?

Clay Jenkinson: Their procedures were state-of-the-art for their time, but that still left some holes. Take Jefferson’s seemingly simple instruction to measure longitude, for example. That was still a highly complex calculation at the
time of the expedition. Dava Sobel, author of the book Longitude explains how difficult it was for Lewis and Clark to tell just where they were.

Dava Sobel: There was a meridian at Greenwich because there was a great observatory there. And that observatory was founded to solve the longitude problem. That was its only reason for existence, to make a map of the stars so that there could be an understanding of the background grid for the motion of the moon. And almanacs and tables could be drawn up that could be given to mariners to take with them all around the world that would help them know the time of certain celestial conjunctions as they occurred over Greenwich. And if you watch that same thing from the Pacific Ocean and measured your local time, and you could compare that with the time it happened at Greenwich, then you could figure out your longitude from the number of hours distant you were from Greenwich because every hour’s distance is 15 degrees of longitude. So when Lewis and Clark set out, they actually took with them the British nautical almanac, and they had three years worth of predictions....They had a real clock, which they could have used to set to the Greenwich meridian and then determined their local time by the height of the sun, but they didn’t do that.

Clay Jenkinson: They didn’t ever do it?

Dava Sobel: No. They wound up using the clock just to time intervals between observations.

Clay Jenkinson: So why didn’t Jefferson and Lewis set that clock to GMT?

Dava Sobel: I don’t know. By the time Lewis and Clark left, they had decided that they would not try to establish longitude in the field, that they would take all the necessary observations and when they got back they would turn this information over to a mathematician who would figure it out and be able to assign precise longitude to each of the places where they had taken observations. But it never happened.

Clay Jenkinson: But if this is Jefferson's prime directive, then in some sense, from the perspective of your work, one would almost have to say the expedition failed.

Dava Sobel: They failed, yes. The ultimate map was based on dead reckoning, which is what the old sailors used to do, and on the very careful Indian maps they were given on the way, which certainly had the right distances between landmarks but not according to a grid of latitude and longitude.

\[
\text{To Point Adams is west} \\
\text{To Point Disappointment north 75 degrees west} \\
\text{To prevent our men getting lost and find a place to make salt steered south 62 degrees west. At two miles, past the head of a brook [fades]} \\
[William Clark, December 7-8, 1805]
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Peter Coyote: So, Clay, what was the great scientific achievement of the journey?

Clay Jenkinson: Well, a number of their achievements might qualify, but scholars like John Logan Allen and Martin Levitt agree on the highlights of their work.
John Logan Allen: If you look at the results of the expedition in scientific terms, the two things that stand out beyond all others are the plant collections that Lewis gathered and returned with that got scattered and are now more or less all back together in one place, and Clark’s maps.

Martin Levitt: One of the greatest results of the journey of Lewis and Clark was the publication in 1814 of a map of the West that Clark had drawn up. To this day it’s considered perhaps the greatest achievement of the Lewis and Clark Expedition. This map is unbelievably detailed. And it was done with 19th century surveying tools they would have taken with them.

Peter Coyote: What would Lewis & Clark have thought about modern technology that could have told them in an instant where they were? We located Stephen Tufte, assistant professor of physics at Lewis & Clark College, and asked him to answer that question.

