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Sir Hans Sloane: 350 years of preserving history Transcript

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Aristotle: Hero or Villain?



Aristotle's Chain of Being

Sir Hans Sloane: 350 years of preserving history

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I intend to summarise the changing perception of biodiversity through time, with specific focus from the period between 1660 and 1750, because this year is the 300th anniversary of the birth of Sir Hans Sloane, the great collector. I will also discuss how biological collections and the legacy that we have from these learned people of the past are still useful today. They will also be useful in the future in the context of natural history collections, some of which I am partly responsible for.

Everybody thinks about the natural world because they eat it. People from early times recognised that things were different. It is useful to know that, if something belongs to the potato family, the leaves are poisonous if eaten, whereas something else is not. People have always had to be conscious of the diversity of nature. It has always existed, but sometimes it has had practical application. However, the actual thinking about nature in a more abstract sense, rather than being necessary to stay alive, was done mainly by the Greeks. The Egyptians had some interest in the natural world but this was usually for medicinal reasons and very much controlled by religion – a constant theme.

My title is “Aristotle: hero or villain?” Aristotle certainly described the natural world, and he made the first and the earliest attempts to classify biodiversity into different groups, some of which we still recognise. His theory was a great chain of life. Aristotle’s great chain of being develops from lower life forms to humans and then to deities. The tree of life is something that is mentioned in modern times; there is discussion about how things are related through the past, so while Aristotle may not have shared our reasoning, he had a similar structure. He organised biodiversity. He was a hero in the sense that he was one of the first people to think about natural history; to describe it, quite accurately sometimes; and probably to collect it. While it cannot be proven that he was a collector, it is known that he was tutor to Alexander the Great, who brought him things back from his new lands that he had invaded. Many kinds of new things were coming back to Aristotle’s Mediterranean world, and that is what he was actually describing – it was the world of the Mediterranean, and that is when he becomes the villain. Developments in biodiversity stagnated for hundreds of years.

During the later Greek times and the Roman times, people took an interest in natural history - mainly for practical purposes. The Romans were very interested in medicinal plants, for instance, and that idea of plants particularly being used for medicine goes right through history, as does the study of botany.

The Renaissance saw the next major developments in the study of biodiversity. People began to think about communicating and describing the natural world. They would write down what they saw, print it and turn it into a book.

Conrad Gessner described the natural world. He produced “A History of the Animals” in which he described the world. However, he was describing Aristotle’s world. The things in his “History of Animals” were everything that Aristotle had mentioned, or would have known. It also included beings which Aristotle thought he knew so the book included all kinds of things including mermaids and unicorns.

I include Gessner because he was communicating his ideas on diversity. He was part of a network of information exchange. For example, if he described a particular seashell or marine organism, he wanted to check with somebody else by writing to them. This exchange of information and ideas is how science operates today

The second thing about Gessner is that he recognised the importance of having a collection of real things. Having the actual objects helped him to accurately show beings to other people whereas drawings or descriptions were less effective. This is an early recognition that real things are important in understanding and describing the natural world. This idea has remained fundamental ever since, although there is clear bias on my part, seeing as I manage seven million things, in a bigger collection of 77 million things.

I also think that Fuchs was important. He was one of three great German botanists of the time who were all medical people and interested in describing medicinal plants accurately. Herbal medicines had been around for a long time. People had described plants that might be useful in medicine and drawn them. These drawings would be copied continually and eventually distorted so it looked like something completely different, which could be fatal. Therefore, the importance of accuracy in drawing was very important to people like Fuchs, so he had a team of very good illustrators, which he presided over and watched all the time. There was a lot of quality control which was another way of accurately communicating information on biodiversity.

Luca Ghini was a Professor of Medicine and Botany at the University of Bologna in the 16th Century. He is recognised as the first person to create a herbarium or a known herbarium (a collection of dried plants as a reference set) from the Botanical Gardens in Bologna. He used it partly as a catalogue of what was in the garden, but also as a teaching aid when instructing medical students. In this way he preserved biodiversity and then used it to teach other people.

Aristotle the villain had effectively limited progress for nearly 2,000 years. The church would only allow the

Aristotelian view. It was very dangerous to actually step outside it. However, big changes were happening in Europe in the 17th Century. People such as Sir Francis Bacon saw things in a different way, as did Rene Descartes, who said, "Why do we have to keep repeating what Aristotle thought? Why can't we go out and think for ourselves?" They wanted people to look and observe and carry out experiments, and work out for themselves how the world worked. This was better than merely copying what Aristotle had said 2,000 years previously and merely repeating it with increasing accuracy. Bacon was a keen experimentalist - he was also a statesman - but he also was a philosopher of science and natural history.

