Susan lecture notes (Feb. 24)
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The Heyday of Natural History

A time when a number of important factors come together to make "doing science" something that a growing number of people considered important—and considered something they would do—

Technology—changes the way people live and work, and applies science to industry. Some of the most innovative science came from dissenters—those outside the Church of England, who were not able to attend Oxford (where the emphasis was entirely on what we would call the humanities) so they were educated elsewhere and learned science—with a particular emphasis on how it might be applied to industry and business. Because dissenters were almost entirely middle/working class—they were not aristocracy. They were not the landowners, but the factory owners. The compound microscope came into common use—and became a source of entertainment. An "evening with the
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microscope" was a fashionable form of after dinner entertainment."

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Empire—As the empire spanned the globe Victorians were introduced to a plethora of plants and animals, to vastly different geography, and they were of course curious about all of it. So, Darwin's Voyage of the Beagle, Wallace and his voyage, people traveling and bringing/sending back all kinds of specimens

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to be classified. The Crystal Palace—where things from all over the world come together for the first huge worlds fair.
And each discovery of some new species would be written about in the press, and readers followed the stories avidly. "toucans, bird-eating spiders, giant tortoises, moon moths from Java, the Victoria Regia waterlily, which was so large it had to have its own conservatory built to house it—an endless supply of new wonders –and when the supply seemed to wane, something new would be found—in 1861, e.g. it was the turn of the gorilla—an animal whose

existence had been rumored, but never previously seen. –things like the giant panda—And some of them ended up on display at the London Zoo.

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Wardian Cases (picture)—surgeon named Nathaniel Bagshaw Ward. He put a chrysalis in a corked bottle, and when he came back next spring, he noticed seedlings alive in the bottle. –accidentally discovered the way a terrarium works. Plants ferns that way, and then the cases begin being commercially manufactured. Before this, it had been almost impossible to bring plants over a long sea voyage. Wardian cases started a fashion for growing ferns in them

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(Pteridomania). A huge fad. Then, aquariums--. One feature of both the fern and aquarium crazes was that they were almost entirely sustained by women. Women also became illustrators of natural history. It was considered suitable for a woman to draw/paint plants and animals. **Pictures from women Slides Slides 7-10**

illustrators. Women also became well-known as collectors.

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Mary Anning, e.g. was a fossil collector from the time she was a child—although she had not training and was barely literate, she found many fossils, supporting herself and her mother from the time she was 11 selling mostly ammonites to tourists. She found the first British ichthysaur, a plesiosaur, and a pterosaur. Others made their reputations from her work—But visiting the V and A, you can see her picture and some of her finds.

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But Ward's discovery also had important implications connected to the Empire. They made it possible to transport plants from anywhere in the world. Kew Gardens built and used them to find plants for economic gain—and it was the Wardian case that brought tea from China to Kew—and then to India.

Reading—with inexpensive publication (technology) comes the ability to share all kinds of ideas, and Victorian middle class was a large and growing reading public, and they read all kinds of things. Some of the natural history books they read were pretty thin science, but they were hugely popular, and the more prestigious, but still for general public magazines, published articles about science and theory. The Royal Society published its members' work and had an influential audience as well.

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Naturalists like **John James Audubon** (*Jean-Jacques Audubon*) (April 26, 1785 – January 27, 1851) was a French-American naturalist and painter. He was notable for his expansive studies to document all types of American birds and for his detailed illustrations that depicted the birds in their natural habitats. His major work, a color-plate book entitled *The Birds of North America* (1827–1839), is considered one of the finest ornithological works ever completed. Audubon identified 25 new species and a number of new sub-species.

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For pre-Darwinian naturalists, finding and describing new species was the ultimate thrill. Audubon wrote to his friend, Richard Harlan: "I reopened my letter to say I have just now killed a large new falcon, yes positively a new species of hawk, almost black about 25 inches long and 4 ft broad tail, square eye yellowish white, legs and feet bare short and strong—I will skin it!!!"--59

There is also a complicated, reciprocal relationship between scientific discovery, technology, industry, economy, and a world that seemed to be changing very rapidly and long held religious belief.

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While the 19th century saw a tremendous expansion in the number of books published on natural history, they idea wasn't new. In 1789, Gilbert White (a clergyman) published *Natural History of Selborne*, which was certainly an important source of inspiration for every Victorian amateur naturalist, although its popularity can't really account for the increase in interest.

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-William Paley's 1802 book, *Natural Theology, or Evidences of the Existence and Attributes of the Deity*, would have been in many, many middle class Victorian homes. In it, --and at unbelievably tedious length, he sets out some very common Victorian beliefs about the value of studying natural history—and it had to have some purpose—so that it became rational and useful activity. And many of the popular books about natural history began with prefaces that noted its value—as useful, moral, and enlightening. So, back to Paley—his is an early book, and he notes that whenever one examines a plant or an animal, one would find it possessing various structures or functions that enable it to survive and propogate (sound familiar)?—but not, certainly in a Darwinian sense. No.

