Student: Mr. James Burnes
Graduate Field Examination in Comparative 19th-century Natural History
March 2, 2017

- There are five questions to choose from; select two to answer.
- The examination is open-book and open-notes.
- The duration of the examination is from 8:00 a.m. to 4:00 p.m.
- At the conclusion of the allotted time for the examination email the answers to the two questions you chose to Dr. Katherine Pandora at kpandora@ou.edu.

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1. Networks have been crucial for the development of natural history: networks of power; networks of bureaucracy and infrastructure; and networks of natural knowledge. With reference to your reading, illustrate the importance of these networks.

2. Collecting and fieldwork have recently received extensive attention from historians. What are the dominant themes in this (admittedly broad) historiography, and how have they changed our/your understanding of the development of modern science?

3. Historians of the modern period on both sides of the Atlantic recognise the significance of what they have variously called 'science-popularization' or 'vernacular' science. These terms have limitations, but their persistence also demonstrates that (as of yet?) they are terms we cannot do without. With reference to Britain and America, explain your understanding of the process(es) these terms attempt to capture and their relevance to the shaping of modern science.

4. What, in your estimation, have been the crucial factors in the development of modern science in America? To what extent is it the case that American science can best be understood as a hybrid beast born of European parentage?

5. In your view, what accounts for the the fact that historians of science paid so little historiographic attention to natural history until relatively recently? Taking the 1996 publication of N. Jardine, J.A. Secord, and E.C. Spary's edited collection *Cultures of Natural History* as indicative of when a major shift finally commenced, address the questions of what made this shift possible and what the impact of the new historiography has been for understanding 19th-century science and society. And, finally, if you were overseeing a second edition of *Cultures of Natural History*, what topics and themes related to natural history in the United States would you include, given that none appeared in the first edition?

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March 2, 2017
Exam Question #2
Natural History

Trade Networks

The largest and most easily recognized trade networks of natural knowledge are the Kew Gardens and the post revolution Jardin du Roi. Jim Endersby calls the work of Joseph Hooker at Kew, and his book *Imperial Nature*'s subtitle "the Practice of Victorian Science." Joseph Hooker's career path provides a case study in which to map the expansion of science as a profession, that is something "professed," as Endersby points out, as well as the beginning of the end for gentlemanly pursuits of scientific inquiry for interest's sake, or the gentleman hobbyist as it were. Endersby separates the aspects of the new scientific climate into chapters on subjects like "collecting, "publishing," "corresponding," "seeing," and other narrow bits of methodological shaping–with important reminders that these headings are separated for clarity, and not because they acted independently of one another in practice.

Trade in knowledge was not without hierarchy as the struggle for authority between the metropolitan scientist (Hooker) and his colonial collectors (Colenso in New Zealand and Gunn in Australia) attest. Here is one of the finest examples of exploring the relationship not only between who gets to "do" science, but who also has the authority to create scientific knowledge. Hooker needs well trained collectors, especially ones he does not have to pay, but he also needs to remain removed enough from his trading partners to exert his botanical knowledge over their "idiosyncratic" and often misinterpretations in naming separate species. He, after all, is poised on top of the botanical world within Kew Gardens which was largest herbarium collection in the world, constructed through vast global trades, and conveniently at his disposal to make varied and broad conclusions where his local collectors could not.

The trade network revealed here should serve as a model for studying scientific relationships between any central power and periphery. The colonial collectors required adequate tools to provide Hooker with adequate specimens, so the latter may send gift of books, collecting paper, or even a highly prized microscope in order to maintain congenial relationships. In return the gentleman, in Hooker's case Gunn and the missionary Colenso, continued to work hard at their collecting.

