The Limits of History: Crash Course History of Science #46

Crash Course: History of Science
https://youtube.com/watch?v=EhBhP-zk0_I
https://nerdfighteria.info/v/EhBhP-zk0_I

We started this show by asking, what is the history of science the history of? And we answered that question in short with "knowledge-making." We then went on to explore a lot of different kinds of knowledge-making at different places and times, from Ancient Greece and Mesoamerica and India, to medieval China and Europe, to outer space during the Cold War, and corporate R&D labs today.

But remember that everyone makes knowledge about their worlds all the time. It's what humans do. Dogs eat shoes. Cats turn their butts up at you. And humans ask questions about patterns they see in the world around them, in their societies, and in their own heads. Unfortunately, we haven't been able to tell all of the greatest stories of the history of knowledge-making because we have limited time. And more importantly, because there is no one list of the greatest stories.

So let's get meta: this is the future... of the history... of science.

[intro]

Doing history involves making choices about which events could be seen as "history," how to tell the stories of the people and non-humans involved in these events, and from whose perspective to speak. Perhaps, at first, this might seem simple: aim for something called objectivity, or neutrality toward opinions. To stick to the facts.

Even though we'd love to adopt a purely objective stance, we can't do that. We can't speak every language, we don't know every fact, and neither does our audience. We can do our best to stick to the facts, but choosing which facts to highlight in a short show gives away something about us.

Like, hey there, Allison! Hey, Wythe! Allison is the consultant, and Wythe is the writer. They did most of the fact-picking on our show. So how did our team choose which stories within a given chunk of history to highlight? Well for one thing, we read a lot, and we asked our colleagues. But for another, we focused on stories that were fun to read aloud and to bring to life visually. We threw in some stories you may have heard before, like the absolute amazing-ness of Marie Sklodowska Curie. And we did throw in a few stories as well that we're pretty sure you had not heard, like the Miltini.

But we also threw in stories to challenge a simplified heroic version of the history of science; we talked about science and empire, science and race, science and war, science and corporate greed, and science and planetary devastation. Science, it turns out, isn't all about lone hero knowledge-makers, but about complex systems of understanding and controlling the world- systems that aren't always moral or just, by present standards.

We've also specifically highlighted women in science throughout this show, and that's not only because, as you really should know by now, there are so many rad woman in science. But it's also because, historically, they've been under-represented, ignored, or ridiculed. Like remember, for example, Jim Watson calling pioneering crystallographer Rosalind Franklin "Wilkins's assistant?"

And of course we left out so many, and we know it. We've had to cut whole fields of science. And we haven't always been able to provide modern updates regarding sciences that we mentioned in earlier centuries. So before we call this little experiment of ours finished, let's give a last shout-out to a few folks we haven't mentioned who have been more recently making it into history of science narratives.

For starters, we could have covered more chemists, post-phlogiston theory. Like crystallographer Ada Yonath, who won the Nobel in chemistry for the structure of the vital cellular machine called the ribosome. Or Stephanie Kwolek, who invented the first synthetic extra-strong fiber, Kevlar.

And we could have talked more about the Earth sciences after the acceptance of fossils. Geographer Marie Tharp's maps of the ocean floor led to the acceptance of the theory of plate tectonics, which is a wild story that we feel terrible about having to cut.

We talked a good bit about biologists, but there are so many more. Molecular biologist Elizabeth Blackburn, for example, who won the Nobel for her work on telomeres, the end bits of chromosomes that protect the rest of the DNA. Telomeres are seen as vitally important to the study of why humans age and how we might live longer. There was even an X-Files episode based on her work! That's how you know you've made it in science.

Also, there has been a development or two in astronomy since we figured out the heliocentric nature of the Solar System. Dame Susan Jocelyn Bell Burnell co-discovered the first radio pulsars in 1967, and was the first person to observe them, but was excluded from the Nobel.