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He argued that the first purpose of the study of Nature is to teach us that God exists. The second is to illustrate God's attributes. His analogy—to a watch. Just as we see the watch and how it works and admire the skill of the watchmaker, when we see something, say a plant, animal, shell, etc. from the natural world, we are inevitably led to think about the perfection of its designer —God. He argued that nothing happens by chance—everything happens by design. The more one learned to understand and appreciate design in nature, the more one approached a knowledge of God—therefore, the purpose studying Nature was spiritual. This was called "Natural Theology."

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There were many, many popular books about natural history during the 1840s, 50s, and 60s. They outsold popular novelists, *Common Objects of the Country*, by the Rev. J.G. Wood sold 100,000 copies in a week. (Barber 14). The writers of these books were often pretty fast and loose with actual scientific fact, filling them with often repeated (and accepted) myths about animals and plants—and completely anthropomorphizing animals—e.g. birds "homemaking" and even things like moss—"one of those cheerful, humble things"— They were also very concerned to find "goodness" in everything created. So, something that was seemingly "not good' required some interpretation. And, since most animals care for young—that was a universal "good." They gave their books titles that caught public interest: *Marvels of Pond life, Wonders of the Sea Shore, The Romance of Natural History*. They often quoted poetry (sadly often their own),

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Charles Waterton—Published a book (1825) and then a tremendously popular series of essays in 1857—about his adventures as a traveler and naturalist in South America (shades of Wm. Adamson). *Wanderings in South America***.**

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Another unlikely natural historian—Hugh Miller—a stonemason who became a geologist, almost by accident while he worked in a quarry and noticed the waterworn stones embedded in layers of sandstone. He found fossils as well. He worked in the quarries for 15 years—buying and reading books about rocks and fossils. He was looking for some explanation of the fossilized fish parts he was finding. He wrote—a book of poems, a collection of Scots legends, and then *Old Red Sandstone* which told of his geological findings and ideas. It became a best-seller, probably because it was very well written. He defined geology as "natural History extended over all ages." He continued writing and publishing. In *The Testimony of the Rocks* in 1857 he argues that the earth is much older than the biblical 6000 yrs, but that "geology, rightly understood, does not conflict with revelation" and goes on with some imaginative explanations for the biblical accounts. His *Footprints of the Creator* didn't draw tremendous attention until Darwin published—and then his *Footprints* became a touchstone text for creationist arguments.

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One Victorian very well known in his own time, but not now, was Frank Buckland. He was the perfect intermediary between amateur and professional scientist, wrote regularly for popular Natural History journals, was an avid, interesting speaker, and he knew almost everyone in the field. Most liked him very much (not Darwin who thought him crude). One of the more interesting aspects of his study was what he called "Zoophagy" the study of animals for human consumption, and he really tried almost anything. (and this is typical I think of Victorian emphasis on "usefulness" and certainly on humans as center of all:: From Barber, "[Buckland] institutionalized it. It all began with the 'Eland Dinner', held in 1859 at the London Tavern, when all the braver naturalists assembled to see if they thought eland should be introduced to the national diet. This occasion was not organized by Buckland but by Professor

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Owen who, after the meal, gave a speech about 'the benefits which would accrue to us by naturalizing animals from foreign parts, animals good for food as well as ornamental to the parks." He hoped " that we might one day see troops of elands gracefully galloping over our green sward, and herds of koodoos and other representatives of the antelope family which are so numerous in Africa, enjoying their existence in English parks, and added to the list of food good for the inhabitants of not only England, but Europe in general."(147)---the president of the London Zoo said that although the zoo had not enough, there were "plenty more elands in South Africa, to be had for the trouble of importing them" and he "trusted that this subject might be taken up by those who had convenient pasture-ground for them in England, and would be patriotic enough to further the important cause of the acclimatization of useful exotic animals in English parks and homesteads."

The term "natural history" had a different meaning to the Victorians –and the meaning changed over the century. According to Lynn Barber, *The Heyday of Natural History,* "in the early decades of the nineteenth century, it still theoretically meant the study of the three kingdoms of Nature, animal, vegetable and mineral, and therefore included geology, as much as botany and zoology, in its purview. It was in this sense that Charles Darwin described himself, accurately and sufficiently, as a naturalist, and it was precisely because he did include geology and paleontology in his researches that he was able to arrive at the theory of evolution by natural selection. Until the 1860s (at least in England), the term "biology" was new. Until then, the term "naturalist" could apply to anyone from Darwin to a Sunday afternoon bug collector. There were journals with articles –most submitted by amateur naturalists, a huge correspondence between people with similar interests, and specimens were sent through the mail.