Across the Channel, E.C. Spary highlights the bureaucratization of the Jardin du Roi as it, and most of its staff weather the change from a royal to a republican institution. Spary maintains that "Natural History was based upon a material economy of objects which had to be controlled by a social economy of morals" (47). This economy of objects was completely controlled by exchanges within pre-Revolution colonial trade. Even within the Jardin itself knowledge was controlled and networks continued to influence knowledge. For instance, "keys [to various parts of the Jardin] could be seen as the physical emblem of the ways in which power was diffused though the Old Regime Society" (57). Outside the Jardin, other post royal collections reveal the importance of colonial trade within the kingdom. Spary works in the establishment of a menagerie at the Jardin post revolution (the beginning of France's later National Zoo) and simply put, the exoticness of a displayed animal's natural environment was directly proportional to the vast holdings and transit systems ran by the government. As the new republicans broke up the private collections of the French aristocracy from piles of things that "resembled treasure chests" and not collected systems of learned society the public could come into contact with the exotic, the marvelous, and the "other." As the democratization of these collected treasure chest occurred the realization is inescapable that much of what it meant to be *French* scientists (natural philosophers, etc) was defined by their relationship and collections of *foreign* specimens.

These are just examples of finished (or the finishing) of collections. To understand the broader implications and interworking of trade networks we have to follow the objects. Looking back from Kew, Richard Drayton's *Nature's Government* reveals that British economic trade in India is impossible to separate from the narrative of nature, botany, and Kew itself. Following Britain's conquest of the world, Drayton's analysis of trade back "upstream" that provides the most useful analysis of Britain's various and sundry networks. The importance of developing "British" agriculture across the vast landholdings in various climates and geographic areas of the Empire had on the establishment and continued success of such an empire cannot be understated and is also something new for researchers who are only family with England as a "nation of shopkeepers." He even admits in the preface that another subtitle might have been "The agrarian origins of the British Empire" (xvii).

Distilled to its purest form Drayton's work reveals that not only were global trade networks important to and influential on those at the highest node. Trade influenced all participants and the goods—whether physical or philosophical—were rarely unidirectional. Even in instances where one colonial product was sent to directly to another colony without passing through the any ports in Britain proper, as the case with breadfruit sent to feed slaves on sugar plantations, British culture was shaped by the nature that was traded.

In comparison to Drayton's big picture work, Jennifer Newell's *Trading Nature* takes a case study approach in order to get into the heart of the island of Tahiti and ecological exchange. The argument is in agreement with Drayton: every instance of trade in the case of something living (including seeds) is ecological exchange and it has an impact on both parties involved in the trade. This more modern take on the "fatal impact" theory. Newell's search for "indigenous agency" will probably meet with some resistance if not merely controversy. Without a full record

of the relationships we are at a constant disadvantage of painting these portraits from one side. It is likely that for whatever the Europeans believed they were duping the islanders, the islanders thought they were getting the best of the Europeans. Human nature. We see Cook and explorer's attempts to set up filling stations on the islands to aid in sea travel, with unintended consequences on the native geopolitics. But, just as Drayton suggests in *Nature's Government*, there were just as many unintended consequences back in Europe, they just did not necessarily involve complete upheaval of standard organization of power–unless you consider something like the Great Reform Act. I am not saying that it is a direct result of Cook's voyages or even trade, I am suggesting that many of the changes in British and European culture began with the wealth generated by trade.

There are two types of "imperialism." The standard "we must have more landholdings than x" and the economic imperialism, which is the usual connotation meant when the word is used. They are intricately related, but there are different aspects of each and we would do well to think about that as a complex just as these trade systems. As far as "Americanization" goes, the starkest example of that comes through James Haley's *Captive Paradise: The Unites States and Hawai'i*. Haley's work is revisionist, but not in the manner that the modern academy is expecting or producing. His arguments come from extensive work within the Hawaiian archives themselves as well as the islands history before American contact. The standard narrative is the usurpation of the independent country, annexation and eventual statehood of the indigenous people at the hand of the more powerful Euro-Americans in the hardest, clearest picture of American Imperialism. Haley argues that long before it was a protectorate or territory under American conquest, Hawai'i was aware of its power for trade and navigation. Going back to the *Trading Nature* the arguments are there as well. The islanders were working a system that was

working them. Haley's lynchpin is that Hawai'i was "Americanizing" long before it became part of America. This is that dual system of imperialism I mentioned earlier. For most other holdings, they were part of land grabbing imperialism first and economic imperialism after. In the case of mainland America and Hawaii that process seems to be reversed.