Stephen Tufte: What were they thinking? When Lewis and Clark made their difficult journey into terra incognita, they really should have brought along a hand-held Global Positioning System unit, or GPS.
Consider what Lewis and Clark had to go through to determine their latitude and longitude coordinates as they crossed the continent sans GPS. Before they left, they had to receive extensive training in celestial navigation by the world’s experts. They had to purchase and bring many bulky, delicate, and expensive instruments. In the field and under harsh conditions, they had to spend valuable time making many painstaking celestial observations. They had to carry multiple volumes of tables and formulae and apply complex calculations to their observations.
In the end, the latitude coordinates they got for their trek across the country were not very accurate, typically off by 30 miles. And in the end, they rarely got useful longitudes at all!
Their mapping efforts would have been much simpler and easier, and their results far more accurate if they had simply brought along a GPS unit. These devices are about the size of a calculator and at the press of the “set waypoint” button, will tell you your precise location within meters. They do this by communicating via radio waves with a constellation of 24 special-purpose satellites in orbit around the Earth.
Thanks to Captain Vancouver, the coordinates of Lewis and Clark’s destination were known and they could have used the feature of the GPS unit that displays a little arrow to identify the correct direction of travel and the number of miles left to go. The instructions from Thomas Jefferson really could have been a lot less wordy: “Go forth and push the ‘set waypoint’ button at all remarkable points,” he could have said.
“Oh, what the heck, just turn on the ‘track course’ feature.”
People associate the word ‘exploration’ with history and characters like Magellan, Captain Cook and Lewis and Clark. But we continue to explore uncharted territories today as we look out into the depths of outer space.
To get an idea of how technology has influenced exploration, consider modern astronomy. I am on the living room couch and having some tea while operating a telescope that sits on a remote mountaintop using my laptop computer. Light from an exploding star that left before the dinosaurs lived passes through my telescope, strikes my electronic camera, and appears as an image on my computer screen. In the safety and warmth of my home, with the Goldberg Variations playing quietly, I should feel guilty calling myself an explorer under such luxurious conditions! Where is the romance of it? Shouldn’t I be hungry and shivering, scratching mosquito bites and struggling to keep my tent up in the wind? But despite the fact that these interstellar realms are revealed to my imagination after having filtered though many layers of abstraction, they are nonetheless beautiful. Our galaxy is filled with the most unlikely things, often wild to the point of bombastic, fantastically remote and of unimaginable sizes. These modern astronomical discoveries are every bit as new and real, thrilling and strange as what Lewis and Clark experienced 200 years ago. Perhaps in 200 more years, GPS will stand for Galactic Positioning System.

[Star Trek opening theme plays]
Marilyn Hudson: In the age of Lewis and Clark, there probably was not a whole lot of science, the process of testing and evidence and so forth. A lot of it was just simple reliance on nature.

Peter Coyote: Marilyn Hudson is a Mandan who notes that Lewis and Clark’s scientific mission was occurring among people who already had a track record of using applied science to improve their lives. Here’s one example of that.

Marilyn Hudson: Mandan people in particular had taken corn and through a process of whether it was happenstance or scientific experimentation had adapted that corn into at least 12 varieties of corn, each having a different purpose.

Clay Jenkinson: That’s an excellent example of the holistic approach Indians take to science. Macalester College anthropology professor Jack Weatherford, author of Indian Givers, provides this perspective on what role “science” played in the lives of America’s indigenous peoples.

Jack Weatherford: In the native world in the 1800’s, it would be impossible to separate out science from spirituality from production and from daily life. Science would be a way of understanding the world as it’s involved with the spiritual world and is involved with all the daily activities.

Peter Coyote: After a break, we’ll find out more about relationship between the science of the Indian tribes of the West, and the fate of plants and animals Lewis and Clark observed on the expedition, among them, the California condor.

Tony Vecchio: They named it ‘The Beautiful Buzzard of the Columbia,’ because its beautiful head isn’t covered in feathers. You can see the red and orange and yellow color of the head.

Peter Coyote: I’m Peter Coyote. You’re listening to “Unfinished Journey: The Lewis and Clark Expedition” on PRI.

[Program Break: The Makoché Masters “Cheyenne Nation” (Makoché Music MM0191D)]

Peter Coyote: Modern European scientists—trained in methods developed back in the Enlightenment—are only now starting to appreciate the scientific knowledge passed down for generations by indigenous cultures. Long before Lewis and Clark crossed the West, seeking to name and categorize its flora and fauna, Indian people had a long history with the plants and animals here, and had deduced many things about them.

Roberta Conner: Many good things have endured that were smart when Lewis and Clark arrived, smart lifeways of our people, technologies of our people.

Peter Coyote: Roberta Conner, a member of the Confederated Tribes of the Umatilla and director of Tamástslikt Cultural Institute near Pendleton, Oregon.

Roberta Conner: We did not require salt or brine to dry fish or meat. We did not have to consume moldy meat months after hunting season was over. I think we had superior food preservation technology and superior food storage methods to the expedition’s. I think our people had learned what happens if you overharvest. Our people
had learned what happens if you overpopulate. They had learned about pollution and all of our laws were to prevent those things from happening.