And we've read the comments and know that there's a strong interest in the history of mathematics, so how about acknowledging the contributions of African-American mathematician Katherine Johnson. Johnson calculated critical orbital mechanics for NASA that were used for the first manned space flights. Being female was only half the discrimination she faced. Or Karen Sparck Jones, who pioneered the intersection of computer science, statistics, and linguistics, teaching computers how to understand human language and providing the basis for search engines.

And we can't leave out non-binary or trans scientists, such as trans evolutionary biologist Joan Roughgarden. She published revolutionary work challenging long-held ideas about sexual selection, one of the mechanisms of evolution, and forwarding a new idea of social selection that better explains many animal behaviors.

All of these people could have had whole episodes devoted to their work. But until recently, historians have generally been pretty bad about representing women, and many other people who happen to not be white men, as awesome at science. And representation matters, a lot. If "scientist" always seems to mean "white dude" in a given culture, then you probably won't see as many women of color going on to become astronauts, heart surgeons, or billionaire app developers. So, in a way, hero narratives can serve an important purpose. They help us meet new kinds of heroes, allowing more people to see themselves as knowledge-heroes-in-the-making.

But we need to be careful to recognize the many people involved in creating knowledge. And the flip side of telling clear, heroic stories, however inclusive, is that the history of science isn't perfect. Because all sciences are dynamic tools, not perfect, unchanging wisdoms. And because scientists and historians are people. Remember Newton? His model of the world wasn't quite right beyond a certain scale. The anomalies just kept piling up. And then, physics changed. That is, how to do science changed. And Enlightenment natural philosophers repressed Newton's alchemical work until historians in the twentieth century made it public again. That is, how to do history changed.

So while the history of science as a professional discipline began as a list of Great Dead White Dudes, it's changed a lot over time. Today, we talk a lot more about knowledge systems outside of the tradition of science-that-is-called-science. Which, remember how the word 'science' is only two hundred years old, anyway?

And yes, some people think of history as one of the humanities, or

studies of human cultures that are qualitative and non-predictive. But in some universities, history is a social science. However imperfectly, historians seek to amass data about a particular kind of human behavior- knowledge-making- and then generate theories that explain it.

Another way to think about doing science and doing its history, as a job, comes from feminist Sandra Harding. In her work, knowledge is situated. Anyoen who makes knowledge has a standpoint- as does the person writing history about that person. And this standpoint isn't some subjective, personal opinion. It's a way of understanding reality. So the selecting of facts that we've done throughout this show is not just about what stories we think are fun. It's a standpoint that says, "Hey, as far as we know, after lots of time doing PhDs and researching these topics, this is the history of science." Even though, as Allison would comment on just about every script, the stories are always much more nuanced and complex.

And there are so many stories in this history. We just couldn't get to them all. We've been keeping a running list of everything that hit the cutting room floor. For example, how about birth control technologies? The Pill came from synthesizing a hormone out of a raw material- a yam that grows in Mexico. The person who invented the Pill was a white guy, but the people who could find the yams and work with them were Mexicans. They weren't "scientists" according to the standards of the day. But in 2009, historian of science Gabriela Soto Leveaga published a whole book detailing how these yam hunters created "jungle laboratories" that allowed for knowledge about plants to be turned into lucrative and socially transformative pills.

Or take biology in the twentieth century. We just gave you the highlights. There was so much more going on! For example, did the characterization of DNA by Franklin and the whole gang in 1953 reveal the capital-T truth about how organisms pass on characteristics from one generation to the next? Sort of. It did create useful facts and help spawn biotechnology as an industry. But it didn't answer a lot of other questions, like ones about epigenetics. And we've since learned that some of the early ideas about DNA are just plain inaccurate.

The process of asking questions again and again, and revising them in the face of failures, mounting anomalies, and outside influences, is the story of science. And the history of science is a similar dynamic assemblage that we have to revisit periodically.

So there you have it. Science is awesome, and its history is so fascinating that we could keep doing this show forever. So from everyone here at History of Science, thank you so, so much for watching. As Marie Curie said, "Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less."

Crash Course History of Science is filmed in the Dr. Cheryl C. Kinney studio in Missoula, Montana and it's made with the help of all these nice people and our animation team is Thought Cafe.

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