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0:00:05.9 Sarah Crespi: Welcome to the Science Podcast for December 18th, 2020. I'm Sarah Crespi. Each week we feature the most interesting news and research published in Science and the sister journals. This week, though, is special. It's the most interesting news and research published this year. It's our breakthrough issue and our end-of-the-year wrap-up. We've got the top online stories with online news editor David Grimm, the Breakthrough of the Year with online news editor Catherine Matacic, and our books editor, Valerie Thompson, joins us to talk about the highlights from the books section this year.

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0:00:40.2 SC: So first up for our end-of-the-year episode, we have online news editor David Grimm. He has some of the top online news stories from 2020 to share. Hi, Dave.

0:00:51.1 David Grimm: Hey, Sarah.

0:00:51.9 SC: Can you remind me how you pick these stories?

0:00:55.2 DG: Well, this year it's been kind of an extra challenge because of coronavirus. A large percentage of the stories that we've covered this year, especially since about March, have been COVID-19 related. And I sort of made the command decision because I can [chuckle] to not focus on COVID stories because we're doing plenty of that in our other end-of-the-year coverage and just sort of make this our top 10 stories of the year that were non-COVID stories, were a lot of fun, were really interesting, and especially stories that were exclusive to us. But there's also some stories in here that were among our highest-traffic earners of the year, not competing with COVID, but just sort of in a league of their own. So it's a little mix of everything.

0:01:36.1 SC: Yeah, I did notice a lot of them clustered to the first quarter of the year.

0:01:39.4 DG: That's probably true.

[laughter]

0:01:42.4 DG: After that, it was all COVID all the time.

0:01:44.2 SC: Exactly. We're only gonna talk about some of these. It's the top 10 list, you'll have to go online to see the rest. But it was pretty easy for me to pick my favorites. The first one just sold me on headline alone: "Is This the Original Board Game of Death?" sounds like a bad horror movie. What board game are we talking about?

0:02:03.5 DG: An agent actually reached out to us about getting the rights to the story, which was pretty wild, which I don't think has ever happened before in my history at Science. But it's a very fun, evocative story. It's about this board game called Senet, which traces back about 5000 years to Ancient Egypt, and it was kind of like a backgammon-like game. There was a die that your rolled.

You had to hop from place to place.

0:02:25.4 SC: That sounds like a lot of different games I've played. You have to dice, you move to spaces, but how is this related to death? How does it become the board game of death?

0:02:33.0 DG: At the beginning, it wasn't. This was a very purely entertainment game, or at least that's what archaeologists think. But over the centuries, it seemed to have started to have these connections to the afterlife. So for example, all of a sudden in tomb paintings, we start to see the dead playing the game with their living relatives. And this was a clue that, well, maybe this game was starting to be seen as sort of a conduit between the living and the dead, a way that they could can communicate. And then as the centuries went on, parts of the game, the symbols of the game changed from more neutral symbols to symbols that were more related to these hieroglyphic birds that represent the soul in Ancient Egypt, things like that. And it looked like as the game was played now, instead of trying to win, the pieces were moving through these various stages to get to the Egyptian afterlife.

0:03:25.4 SC: I find this amazing. The game was first recorded 5000 years ago. 2500 years later, people were still playing this now death-infused game. 2500 years later, we're talking about it. What is the new piece of information, what is the research on this game telling us now? What's the new finding?

0:03:44.6 DG: Well, so the new finding is that in the California Museum, archaeologists discovered a copy of this game that they think dates to about 3500 years old. And what's really interesting about this version of the game is that it's very transitional. So it starts to have a little bit of that death iconography in it, but it's not fully there yet. And so they think that this is kind of this missing link between when the game was purely for entertainment purposes until when it was full-fledged about death. They've caught the game in this transitional phase where it was just starting to transform into having much more symbolic afterlife overtones to it.

0:04:19.6 SC: Well, I really found all the details on this game, like looking at pictures of the dice, looking at different boards, really fascinating. I would definitely watch this movie.