Jack Weatherford: American Indian people, although we often think of them as very spiritual, they were also very practical. Their whole spirituality had a practical aspect of how to live in the world and to a certain degree it was necessary to live in harmony with the world.

Clay Jenkinson: That’s Jack Weatherford. He explained how the fundamentally different methodologies of Indian and European science influenced the blending of the two cultures in American life.

Jack Weatherford: Europeans did not understand American Indian agricultural at all. First of all, the Europeans were accustomed to the segregation of plants, that is, you grow one plant in one field, and all the plants in that field must be as nearly identical as possible. American Indians had the exact opposite, that is, you grow as many different kinds of plants together as will grow together because they can often help one another by giving one another nutrients or shading one another. So when the Europeans arrived and they saw American Indian fields, they just saw chaos, they did not understand the system behind it.

Peter Coyote: The oral traditions of native Americans are in some ways a type of scientific textbook. Certainly when it comes to the land, the stories that are passed from generation to generation can shed light on who we are and how landmarks came to be. Pulitzer-prize winning author N. Scott Momaday tells one of those oral histories.

N. Scott Momaday: The Kiowas are known to have lived in the Black Hills for a time in the course of their migration southward. They have a story about Devil’s Tower, which they call “Tsoai”, which means “Rock Tree.” And it’s obvious when you see it that the name is perfectly appropriate because the monolith resembles nothing so much as the trunk of a tree. But it’s huge—a thousand feet from base to summit, a mile around at the base. And Kiowas have a story about Tsoai. They say: When we lived in that area, there were some children playing in the woods, eight children, seven sisters and their brother. The boy was pretending to be a bear and he was chasing his sisters through the woods. The girls were pretending to be afraid and running. Well, a terrible thing happened. The boy actually turned into a bear and when the little girls saw this they were truly terrified and they ran for their lives, and the bear after them. As they were running, they passed the stump of the tree, a huge stump. And the tree spoke to them and said, “If you will climb upon me, I will save you.” So the little girls clambed on top of the stump. And as they did so, it began to rise into the air. The bear came to kill them but they were beyond its reach. And it reared up and scored the bark all around with its claws. And the story ends, the seven sisters were borne into the sky and they became the stars of the Big Dipper.

Well, I love that story because it seems to me the model of the Ur-story, because not only does it account for this feature in the landscape—which is something in itself—but in the process the story relates humankind to the stars and that is a quantum leap of the imagination. And I love the story moreover because my name comes from that place—Tsoai, my Indian name is Tsoai Tallee-Rock Tree Boy. And I was given the name because I was taken there when I was an infant, a very important place in time and tradition, and that’s why I live with that name.

The buzzard which Ruben Fields killed diameter of one feather is—1—one quarter & one line from the top of one to the top of the other wings is 9 feet 0 inches from the point of the bill to the tale is 3 feet 10-one quarter inches middle toe 5-one-half inches, middle toe, five one-half inches.

William Clark, November 19, 1805
Peter Coyote: That last description by Clark of a “buzzard” is a California condor, a species that was abundant when the expedition traveled west, but that nearly went extinct. The Sierra Club estimates that many of the species Lewis and Clark observed are endangered, including the white sturgeon, gray wolf, the whooping crane and coho salmon, to name a few. But thanks to the efforts of modern-day scientists, some species—like the condor—are being brought back from the brink. We sent correspondent Kristian Foden-Vencil on a quest to find out about efforts to save this bird, that was mentioned so many times in the Lewis and Clark journals.

Kristian Foden-Vencil: The name California condor conjures up an image of an exotic and rare beast. Indeed, my quest for this almost mythical fowl starts in the misty and verdant Northwest – at the Oregon Zoo. The organization runs a captive breeding program for this endangered species, which came close to extinction in the 1980’s. Six pairs live together here. Each year the hope is that each pair will lay one egg. Once that precious chick hatches, the adults are allowed to rear it for 12 months, before it’s spirited away for introduction to the wild. Taking the chick encourages the pair to start the process all over again. But condors are so scarce, that all the public actually gets to see at the zoo is a life size wooden silhouette of its wingspan.