This history of Natural History in the Unites States begins with botany. In fact, as we have seen in Britain's Kew and France's Jardin, most histories of Natural History begin with Botany. Christopher Irmsher's *The Poetics of Natural History* opens with two Quaker botanista, or rather plant enthusiasts, and their lasting exchanges of letters and botanical specimens across the colonies and across the Atlantic. The poetics turn towards the earliest American museum collections of both Charles Wilson Peale and P.T. Barnum. Some specimens were the same ones as Barnum purchased the last remnants of Peale's museum to create his own).

Irmscher's work provides an avenue for information dispersal that does not necessarily require structured education, although it does require literacy, at least for the descriptions of Audubon's birds or Holbrook's snakes (*North American Herpetology*). It is the sources of information and not the information itself that is important to Irmscher's analysis. The work goes well into his chosen project to expand the importance of storytelling and collecting beyond the "belles lettres" and to its beginnings in concrete experience. Once the information or knowledge is generated within the network then it can be traded throughout the network.

Susan Scott Parrish's *American Curiosity* can be viewed as the American colonial companion to Newell's *Trading Nature*'s Tahitian ecological exchange, in essence: knowledge was never a unidirectional commodity no more than pigs or plants were. Parrish's work situates colonial Americans, in the earliest years including women, Native Americans, and slaves, not in reference to London, but in concert with the capital. Any and all information was useful during

the colonial period. Parrish's work reveals the adversarial nature of colonization was a driving force in the early diversity of natural history "knowledge makers." This also explains why, as Great Britain came to dominate the continent all enterprises became less diverse. This coincides with the treatment of the Native Americans as well, following the end of the French and Indian Wars, many Native people were on the losing end of decisions that left them with no ally to offset British power. This more or less was the case for natural history providers as well.

Correspondence from women was important in practice but failed to be printed in the Proceedings of the Royal Society. One of the issues to remember from this process is that it repeats itself in the newly formed country following the American Revolution and as the Republic discovers itself. There is almost a frontier theory of scientific correspondence and authority. Once a center is solidified, London, or in the case of America Philadelphia for science and Washington D.C. for politics the periphery becomes less important as voices of authority in most matters not least natural history collecting, naming, trading. While not directly related to scientific knowledge and non-economic culture, this book would provide a more complete of America at the end of the 18th century if paired with Kariann Yokota's *Unbecoming British*.

As American science expanded through the 19th century trade networks became more important for people who could afford correspondence but not field work. One of the strongest, and most macabre, examples of this is Samuel Morton's skull collection in Philadelphia. Aside from the count, Morton's collection stands as a testament to early American scientific methods. Morton's collection grew as people from across the globe sent him skulls. A trade network of what Fabian calls the "unburied dead" existed for most of the century. In its earliest guise it was grave robbers selling corpses to medical schools, but as the recent turn in scientific inquiry was anthropology, that was where the enterprise lay. Since most "civilized" people could afford

burial in a protected area, Morton's collection skewed heavily towards the poor and minority groups. While the makeup of his collection was less than diverse, which is revealing in itself, it provides an ample example the power of specimen-ization. Darwin had bartered for extinct mammal skulls in South America and post-Civil War entrepreneurs developed trading in Native burial goods. The differences to our eyes are one was a living breathing prehistoric beast and the other was a living breathing human. The hardest point to get through here, beyond the whys and wherewithals is to many people, especially the collectors and early anthropologists and their network of collectors, such distinctions simply did not exist.