0:04:27.6 DG: I would too.

[laughter]

0:04:30.1 SC: Alright, let's talk a little bit more about death. [chuckle] This is about undertaker bees, which is not a kind of bee species, but rather kind of a role within the hive.

0:04:41.9 DG: Right. So we know that in bee society there's a lot of different roles. You got workers, you got the queen, and there's actually a class of bees called undertaker bees. And they maybe have the least glamorous job in the bee world. They've got to go into the colony, the hive, and find dead comrades and remove them. The scientists just couldn't figure out how they determined a dead bee from a living bee.

0:05:03.5 SC: Why would that be so hard to do? [chuckle]

0:05:05.5 DG: You wouldn't think it would be so hard, but bees don't see the world like we do. They're very smell-oriented, they're taste-oriented.

0:05:11.3 SC: It's really dark in the hive, too.

0:05:12.8 DG: It's dark in those hives. So you know, even you and I might not be able to tell something dead from something living. These are complicated hives, and being able to exactly pinpoint where these dead bees are is actually not an easy process.

0:05:24.9 SC: This is a really cool study in the way they figured out what's likely making the undertaker bees zero in on the little bee corpses.

0:05:32.9 DG: This is kind of one of my favorite methodologies of the year, that bees typically emit these compounds called CHCs, and they sort of arise from this waxy outer coating that a lot of insects have. And the idea was, well, maybe when they die, they stop emitting these CHCs, and it's this lack of emission that the undertaker bees are picking up on. And to figure out if this was the case...

0:05:54.9 SC: Oh, it's time to heat up some dead bees. [chuckle]

0:05:57.2 DG: Yeah, exactly. So scientists grabbed some Asian honey bees and it actually increases the release of the CHCs. And lo and behold, when they did heat these bees up, the undertaker bees were a lot more likely to assume that they were alive and not remove them. And then the researchers did some more experiments where they actually chemically removed the CHCs. And when they removed the CHCs, the undertaker bees were a lot more likely to remove these bees. And so it really sort of solidifies this idea that it's the emission of these compounds, or actually the lack of emission of these compounds, that's really the signal to the undertaker bees that this is an expired comrade that they're dealing with.

0:06:33.4 SC: Alright, so it sounds like this theory passed the smell test.

0:06:36.0 DG: It did very much so.

0:06:38.8 SC: The next study we're gonna talk about is based on a movie. The study asked, "Could a habitable planet orbit a black hole?" So what movie does that make you think of?

0:06:49.8 DG: It made me think of Interstellar. This is a Christopher Nolan movie that came out in 2014. And one of the big central visuals in the movie is this giant black hole around which actually planets are orbiting. The question in this study was, "If a planet was, A, orbiting a giant black hole, could it actually have life on it?"

0:07:10.8 SC: Just a reminder, Interstellar came out in 2014. Why is the paper coming out now in 2020, six years later?

0:07:18.1 DG: Scientists first tackled this question in 2017, just a few years after the movie came out. And they came to a hypothesis, but now they're kind of firming up the numbers and they have a better sense of how this would work, how life could actually exist on a planet like this.

0:07:32.5 SC: In order to get the planet not to be pulled into the black hole, what would have to happen?

0:07:39.6 DG: It turns out that if a black hole is spinning super fast, about 100 millionth of a percent shy of the speed of light, objects can actually orbit it without being destroyed.

0:07:51.1 SC: What would it look like if you're standing on this planet looking into the center of your solar system? I guess it wouldn't be a solar system, your black hole system.

0:08:00.2 DG: Right, half of the sky would be basically taken up by the super massive black hole, and you would see what looked kind of like a little star on the horizon. But actually it would be a focused beam of what's called the cosmic microwave background, which this black hole would basically be focusing into a beam. And that's where the energy for the planet would come from. Life needs some sort of energy.

0:08:18.3 SC: Right. We have a sun, it's powering a lot of life here. The other thing I remember from Interstellar was something happened with time.

0:08:25.2 DG: One year passing on this planet would see 1000 years go by around an ordinary star, so time would be super weird on this planet as well.