Amy Kite: You stretch your arms out. Let’s see how many of you it takes.

Kristian Foden-Vencil: Portland teacher Amy Kite lines up her four-year-olds next to the condor’s outline for a quick lesson from zoo spokesman Bill LaMarche:

Amy Kite: Hold her hand, and you hold her hand. Stretch out. It takes almost four of you! Wow, look at that four of you! What is a condor?”

Kid’s voice: They’re the world’s biggest bird.

Kristian Foden-Vencil: Well done! How did you know that? Is that true? Biologically?

Bill LaMarche: It’s North America’s largest bird.

Kristian Foden-Vencil: Do you think he could pick you up and take you away?

Kids’ voices: Yeah! No!

Kristian Foden-Vencil: Does that happen?

Bill LaMarche: No, that doesn’t happen. These birds are scavengers and you guys know what that means? That means they don’t hunt for their food they just come across it. They’re nature’s garbage bird.

Kristian Foden-Vencil: While ‘garbage bird’ isn’t perhaps the most elegant description, it is accurate. It turns out that the noble California condor actually has a completely bald, pink head—doubtless an ingenious quirk of natural selection—which allows it to gnaw through the cavity of a rotting carcass and not catch diseases from all the bacteria.

Captain William Clark described the bald bird in great detail and even drew a picture of it in the journals. I ask LaMarche to explain another unattractive habit and he confirms that “to help reduce core body temperature, California condors defecate on their legs – a behavior known as urohydrosis.” In other words, it poops and pees on its feet to stay cool. It appears my quest for the California Condor is unveiling an animal that’s not as elegant as its
name suggests. Even Tony Vecchio, the director of the Oregon Zoo, concedes it’s not the easiest creature for which to raise money.

Tony Vecchio: The cliché of course is beauty is in the eye of the beholder, and being as bald as a cue ball myself, I think it’s a rather handsome bird.

Kristian Foden-Vencil: I’m going that way, too, so....

Tony Vecchio: I always go back to Lewis and Clark who are heroes here in the Northwest and their first impression of the bird. They named it ‘The Beautiful Buzzard of the Columbia,’ because its beautiful head isn’t covered in feathers. You can see the red and orange and yellow color of the head. It’s not what we would call a charismatic mega-vertebrate. Raising money for big furry mammals is probably easier than a bird that eats dead things.”

Kristian Foden-Vencil: Still, after reading the expedition’s journals, it’s easy to see that Lewis and Clark were very impressed by the condor. They recount stories of the birds soaring high above the corps all day, or protecting a whale carcass by barking like dogs.

Vecchio says native Americans have also long revered the vulture, calling it the Thunder Bird, the Lightning Bird, or most poetically ‘The Bird that Rides the Wind down the Mountain’ because it can effortlessly glide for hours on thermal updrafts.

Tony Vecchio: They really believed the condor protected their villages from inclement weather and natural disasters. And it was very important for them to go out and collect a baby condor and raise it in the village, so they would have a condor in the village. So, a very important part of their culture and history.

Kristian Foden-Vencil: Okay, enough description already. I want to actually see a condor. But catching a glimpse of a species that in the 1980’s only numbered 22 isn’t so easy. First, I have to schmooze zoo officials to get permission as apparently visits with humans are discouraged, so that the condor will maintain a natural aversion to people. It turns out, the zoo’s condor breeding program is out in the boonies, surrounded by a chain link fence.

[SOUND OF STARTING MINI-VAN AND RIPPING TAPE]

Kristian Foden-Vencil: Curator Joe Burnett tapes cloth around a large dog cage and drives down to the bird pens to capture bird number 340. The zoo is about to send it’s first juvenile condor south to a wild breeding colony in California. Once we’re at the cage, he grabs a net large enough to cover a child and whispers that he’s anticipating a struggle.

Joe Burnett: Most of these things you have to get specially made.

Kristian Foden-Vencil: Now, are they sleeping at this time, or are they ready for you?

Joe Burnett: He’s going to be ready for me.

Kristian Foden-Vencil: Then Burnett is off with an assistant. She’s chasing down the hapless buzzard. Picture a vulture the size of a Labrador covered in gray feathers. Then add wings that could stretch from one end of your car to the other, and you begin to get an idea of the size of this thing they’re going to try and wrestle to the ground.
Now picture two keepers stuffing it into a plastic kennel. The condor may be endangered, but the keepers are merciless!