For Morton, and those who collected for him, the pieces of what once made up individuals became important pieces of a larger puzzle, nameless, if not faceless, data points used to try and answer the same questions about man that were being addressed among other species collected, such as the evolution of the horse. For many of Morton's collectors, and maybe Morton himself, the remains were no more or less than that of horses. They would see "primitive" burial practices as quaint, and wait for the ceremony to be over before swiping the skull and mailing it back to Pennsylvania. There was always someone willing to help. Even John James Audubon of bird and quadruped fame shipped skulls back to Morton from the battlefield of San Jacinto in Texas. Ever the scientific collector, Audubon surmised that the specimen he sent Morton was of Spanish and Indian descent.

With the oddities pouring in, and more than a few bags of skulls coming in from the Pacific Northwest and California it would sound like Morton had many experimental measurements of the "other" but nothing so much as a standard or a control. The American Civil War provided an abundant opportunity for the skulls of white men to be added to Morton's collection. In fact, this type of windfall was exactly what one of Morton's collectors pegged as

the best opportunity for collecting–death on such a scale that the living would have no time, energy, or ability to buried their dead. Embalming and funerary history aside, this is one of the driving forces for the new middle class to have their family members embalmed and returned to the cities. Many of them were aware of the trade networks at place and they knew the fate of the unburied dead.

In Morton's lifetime he saw the end to this type of scientific collecting as the Smithsonian's Bureau of Ethnography began undertaking government-sponsored large scale collecting expeditions and gone were the days that individuals without government authority could collect skulls. The government and universities took control of the trade networks with the development of professional disciplines and practitioners of Decades later the move to repatriate remains reduced the collection but because not all of the skulls had claimants it wasn't completely dismantled. In fact, this further skews the original Morton collection towards the poorest class as many of the Native American remains have been claimed and repatriated while skulls of those from tenements and asylums are still part of the collection at UPENN.

Working back outwards to larger trading networks of ideas follows the structure of map culture and surveying work. In *Masters of All They Surveyed* D. Graham Burnett argues that the very act of making maps allowed for the trade of space that was physically too large to be traded. In order for colonial possessions to be claimed they had to be named and borders must be drawn. Working in the field as a surveyor meant literally scouting out the lines that were to go on a map. In the case Robert Hermann Schomburgk he tries to reveal the lasting legacy of the survey in imperial studies as more than just "map scouts." They were knowledge creators and the information their maps contained were shared throughout colonial governments and used to dispute and claim landholdings between other European colonial powers. This includes the

thousands of deaths over imaginary lines argued over in drawing rooms. Many times the elite, armed with reports such as Schomburgk's argued for the "naturalness" of such boundaries as following certain rivers, or from the surveying tradition "landmarks" which are fixed and, if possible, enormous. To compound the issue earlier surveyors were intent on finding the lost lands of El Dorado or other mythical regions that only existed on maps and in the minds of men, but were traded as if actualities.

Just as economic and political histories cannot be fully understood without following the economic trade routes, scientific knowledge and the development of ideas, theories, and eventually disciplines can only be understood in light of the cross cultural and intercultural exchanges within and between all the nodes of the network. Some of those nodes are the political seat of government or governmental controlled organizations such as the Kew Gardens while others might be missionary collectors in foreign parishes or the wives of colonial governors. The sizes of these nodes are rarely indicative of their importance for knowledge creation within the network. They do, however, tend to represent the authority within the discipline that the node (or actor) may possess. In the end ideas and information could travel more quickly, store more readily, than goods and in the case of Cook's final voyage the news of his death reached Britain months before the remainder of his crew returned to home port.