0:08:34.9 SC: This is a study, this is something that people tried to do the math on, but how likely are these things to coincide? So how likely is a black hole to spin like this? How likely is a habitable planet gonna be seen near one of these? Those kinds of things.

0:08:50.7 DG: Right. There's so many barriers here. One is you have to have this giant black hole, it has to be spinning at this super fast speed, and that's never been observed before, and actually some physicists don't even think it's possible. You've gotta have this beam of energy that's able to actually seed life. It's still incredibly violent around a black hole. Stars are being stripped of their atmosphere and other things are being destroyed, so the chances that a planet would even get to this place in the first place and to be able to survive is all really, really unlikely. And then even if this were happening, the chance of us actually being able to detect a planet like this are vanishingly small. We have a hard enough time detecting ordinary planets around ordinary stars, and trying to detect this wild planet around a this super massive black hole is not within the realm of possibility right now.

0:09:36.2 SC: Okay, one last one Dave. Everything is cubes, all the way down.

[laughter]

0:09:42.3 DG: We thought it was turtles, but it's actually cubes.

[chuckle]

0:09:45.2 SC: You know, this might be the most poetic story of the year, the most philosophical.

0:09:49.2 DG: Yeah, I would say it's my nominee for most philosophical story of year by far.

0:09:54.2 SC: Reading it was really fun though. I got introduced to the term gömböc. Have you heard of this before?

0:10:00.7 DG: I have not. But basically this a shape that it will always come to rest. So if you had an object like a die, for example, in this shape, no matter how you roll the die, it would always come to rest on the same side. Pebbles washing down rivers and sand grains blowing in the wind, they tend to erode towards these gömböc-ish shapes. [chuckle] But they never achieve that shape. This is a story full of great quotes, and one of the quotes related to this is, "The gömböc is a part of nature, but only as a dream." [chuckle]

0:10:27.8 SC: Right. And if you look at the Wikipedia page for gömböcs, there is literally a list of all the ones that have been manufactured. This is a very interesting area of research.

0:10:37.5 DG: Oh yeah, I would love to see that actually.

0:10:39.5 SC: Well, we're not gonna talk about gömböcs. We're gonna talk about a different shape. We're gonna talk about cubes. So what exactly was the study here? Why is everything made of cubes?

0:10:48.8 DG: Gömböcs are important because it started the scientists on this idea that, "Well, maybe when you break everything down to its fundamental pieces, and it all shares a similar shape." This team did a number of experiments here, but one of the first things they did is they fragmented an abstract cube in a computer simulation and they cut it into fragments. And what they found is even when they cut this cube down 600,000 times, on average, all the fragments themselves were cubes as well.

0:11:17.5 SC: They averaged to the cube.

0:11:19.4 DG: They were average to a cube. And so of course, this is just a computer simulation, so they actually went out to a local mountainside in Budapest, and they counted the number of vertices and cracks in the stone face of the mountain. And they found that most of these cracks formed square shapes, regardless if they had been formed naturally or had been formed by humans dynamiting the mountain. The fragments and the fragments of these fragments were all kind of cube-shaped.

0:11:44.4 SC: Okay, Dave. Some rocks or minerals are cube-y, cuboid, at the molecular level, and that influences their macro structure. Other things form flakes like mica. Are they saying it's the same, that these are all cubes?

0:12:00.4 DG: But they're basically saying that this isn't a universal rule. They're saying kind of on average, rocks are born as something that's a vague shadow of a cube, and so that even when it's broken down, you would just get more cubes out of that cube.

0:12:14.6 SC: So say this is universal. We are all voxels, basically. How is it useful? How can we use that information?

0:12:21.9 DG: The team says that perhaps hydrologists could use this to predict fluid flow through cracks in the ground for oil extraction, or perhaps even geologists could use the findings to calculate the sizes of hazardous rocks breaking off cliff faces. So Sarah, see, this may all seem philosophical and theoretical, but it could one day save your life.