Joe Burnett: Make sure both of his front shoulders are in. There we go. One, two, three! [Bang!] Got it, hold its tail! [Bang!]

Kristian Foden-Vencil: Mission successful?

Joe Burnett: Yeah, very successful. He’s tough, though. He’s fast. He’ll be great out in the wild.

Kristian Foden-Vencil: Burnett is pleased that this, one of the condor’s few interactions with people, was what he euphemistically calls ‘negative.’ It bordered on assault if you ask me, but Burnett explains that this young Lightning Bird is less likely to cozy up to anyone in the wild if he has a negative association with humans. That means I’m one of the few people in modern times privileged enough to see the bird. During the fracas, just as the condor took-off across the aviary to avoid its captors, it spread its wings and began to fly! In that split second, the Thunder Bird’s peculiarities melted away and the grace and dignity that Lewis and Clark found so remarkable is overwhelmingly evident. Although I’m no bird nerd...err...ornithologist, I can see it would be a tragedy if the ‘Bird that Rides the Wind down the Mountain’ died off. This recovery effort holds the promise that the California condor will be here for another 200 years. I’m Kristian Foden-Vencil.

[Music]

Peter Coyote: Clay, step back for a moment, if you will, and summarize the scientific achievements of the expedition.

Clay Jenkinson: Most of the scientific achievement has been superceded by technological and methodological developments that have come to pass in the 200 years since Lewis and Clark made their famous journey. And unfortunately, because Lewis didn’t publish his three-volume account of the expedition, the later paraphrase narrative that was produced in 1814 deliberately left off all of the scientific investigations of the expedition. So Lewis and Clark have never received the recognition they deserve as pioneering American scientists. And they’ve largely been seen through American history as grand adventurers sent out by Thomas Jefferson. But there is a scientific legacy of the Lewis and Clark Expedition.

Peter Coyote: Part of that legacy can be found in Philadelphia at the American Academy of Natural Sciences. That’s where the plant specimens that Meriwether Lewis gathered are housed, including an example of Lewisia rediviva, better known as the bitterroot. Montana made it that state’s official flower, and now you have the answer to our quiz question. Rick McCourt helped to curate the plant collection at the academy and tells us about what it includes.

Rick McCourt: What survived and what he brought back with him were 222 specimens that, actually about 230 specimens that exist today. Among those 230 specimens approximately are about 179 species, so there are some duplicates. So, about 179 species, and of those about half were new to science. They’re still in general, by and large, identifiable, easily identifiable, from the structure of the flowers and the leaves and the stems and things like that. So they came back in fairly decent shape.
Peter Coyote: So Clay, what happened to all the other things that the expedition collected on its journey?

Clay Jenkinson: Unfortunately, most of the material items associated with Lewis and Clark are gone, dispersed, destroyed, misidentified. They auctioned off most of their gear when they got back to St. Louis in September of 1806. We don't really know what happened to the artifacts of the expedition. What little we know can be described by Stephen Dow Beckham of Lewis & Clark College.

Stephen Dow Beckham: To Thomas Jefferson’s house at Monticello went some special objects—fossils, Indian artifacts. Those were probably disposed of after his death by his family when they sold that property. A significant part of the flora and fauna went into the collections of Charles Wilson Peale, an artist, intellect, educator and traveler based in Philadelphia. He operated Peale’s Museum. At Peale’s death, his large family sold the collection to P.T. Barnum. Barnum’s circus tent caught on fire and these items were then destroyed. A few special artifacts, including Indian baskets, made their way from the Barnum family to the Peabody Museum at Harvard University. These are preserved.

Peter Coyote: Science even to this day is dependent on observation, calculation, theory and then the search for proof. But today, scientists are grappling increasingly with what we cannot see, and increasingly we recognize that we cannot observe the world without affecting what we observe. Whether it’s string theory or simply trying to account for vanishing species, Clay Jenkinson ponders what we can’t see in his final thoughts.