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Exam Question #2
Natural History

Fieldwork and Collecting

Fieldwork and Collecting can be seen as exploration with purpose. Not that exploring and surveying was a directionless endeavor, but that fieldwork and collecting in the scientific understanding was a more narrowly driven undertaking than being the first European to sail up a river. All these terms overlap in many ways in an ever shifting Venn-diagram. As with trade networks it is best and easiest to start with Joseph Banks and his travels with Captain Cook. For some authors this is the beginning of "Romantic Science." Richard Holmes popular science account *The Age of Wonder* chronicles the discovery of "the beauty and terror of science" during the Romantic period. Superlatives aside, Holmes' arc specifically covers the decades between the beginning of Cook's *Endeavor* voyage to Tahiti in order to mark the transect of Venus across the sun to the beginning and end of FitzRoy and Darwin's world cruise with the HMS *Beagle.*

At its heart it revolves around field observations, either by exploring geographically, cosmically, or in the laboratory. It is about science as a verb, not a passive noun. It is about the elite men of means who can afford leisure collecting trips–both for knowledge and for specimens–and it is about the brilliant minds from the working class that broke into a new kind of social mobility. Holmes captures the wonder of the age, which was the driving force of early exploration and subsequent collecting expeditions and work in the field. The fear of the unknown, the filling in of the map of Africa by early explorers such as Mungo Park who unfortunately was one of a long line of explorers that disappeared into the blank spaces between the known. Two generations of Herschels draw back the curtain of night and expand the understanding of the sky and the beyond. One of my favorite quotes comes from Banks' diary

and is the best way to start this discussion: “March 1769; It is however some pleasure to be able to disprove that which does not exist but on the opinions of Theoretical writers, of which sort most are who have wrote anything about these seas without themselves been in them.” (11). “Go and see” became the maxim that replaced “sit, think, discourse.”

When Alexander von Humboldt set out to find the common thread among everything, the idea that exploration and fieldwork could be undertaken removed from politics was a foreign concept. Not only is Humboldt’s work and time abroad one of the most extreme examples of collecting and fieldwork, it may also serve as an example of an unattainable goal, or as a warning to not make fieldwork too broad. Humboldt can also serve as an aside for a brief mention of the dated historiography on the subject of fieldwork and collecting. The most recent (2015) book by Andrea Wulf, *The Invention of Nature: Alexander von Humboldt’s New World* attempts to reseat Humboldt as *the* explorer that influenced generations of scientists and authors in comparison with this contemporary Joseph Banks. Incidentally, Wulf also wrote about Banks (among others) in *Chasing Venus*.

Others, such as Aaron Sach’s aptly named *Humboldt Current* attempts to reframe some American exploration in the light of Humboldt’s “ecological” pursuits. Many well-known names in America were students (in the philosophical sense) of Humboldt’s work to provide evidence of an intricately connected world. J.N. Reynolds, Clarence King, George Melville, and John Muir are all connected mainly through their adoption of Humboltian idea(l)s. Between Sachs and Wulf the list of Humboldt’s influence, through his fieldwork and subsequent popular publications, grows to include Charles Darwin, Thomas Jefferson, Simon Bolivar, Wordsworth, and Goethe, and even helped shape Thoreau’s Walden. Such a register of influential individuals leads one to believe the Humboldt’s importance lies beyond any one establish discipline. *The*

Humboldt Current provides another angle to explore not only exploration, but ironically, empire, ecology, environmentalism, and nature. That some expeditions were undertaken for explorations sake, or to prove some pet theory (in the case of Symmes' Hollow Earth) seems to be beyond belief for more than a few historians. Many of these people also have a problem differentiating between exploration and exploitation (and that says nothing of using the word "exploitation" as a neutral descriptor for environment use a la anthropological theory).

The Passage to Cosmos adds another facet to the Humboldt exploration and fieldwork studies and it is best to see them all together. Laura Dassow Walls works in the same manner as Sachs in resituating Humboldt's expeditions. In Sachs case it was to make it less imperialistic, and to Walls it meant fighting the dismissal that Humboldt's work was overly romantic. More importantly, Walls delves into the loss of Humboldt in American History shortly after his death and huge continent-wide celebrations for his centennial. As much as Humboldt tried to find the common thread throughout nature, the differences in his disciples (chosen and unchosen) unraveled it as quickly as he could make ends meet. Materialist, atheist, scientist, "ecologist", man of letters, romantic, Prussian, Humboldt was all these things and just as individuals can attach themselves to parts of nature and ignore others, the same can be seen in those early adopters of Humboldt's ideas. In the end it was the professionalization of science, arguments of Social Darwinism, and (above all) wars with Germany that ground Humboldt's name out of the annals of North American history.