[chuckle]

0:12:41.0 SC: Thank you so much. I feel much safer now. Okay, Dave, so that's the last one we're gonna talk about. There are six more online. Is that right?

0:12:49.6 DG: That's right. So we've got some other stories, a story involving dogs. We always try to get a cat or a dog story there in the top 10. Something about nuclear fallout and making it rain, and our top non-COVID story of the year as well. So be sure to check out all of those on the site.

0:13:04.5 SC: Alright, thank you so much, Dave.

0:13:05.6 DG: Thanks, Sarah.

0:13:06.3 SC: David Grimm is the online news editor for Science. You can find a link to his top 10 at sciencemag.org/podcasts. Stay tuned for the breakthrough of the year, and some of the runners-up with Catherine Matacic.

[music]

0:13:21.7 SC: This week is our Breakthrough of the Year issue. An online news editor, Catherine Matacic, who pulled the whole package together is gonna walk us through the breakthrough and some of the runners-up. Hi, Catherine.

0:13:37.9 Catherine Matacic: Hey, Sarah.

0:13:39.4 SC: Was it hard to pick a breakthrough this year?

0:13:42.2 CM: This is the first year since I've started working at Science that it was actually easy. Although actually, in 2016, we did have gravitational waves, so that one was also easy, but there was no question this year that we were going to make some aspect of COVID-19 the breakthrough of the year. The only question was, "What?" When we started planning for this issue back in

September, none of the vaccines had come out with good data. In fact, some of them had just started their clinical trials. So plan A was to write a piece about how the scientific community has come together in remarkable ways in 2020: Sharing data, setting up joint massive trials across the globe, investigating, collecting and publishing studies at lightning speed. And of course, we would need to acknowledge some of the accidents that come with that kind of speed. This was going to be not just the breakthrough of the year, but it was also going to be the breakdown of the year. Plan B was to throw all that out the window as soon as a vaccine or vaccines with solid data arrived. And as you can see, we didn't actually throw out plan A, and we're really glad we kept it.

0:14:55.6 SC: So we did both. We did the speed of the science, some of the breakdowns and also, yay, there's vaccines as the breakthrough. How did plan A work then once the vaccines were in contention?

0:15:07.6 CM: We've been referring to this as our dark story, because just as the breakthrough itself is a celebration of what science got right, this piece is a meditation on many of the things that went wrong: How shoddy research went viral and even made it into major scientific publications, how scientists struggled and ultimately failed many times to convey the seriousness of the COVID threat to the public, and how that combined with the rampant disinformation that is everywhere these days led to a really tragic breakdown in public trust.

0:15:41.4 SC: So the author of this piece, contributing correspondent Kai Kupferschmidt, he's been writing on the pandemic, on coronavirus. He's very deep into this.

0:15:50.5 CM: He's a superstar.

0:15:51.2 SC: I know. He calls this a syndemic. What exactly does he mean by that?

0:15:56.7 CM: Yeah, a syndemic is the intersection of two epidemics, two diseases ravaging a population at the same time, making each one of them worse. A good example of this is HIV, which weakens the immune system and makes it easy for diseases like tuberculosis to take hold. Kai's story argues that the world witnessed something similar this year. Not only did we have to deal with COVID-19, but we also had to deal with another disease: Misinformation. The shaky ground on which reality stands today makes it nearly impossible for many people, even well-meaning people, to trust scientific evidence. And that mistrust along with the deliberate sowing of disinformation that we saw this year has weakened our ability as a society to respond to new threats. That made the pandemic far worse than it had to be.

0:16:50.5 SC: But we did end up with some good news after all of that, and that is the vaccines.

0:16:57.3 CM: That's right. And as Jeremy Farrar, head of the UK's Wellcome Trust, said in Kai's story, "Science is our exit strategy." And as my favorite, Matt Damon, said in The Martian, "We scienced the potatoes out of that one." But it wasn't just one thing. It was money, it was time and it was luck. Never before have researchers developed so many experimental vaccines so quickly against the same disease. I think we're more than 200 at the latest count. Never before have researchers collaborated so openly and so frequently, and never before have governments, businesses and other institutions thrown this much money, muscle and brains at the same disease, at the same time. It's really amazing because it makes you realize what we're capable of when we put our minds to it.