Clay Jenkinson: On January 20, 1805, Sergeant Patrick Gass recorded a Mandan religious ritual: “After we were done eating, they presented a bowlful to a buffalo head, saying, ‘Eat that.’ Their superstitious credulity is so great that they believe by using the head well, the living buffalo will come and that they will get a supply of meat.”

Gass thought the Mandan custom preposterous. He was right, at least from his own perspective. Lewis and Clark were scientists. They were men of the Enlightenment and they were supremely confident in their secular scientific view of the world. They described whatever they discovered in a language they hoped would permit others back home to see through their eyes. They liked to measure things: Yellowstone River, 858 yards wide at its mouth.

When Lewis wanted to describe an animal new to science, he began by killing it. But didn’t the English poet William Wordsworth say, “We murder to dissect”?

Equipped with their urge to measure, to classify and to collect artifacts, Lewis and Clark crossed the American continent. The great sciences were still in their infancy then. But the captains made the most of what they had, particularly botanical science. We are all indebted to their scientific integrity. They couldn’t help but see Indians as superstitious and primitive, in part because their ways of seeing were so different. The men of the expedition exhibited enormous confidence, even arrogance, in their own way of knowing, and little or no curiosity about alternative approaches. They could not see that over the course of long field experience, native Americans had worked out a science of considerable sophistication, that enabled them to make sense of their universe, manipulate their resource base and have a good working relationship with the other things of the earth.

When Lewis and Clark thought of science, they saw telescopes and sextants. When Indians thought of science, they contemplated their interconnectivity with other things, particularly creatures all around them. Living lightly on the planet mattered to Indians. It has mattered very little to the children of Francis Bacon or Isaac Newton.

In Indian culture, you don’t make sense of a wolf by killing it and measuring the length of its tail. You make sense of it by watching it in action, trying to understand how it hunts, how it reacts to a confrontation, how it finds its...
way across the prairie on a moonless night. In the Indian world, you do not distance yourself from the thing being studied. You try to find affinities that percolate beneath the surface of things. You try to ascertain the ‘wolfness’ of the wolf, or the ‘owlness’ of the owl. In simplistic terms, you psych it out and try to incorporate wolfness into your own being. You may even create a wolf headdress for the religious festival. Such action is likely to inspire derision in Patrick Gass, but in the Mandan world it shows that you are trying to get in tune with a universe beyond your own very limited experience. It’s a kind of law of spiritual gravitation.

Nobody can doubt the efficacy of Western science. Using Newtonian mechanics, we can land a probe the size of a Weber grill on Mars. But that same scientific genius enables us also to lob a cruise missile into whichever window we wish of the Iraqi Defense Ministry.

And most cultural historians acknowledge that our scientific prowess, our Faustian mastery of nature, has brought on a host of unintended material consequences, not to mention a psychic cost that is easier to acknowledge than to measure.

In the 20th century, Western hard science butted up against quantum mechanics, indeterminacy, the paradox of Schrödinger’s cat, Heisenberg’s uncertainty principle. The deeper modern physicists probed into the heart of things, the less Newtonian certainty they found.

In a fascinating way, modern science has curved back in on itself and undermined some of those Newtonian certitudes that gave men like Thomas Jefferson such confidence.

The interconnected Mandan way of seeing turns out to be closer to the best thinking in Western science than Jefferson would have thought or liked. It may be that Hamlet was right when he said, “There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy.”

And the best science of the 21st century might very well wipe that smirk off of Patrick Gass’s face. For the Unfinished Journey, I’m Clay Jenkinson.

Peter Coyote: I’m Peter Coyote. This program was produced by Lewis & Clark College and Oregon Public Broadcasting. The producer is Eve Epstein, audio engineer Steven Kray, associate producer Sherry Manning. Original music composed and conducted by Aaron Meyer and Bill Lamb. The executive producers are Clay Jenkinson and Morgan Holm. Major funding provided by the National Endowment for the Humanities. Additional funding was provided by the National Park Service and the Jonsson Family Foundation. Support for this program also comes from this station and Public Radio International stations nationwide and is made possible in part by the PRI program fund whose contributors include the Ford Foundation and the John D. and Catherine T. MacArthur Foundation. To learn more about this series visit opb.org and click on the “Guide to Lewis and Clark.”