If *Passage* does nothing else, it should serve as a call to action among historians of science, especially cultural historians of science, to work more unravel the mysteries Walls presents. That Humboldt is still a national hero in many Latin American countries is not just a quaint aside, it is vastly important to the development of natural history through extensive

fieldwork and relationships with nature south of the United States border. That most of the English editions of Humboldt works and biographies are severely dated would be an easy place to start. As Walls is a specialist in English Literature the bulk of *Passage* is devoted to many of the same American Transcendentalist authors and poets from Sach's *Humboldt Current* that were the earliest adopters of those Humboldtian idea(l)s. While this may not seem of interest to historians of science it is evidence that the experience that Humboldt derived from fieldwork influenced disciplines far beyond the sciences. Fieldwork is not just a question of science history and its influence on literature is not grounds for dismissal as a relic of the Romantics.

Arguable one of the most famous fieldwork and collecting expedition forms around Charles Darwin's work aboard the HMS *Beagle*. Darwin's journals, published as *The Voyage of the Beagle*, were a continuation of Humboldt's publications and became one of (if not the) best-selling travel writing of the 19th century. One of the things that surprises most non-specialists is that Darwin travelled as a geologist. The boundaries between disciplines were much more fluid in the early 19th century, but as Sandra Herbert argues in *Charles Darwin, Geologist* Darwin saw the world through a geologists' lens and as such his discoveries should not be surprising in relation to geological thought in the 1830s/40s. When paired with the first volume of a large Darwin biography by Janet Browne (*Voyaging*) there is no escaping the importance of fieldwork for understanding the world at large. The voyage and its influence on Darwin and biology are still argued and lauded, but the simple matter of fact is that is indispensable in the shaping of Darwin's theories. The tortoises and finches on the Galapagos are the most obvious, but *geologist* Darwin also worked out how atolls and new land led to new life. This theory was only testable or viewable for a Darwin that was *on* the ocean as Banks described in his journal.

Outside of geology Darwin's biological theories were also influenced by his time collecting in the field. The co-presenter of what became known as the theory of evolution, Alfred Russell Wallace, came to the same conclusions as Darwin from his own fieldwork in the Malay Archipelago. Wallace had spent most of his life in the field collecting for patrons or other nodes in the natural history trade network of Britain in the 19th century. Wallace's early work in South America was lost when the ship containing a large collection of specimens caught fire and sank. Fieldwork and collecting is not without peril. Fieldwork also influenced other theories of evolution as well. In *Political Descent* Piers Hale follows Peter Kropotkin's field work as part of a geographical survey into Northern Manchuria to the Amur river. His time with the survey, and a subsequent expedition led to his own *anti*-Malthusian version of descent with modification. Fieldwork could lead to the same conclusions, but it could also lead to a difference of theories of methodology. One of the questions for future researchers could be if geography influences such theories, if Kropotkin had seen the natives in Tierra del Fuego would his ideas been more Darwinian, or were the two men's politics—radical Whig (Darwin) and anarchist (Kropotkin)—the major influences on their theories?

Geographic surveys like the ones Kropotkin work with, and their American geological cousins were the main sources of large scale fieldwork in American science. William Goetzmann's works *Army Exploration in the American West, 1803-1863* and *Exploration and Empire* cover most of the 19th century American land exploration. While dated (1957 and 1966 respectively) but they remain excellent starting places to understand what was going on in the western fieldwork. The idea of rugged individualism is a myth. Everything the cowboy owned came from the east. Even the early explorers and mountain men were beholden to the trading stations where the fruits of their labors were part of an international trade network of their own.

The fashion in Paris driving the need for beaver from the Canadian/US borderland wilderness. These market forces led to transportation innovation and fieldwork undertaken to make expansion, settling, and trade easier.