He carried out one experiment, which killed him, involving a chicken. He did an experiment to see whether chickens could be preserved to eat later by putting them in ice and freezing them. This was a perfectly reasonable thing to think about, so he carried out the experiment and ate the chicken. However, the chicken had not thawed out properly and Bacon was presumably poisoned by salmonella and died.

By the 17th Century, there was a new school of thought. People such as John Ray, the English Aristotle, a puritan teacher, who was a Professor at Cambridge, described the natural world, primarily, but not exclusively plants, with his friend Willughby. Ray was very interested in classifying things, but not classifying things by one or two simple characters, which had been done in the past. He used a few of what were believed to be the essential characters of a flower. He thought everything should be examined - the length of the leaf; the number of hairs; and the number of petals - amongst other characteristics. Once that information was collated, there was a better approximation to real relationships between things. He also, quite cleverly, came up with this idea of a species. The unit of biodiversity that scientists often use is a species, and he believed that if things reproduced and brought young which looked like themselves they were probably the same species. If they did not, or could not reproduce at all, they were probably not the same. He had some early ideas, which were not completely wrong, and described the plant world in his *Historia Plantarum*, which is a fantastic work except that it is not necessarily very practical when it comes to identifying and looking at things.

The 17th century was a time when people were bringing things back from newly discovered lands in a similar way to Aristotle and Alexander. Before this time, people had shoehorned them into Aristotelian descriptions. Aristotle's world was the Mediterranean world; therefore something that looked like a lion was classified as a lion even if it was not. During Ray's time this system was no longer viable so scientists had to find better ways of classifying beings.

Ray's life story is quite long and sad, in many ways. He lost his professorship at Cambridge, because he was a Puritan, in 1660 during the Restoration. He refused to sign a covenant saying that he would revoke his previous ideas and join in with the Church of England. He felt that individuals should not be forced into making such statements, so he had to leave his post, and struggled for quite a long time, but still produced some fantastic work that's still useful to this day.

A friend of Ray was Hans Sloane, the great collector. He lived for 93 years and was born in Northern Ireland in a small village, Killyleagh, where he was the son of a local landowner of Scots origin. Sloane, as a boy, was a very keen natural historian. He went around foraging on the shores of Stanford Loch, near where he lived, looking at and examining things. He thought this was very interesting and adored the diversity of the natural world even when he was young. He got the opportunity, through poor health, to be sent away to London. He was trained by the apothecaries, in the Apothecaries Garden, which later became Chelsea Physic Garden, and became a physician.

Then, he had as fantastic an opportunity that a young man could get. He was a physician and also an enthusiastic collector and naturalist. He was appointed as the Physician to the Duke of Albemarle, Monck, who was the son of the famous General Monck, who switched to the Royalists about 1660. He was the new Governor of Jamaica - so Sloane went to Jamaica, via Madeira, collecting things, looking at things and writing down any information. He described not only living things - flies and things that landed on the deck of the ship or interesting nauti-life floating by the water - but also seasickness. He examined the symptoms of seasickness and their effects on different people.

When he got to Jamaica, he was able to go out collecting, particularly as the Duke of Albemarle died and he only had his wife to administer to, so he had lots of spare time. In the 18 months he was there he wrote up his findings in "A Voyage to Jamaica", which is published in two volumes. Not only did he describe all the plants and animals he saw in Jamaica, in good detail, some of which can still be useful to this day, he also described their practical application - their context, value and other characteristics. He thought that the world was there for humans to use, as had Bacon and Ray. He looked at new medicines while he was there and looked at how the native people were using different plants.

There are some wonderful illustrations in the book. He tried to bring a lot of these things back, - including a snake which escaped and was thrown into the sea, and various other things which failed to survive. He made extensive botanical collections, and these are now housed in the Natural History Museum in London. Again, he thought a specimen was needed to show what something actually was.

I love the *Theobroma cacao*. It is an icon associated with Sir Hans Sloane and it is a type specimen. If a scientist names a new species and describes it, the actual specimen the description was made from is called a type specimen. Linnaeus called this *Theobroma cacao*. The name of *Theobroma cacao* can only be used for something

that looks like this. This is a very important concept that botanists use to ensure that there is global consistency and no confusion.

Furthermore, it is evidence of what grew in Jamaica over 300 years ago. This is important because we know the environment changes. It is very useful to be able to see whether things still grow where they used to grow. Therefore, this specimen is an example of the five million plants in botany – they each give an indication of which plants grew in what areas at what time and therefore are a model of biodiversity for the last 300 years which is still being increased.