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Richard Owen was a major figure, a "closet" naturalist who was recognized as the leading authority on zoological or paleontological classification. Began working in the Museum at the Royal College of Surgeons, cataloging the Hunterian Collections which were housed there. He moved to the British Museum, taught, and wrote. Perhaps most famous for identifying the New Zealand Moa—a huge flightless bird—and constructing what it looked like from a large bone. He was mocked for the idea, but in 1843 Owen received a huge box of huge bones from a missionary—and the skeleton matched his

description—He became famous for his paleontological work. In fact, he constructed a series of life-sized cement models of extinct animals for the Crystal Palace gardens in Sydenham.

All kinds of people were engaged and interested in the study of natural history, which was not taught as a part of normal education. "Queen Victoria learned only in middle age that kangaroos carried their young in pouches, and some of her courtiers were quite astounded by the news that tadpoles turned into frogs" (16).

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All of this –evenings with the microscope, museum visits, collecting came under the heading "rational amusement" not just ordinary amusement like reading novels or going to the theater. It was useful and moral—and scientific as well.

Slide 31 South Kensington Museum (now Victoria and Albert)

A divide—between the field naturalist—one who observed species in the field —and the "closet" naturalist—one whose interest was primarily in classification of species. They actually had very little contact with each other—and this led to some huge errors—this from Barber's book where he writes about:

"the famous case of the legless Birds of Paradise which arose because all the first Birds of Paradise sent to England had their legs cut off to facilitate packing. Leglessness thereupon became enshrined as a characteristic of the species, and popular writers went into rhapsodies at the thought of the little creatures spending all their lives in the air. Only the eventual arrival of a Bird of Paradise complete with legs put paid to these ethereal fantasies." (40)

Audubon was unusual as a field naturalist who both found new species in the field and published about them himself. Most field naturalists simply handed their finds over to some acknowledged "closet" naturalist expert to publish.

--What did most Victorians believe about Nature?

At the beginning of the 19th C, many laymen, and even scientists, believed that the earth and all the species on it had been created in 6 days. They even knew the date, thanks to the chronology worked out by Archbishop Usher: Toward the end of October, 4004 B.C. Usher added together all the lifespans of the biblical geneology. As further proof—referred to images on Egyptian pyramids showing the same animals we know—and the pyramids were 3000 years old.

By the 1840s and 50s, this was more and more difficult to maintain. Serious debate about the age of the earth—in fact, it was the age of the earth debate that caused the most anxiety. For the amateur naturalist and popular books about it, the real question was: Why had God created so *many* species—what was their use? They couldn't imagine that God hadn't created everything for human's use. And, in fact, why do some seem quite harmful to humans? --So that's one question, but an even bigger on was the problem posed by fossils. Hugh Miller—amateur, but really interesting geologist—Miller asks—"But, why so much beauty when there was no eye of man to see and admire? " By the time he wrote *Testimony of the Rocks* (1857) he had found an answer. The geological ages before man were a kind of practice. –the earth became more and more man friendly and then, here we were.

One can see, then, how problematic would be Darwin and Wallace's theory of natural selection—that random traits that make organisms more easily survive=they pass on those traits=evolution. That it's not purposeful—real problems.

"Society must fall to pieces of Darwinism be true." Family Herald, 20 May 1871

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Huxley and Wilberforce pictures:

So, it is in the Victorian era that natural science pushes against a strong and deeply held set of beliefs about the world—about the earth itself and human's place on it—that perhaps it isn't a hierarchy with man at the top of the natural world, and god at the head of all.

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In Matthew Arnold's "Dover Beach"—recognition and deep sadness for the passing of an age of faith.

The Sea of Faith
Was once, too, at the full, and round earth's shore
Lay like the folds of a bright girdle furled.
But now I only hear
Its melancholy, long, withdrawing roar,
Retreating, to the breath
Of the night-wind, down the vast edges drear
And naked shingles of the world.

Finally, in Tennyson's "In Memoriam,"---a struggle to come to terms with the seemingly arbitrary world he has to acknowledge:

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From *In Memoriam*

LV
Are God and Nature then at strife,
That Nature lends such evil dreams?
So careful of the type she seems,
So careless of the single life.
. . . .

LVI
'So careful of the type? but no.
From scarped cliff and quarried stone
She cries, "A thousand types are gone:
I care for nothing, all shall go.

Who trusted God was love indeed
And love Creation′s final law
Tho′ Nature, red in tooth and claw
With ravine, shriek′d against his creed