In the same manner of scientific exploration, fieldwork, and collecting, the opening up of the west was the undertaking of those in the East. They either lived there, worked there, or where educated there before moving past the Cumberland Gap, then the Mississippi River, and then later the Great American Desert. Army Exploration and the American West was Goetzmann's American Studies Dissertation at Yale. *Exploration and Empire* was the result of a late reading of the dissertation by a publisher who offered Goetzmann a deal for a follow up book. One of the gleanings from both works is that we have to look at the American West in regards to the east. That is, we have to see the uncharted west the same way we look at the ocean connections of the South Pacific Islands.

We also look at the West as laboratory, just as the ocean was for Cook. It is also another example of the analysis in D. Graham Burnett's *Masters of All They Surveyed*: the surveyor Schomburgk was following the lead of Raleigh in South America. It was a distinctly American process though, as it also mirrors some of that governmental patronage from the new Jardin du Roi in E. C. Spary's *Utopia's Garden*. This is especially true of the post-Civil War period and the development of the topographical engineers as a separate governmental and military entity. Many things impacted the American government's involvement in the west, the shift from sea exploration (the U.S. Ex Ex has ended), the end of privately funded collecting trips of the 1830s and 40s gentlemen geologists, the develop of American Universities, and even the shift of the "Indian Question" from the War Department to the Department of the Interior.

In the end, those aspects were part of a larger complex of issues that were structured with old systems in mind. Most especially when comparing the overland expeditions to their watery counterparts. This is particularly important in our case as the United States military models come from different countries. The American Army is modeled off the the French, so the exploration of the American West is akin to Napoleon in Egypt. The American Navy on the other hand is modeled on that of the British, which leaves the US. Exploring Expedition similar in scope and methodology to the voyages of Cook and Darwin. The U.S. Ex. Ex. Captain, John Wilkes, wanted to be remembered as the "American Cook." As American universities started to arise on the East Coast, there were also calls for more oceanic fieldwork in the fields of hydrography and magnetic studies. I think, as it has turned out it was the huge overland military assisted/led/involved that led to West Point eclipsing Annapolis in American consciousness for the place to go for a workable, military education.

A final example of the malleability of the nature of fieldwork, collecting, and the resulting "collection" is Titian Peale's collecting firearm. Part of the highlight, and one of the photographs in the Smithsonian publishing's *Exploring the West* exhibit guide, Peale's gun as transcended its life as both a "scientific instrument" for collecting and even a tool of expansion as it was used in hostilities twice—both dates and enemies engraved on the silver stock plate—and has become an artifact that is part of the same collection as the war clubs and shields that the U.S. Ex. Ex. Collected during the sea expedition.

Titian Peale provides the best way to understand the differences in naval and army expeditions in the antebellum period as he was part of both an overland and naval expeditionary fieldwork. Kenneth Haltman's *Looking Close and Seeing Far: Samuel Seymour, Titian Ramsey Peale, and the Art of the Long Expedition* follows the first American expedition with "trained

civilians" (that is artist) on payroll. Lewis and Clark's *Corps of Discovery* suffered from the lack of artists and the government was not going to repeat that mistake. Titian had watched his father sketch many of the Lewis and Clark specimens as they were deposited in Peale's museum. Lewis and Clark and Long set the stage for the U.S. Exploring Expedition, on which Titian was artist and naturalist, just as with the Long expedition, but was a naval expedition. The one thing that Art historians like Haltman and Dan Flores haven't touched on, but provided an excellent template to work with is that natural history representations are science. Looking at these expeditions and representations as the history of American Science in broad terms (more specifically geology and natural history) is sorely lacking from any of the books I have researched. The idea that Titian's first sketch of the scissor-tail flycatcher is important for art is only half the story. The collections, sketches, and preserved specimens are history of science.