Finally, Sloane saw native people drinking chocolate. He did not like it very much – he thought it was bitter, so he mixed it with milk and sugar and boiled it up and produced this drink. He thought this was a big improvement so he brought it back to the UK as a medicinal drink for biliousness similar ailments. The recipe was sold on and he made a lot of money. The recipe was sold on - eventually to Cadbury's.

The famed Vegetable Lamb of Tartary does not look especially like a lamb that we would recognise nowadays. It did look more like a lamb many years ago but unfortunately it has lost a lot of its wool. The idea is that there was a plant which grew in Tartary, which is in the Far East of Europe which, instead of a flower, grew a little lamb. The little lamb broke off and grew into a sheep which became the Vegetable Lamb. Sloane was sold this 'real vegetable' by the Royal Society. He compared it to his existing collection of plants which was fairly extensive and decided that it was very similar to a Chinese fern. This example shows how Sloane used the collection as a reference point. Instead of rushing to name something, or take something on trust, he referenced it to see if he already had something similar.

James Petiver was one of Sloane's contemporaries. He was one of a number of people who were members of the Temple House, the Temple Coffee House Botanical Club; a group of people who had an interest in botany, who were interested in collecting new plants, especially from the New World. The Bishop of London was a member as was the Queen's Botanist, Leonard Plukenet, a pompous man who Sloane did not like, and it is very interesting reading the critical remarks they make about each other which were attached to the specimens. It is interesting that butterflies from Petiver's collection were preserved in little mica sheaves rather than being pinned, as with a modern collection. Petiver also was an apothecary rather than a physicist, so there was a class issue and he always felt he was mistreated due to class reasons and this may well be true. Plukenet, on the other hand, was prone to describing every new plant he saw as a new species to improve his reputation. He did not compare them with existing things, so was probably giving different names to 10 things which were all the same. Sloane regularly criticised him for this, although Linnaeus liked him because his collections were tidy, whereas Petiver's, despite being better described, were a mess. In some ways I find Linnaeus highly irritating and this demonstrates why.

William Dampier was a privateer. He circumnavigated the world three times, and whilst on one of his voyages to the Far East, he was chased by the Dutch East India Company, of whom he was the scourge, and ended up on the north coast of Australia. He became the first European to collect plants, rocks and other things on the north coast of Australia, so he is very significant. His collections are good and his *New Voyage around the World* is an excellent read. It is a bizarre mixture of descriptions of plants, animals and whatever he was doing. Also, Dampier is a good example of dedication in botany because when his ship finally fell apart in the Atlantic, he managed to swim ashore, clutching his coat, his notebook, and his botanical specimens – he knew what was important!

We send 16,000 specimens from our Department out on loan every year all around the world, for scientists to look at and to do research on. We generally receive them back and we lose very few. In those previous centuries it was far more difficult to return things home with the dangers of pirates and of maritime travel in general. The value of these specimens is enormous, not just because they are useful for science, but because people risked their lives and lost their lives in pursuit of collecting these new things.

Mark Catesby was another person sponsored by Sloane to collect in the Americas and the colonies. He carried out surveying for the Governor of Carolina because they wanted to know the quantity and quality the resources they possessed, primarily for economic reasons. In the history of biodiversity, Catesby is important because he recognised the relationships between plants and animals. He portrayed birds, animals and plants in their actual associations, not as separate things but as part of a whole. He also observed, from his travels, that the number of species were fewer the further north he travelled, which is correct, and speculated on the reasons for this. He also had historically important relatives namely Robert Catesby, the leader of the 1605 Gunpowder plot, who was his great-grandfather.

When Linnaeus met Sloane they did not have a very good relationship. Sloane was quite old by this stage and quite socially difficult while Carl Linnaeus was probably quite arrogant. However, Linnaeus did look at a lot of Sloane's specimens, gave them names and described them. Linnaeus introduced the naming system and the list, but his primary aim was to find a way of classifying things which was quick and easy. John Ray and Sloane would describe things and give them a long phrase name or polynomial. It would have been very difficult to maintain this system with all the new things coming back from the New World. Therefore, he came up with his sexual system, which upset a lot of people at the time and used sexual characteristics. Rather than the vast set of characters which Ray used, he used a smaller set, a sub-set. This system was much better and it helped at the time.

However, it did not survive, and rightly so, because what it did was put things which were not genuinely related to each other in different families. Linnaeus' system would put things which had some similarity in separate families, so it did not show how they were related. It was merely a system for pigeonholing things.

However, the naming system did survive because Linnaeus reduced the names to simple two word things here: *viola*, the genus; *canina*, the species. It is very simple, it works, and it is still used in modern times as nobody has yet come up with any improvement. It can sometimes be a bit of a hindrance because things have to be named formally, and if there are 18,000 new species of nematodes from a dredge, going through the whole process of naming them all is quite tricky.

Sir Joseph Banks travelled with Captain Cook on Cook's first voyage to Australia and New Zealand. Banks collected extensively on that trip and brought his material and illustrations back to the UK. He had Sidney Parkinson, an artist, and a team of artists, actually drawing things as they were in these new places as he recognised the importance of accurate pictures. It is excellent to have those today, but they weren't printed properly until 1981. Banks was very much an entrepreneur and landed gentry as well. Whereas anybody could do natural history in the 18th Century, there was a shift away from the apothecaries and it became more exclusive. Banks was incredibly enthusiastic. He went on this voyage, and came back as a promoter of science. He was not a great naturalist or scientist himself, but he promoted scientific expeditions and promoted things to do with natural history, particularly things which were to do with the wealth and success of the British Empire.

Banks recognised that the breadfruit, which he had seen in Tahiti, might be a useful food for slaves in the West Indies. This idea actually failed because the slaves would not eat it.

He proposed bringing tea from China to India, which meant exporting from a country in which there was no control, to India, where the East India Trading Company did provide order. In order to do that, he consulted botanists, like Broxburgh and others, who knew about Indian plants, where they grew and what kind of soils they grow in. He gathered information, and then came up with various proposals.

I shall finally discuss the state of biodiversity today. I have just described the collection of biodiversity and its description over the years; all the different individuals involved in progressing the study of biodiversity who left us with this fantastic legacy of objects, collected from all over the world. Many of the environments from which these objects were collected no longer exist. The fossil record includes things that were collected which lived thousands and even millions of years ago. These collections have become a database of time and space. It is a broad spectrum of different forms of the same plant. If one is thinking about attempting to classify things, it is very difficult to do that if there are only one or two things. It is difficult to work out that they are different or not because a wider comparison cannot be made. If there are ten, then there is a wider variety which makes it easier to draw conclusions. The more information is collected, the easier it is to make sound assumptions about classification. The business of the Natural History Museum, and many other big natural history museums in the world, is primarily systematics – the description of the natural world with naming, classification and working out the evolutionary relationships.

In the 19th Century when evolution was considered, people started looking at how time came into that equation, and how things had evolved through time. The fossil record and fossil specimens were a very important part of that story.

For example, seaweed called *padina pavonia*, peacock's tail, was collected by the Essex naturalist, Reverend Buddle in Great Yarmouth. The current distribution of *padina pavonia* is from Cornwall up to the Isle of Wight. In the 17th Century, it was present round the East Anglian coast. These are many other examples of how things have changed, and working out how things have changed in the past does help us to think about how it's going to change in the future.

So we feel that it's worth investing in collections. This is part of the Darwin Centre in the Natural History Museum. These cabinets are full of plant specimens. This is half of the five million we have, all actively used by scientists, mainly for systematics, but increasingly for other things. Some people still debate in this era whether we actually need the collections or could just scan them. However, it is not possible to extract DNA from an image, nor is it possible to carry out electromicroscopy on an image. Increasingly, scientists are able to dig deeper into specimens, even the old ones like this, in different ways. We are able to extract DNA from old historical specimens and we do that with increasing frequency. Better techniques are also being developed. In this way, we are getting even more information about the past and more accurate classifications. If things look very similar, DNA is often the only way they can be separated. We can also obtain an idea of how genes were in the past, how populations have changed, and start to ask questions such as about why they have changed and why particular gene strains have died out.

Although the people can be the jury, I believe it is worth spending money housing 77 million things; making sure they last for another 300 years by maintaining the environmental conditions; spending money on curators to look after them and make sure they're still useable. We are creating new collections all the time and not just relying on those old collections. We have collecting expeditions, research projects to bring in specimens because they are evidence, and also we have been increasingly growing collections of DNA and samples specially taken for DNA and held in liquid nitrogen. They are the modern collections. They sit alongside the traditional collections, which still have a lot of value, but these new collections enable us to do all kinds of other things that we can't

necessarily do with the old ones.

I would like to end on this comment, which Wallace, Alfred Russell Wallace, made about the history of evolution and the early theories of evolution. He said: "It is therefore an important object which government and scientific institutions should immediately take steps to secure, that in all countries, the most perfect collections possible, in every branch of natural history, should be made available for interpretation. If this is not done, people of future ages will certainly look back upon us as a people so immersed in wealth to be blind to higher considerations."

Therefore, I would like to think that Sir Hans Sloane, who created this fantastic collection of 400,000 objects, and wanted them to be used, would be happy to see all the unimaginable ways that those collections have been used today, which he would never have thought of, but I think he would be proud. He would be proud that we are using them to solve problems which affect everybody.

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