Artists themselves can serve as sources for understanding the importance of collecting and fieldwork with regards to authenticity and authority. As George Catlin traveled west documenting the "vanishing race" he would purchase or trade Native American paraphernalia and in turn decorate his studio and some future paintings with them. Having his collection on display not only provided the artist with props for staging his paintings but also provided an implicit authenticity and authority as an artist who had been on the scene.

Other artists accompanied patrons on expeditions in order to provide illustrations for their travelogues that were created "from life." The best example for that, and an excellent way to pull this discussion back to Alexander von Humboldt and his influence is Karl Bodmer. Bodmer was the official artist to Prince Maximiliam of Wied-Neuwied's second expedition to the Western Hemisphere in 1832. Under the mentorship of Alexander von Humboldt, Prince Max's first expedition trekked through Brazil from 1815-1817. Fifteen years later Prince Max and Bodmer

spend two years on the Great Plains of America along the Missouri river. An engraver by trade Bodmer's exacting representations of the artifacts and people that the expedition met provided the illustrations for the official report of the expedition published in 1840.

The illustrations above provide a broad view of some of the dominate themes in the historiography of collecting and fieldwork. Fieldwork and collecting were international affairs throughout the 19th century. Even on the North American continent moving west in the early 19th century meant traveling and collecting across international borders. As the postwar period sped up industrialization in the east and American expansion west through new territories and states the United States Geological Surveys institutionalized fieldwork and collecting in ways that European countries could not. Scientific, and specifically geological fieldwork in the America West shaped American science more forcefully than many of its counterpoints. As paleontological discoveries grew more impressive and personalities like Ferdinand V. Hayden and John Wesley Powell began exploring and publishing their adventures into popular presses, the American public and congress began to take interests in what was becoming a truly American phenomenon.

Powell soon moved up (over) to the new Bureau of Ethnology and began field collecting similar to Catlin's original mission to preserve the vanishing race. Hayden and Powell began a rivalry in the USGS that was continued by their students Edward Cope and O.C Marsh, respectively. The Bone Wars were the most explosive (literally) period of American fieldwork and collecting filling museum collections to bursting of fantastic beasts and enormous bones from America's past. Their feud grew bitter and the accounts of sabotage and personal attacks played out in American newspapers. The entire affair came to a head on the congressional floor with appropriations being pulled from Marsh and the USGS over what congress deemed

frivolous expeditions to find "birds with teeth." Cope was one of the last personally funded men of science while Marsh drew from his uncle Peabody's patronage. The latter set precedent for funding expeditions throughout the Gilded Age and then the progressive era.

With congressional monies drying up, it fell to the newly minted American aristocracy to foot the expeditionary bills. Andrew Carnegie attempted to privatize world peace before the outbreak of the Great War by providing all the major European museums with casts of *his* dinosaur—the diplodocus. J.P. Morgan fronted hundreds of thousands of dollars to Henry Osborne at the American Museum to fund Roy Chapman Andrews' fieldwork in the Gobi Desert. After decades of federally funded expeditions, from the U.S. Ex Ex to the U.S. Mexican Boundary Survey to the Pacific Railroad Surveys, the turn of the 20th century saw a return to private enterprise funding fieldwork for new university and museum specialist in the same form that Humboldt and Prince Max were part of a century before.

Fieldwork and collecting shaped the development of modern science just as it was shaping the American West, mapping the Pacific Islands, and following Venus across the sun. It took men like Joseph Banks to pay his own way for early expeditions before their success influenced governments that there was much to be learned beyond coastal mapping and port soundings. Understanding tides meant spending time on the coast, just as understanding the heavens meant nights at the telescope. Artists and scientists both accompanied major US government surveys west, in many cases the two titles may have belonged to one individual. What fieldwork and collecting meant to American science was authority from being on site and an authenticity in the reports of the West, or the South Pacific, or the borderlands. While much of the adventures were carried out in order to better understand nature, or the world, or to improve

transportation, scientific expeditions, fieldwork and collecting most often echoed Joseph Banks' 1769 entry "to disprove that which does not exist but on the opinions of Theoretical writers."