0:17:50.9 SC: That's right. And Jon Cohen, he's a staff writer who, again, covered this, I can't even say how many stories he wrote this year. 1000?

0:18:00.0 CM: I don't think he knows either, honestly.

0:18:02.9 SC: But he points out in his piece on the vaccine, the science behind the vaccine, the speed of the science, that the biology of coronavirus, of SARS-CoV-2, was actually important to the success as well.

0:18:14.8 CM: Yeah, absolutely. Biology is where we got lucky. Early on, we found out that most people didn't actually get very sick from COVID-19, something that has led to many issues down the road. But the fact remains that we have a lot of asymptomatic people, a lot of people who have only mild versions of the disease. And what that suggests is that the virus is actually an easy mark for most of our immune systems, and that can translate into a vaccine. And compared to HIV, which is another RNA virus, SARS-CoV-2 acquires mutations really slowly, and that means that whatever vaccine or vaccines we come up with will likely work for a long time to come.

0:19:01.0 SC: We have a vaccine that's been authorized for use, a couple others are close behind as we record, and as we keep saying, this is good news, but the syndemic isn't over, and there are other things that we should be keeping an eye on as well.

0:19:15.8 CM: Yeah, so there's a lot to think about, honestly, aside from which champagne you're gonna be drinking after you get vaccinated, vaccines are gonna be in short supply till spring. Manufacturing delays, transportation issues, and the fact that some nations have already bought out early supplies could delay that even longer. Other fears are that these vaccines might prevent disease, but not stop the virus from spreading person to person, making it still an issue for those who are unvaccinated. Many people will refuse to get vaccinated, making it hard on the rest of us. And worst of all, rare serious side effects could emerge when vaccines move from tens of thousands of people in clinical trials to literally billions. That being said, Sarah, this is the best news of 2020. And what we need now, more than anything, is some good news.

0:20:11.6 SC: There is other good news this year, if you think about what researchers have accomplished in the face of all of this going on.

0:20:18.3 CM: That's right.

0:20:19.4 SC: Let's set Coronavirus to the side for now and talk about some of this other amazing research that happened this year. We have nine runners-up. These are outstanding achievements that were considered as breakthrough candidates or would have been if it were not pandemic year. And we're gonna talk about a few of these now, and the rest you're gonna have to check out online. Okay, Catherine. Climate sensitivity. What does this mean exactly?

0:20:43.5 CM: This is the number that really controls how bad global warming is going to be. It's a range, and for almost 40 years, it's been the same. If we double atmospheric CO2 levels from pre-industrial times, the planet should eventually warm between 1.5 degrees and 4.5 degrees Celsius. That's a big range. It's everything from slightly warmer winters to floods that can wipe out entire civilizations. But this year, scientists did something they haven't been able to do, since the first estimate in 1979. They narrowed the range. It is now 2.6 to 3.9 degrees Celsius. That's about a degree off the bottom and half a degree off the top.

0:21:30.8 SC: What problems had to be solved, what scientific questions, what scientific investigations needed to be done to get this window narrowed down so much.

0:21:41.2 CM: There were lots of problems that needed to be solved, and we'll start with the easy ones. First, when researchers started predicting global temperature rise in 1979, they were working with only about 150 years of data, give or take a few decades. Most of that was when humans were pumping out far less CO2 than we are today. Now, we have another 40 years of data on what happens when we binge out on fossil fuels. The researchers also went back in time, ancient climate records like ocean sediments and ice cores can reveal what the atmosphere was like millions of years ago, and how global temperatures changed in response, finally, the scientists tapped into our growing understanding of processes like cloud formation, which has awesome been called the wild card of climate change.

0:22:34.7 SC: Is this more refined understanding of the range good news, or does it just tell us we're in trouble more specifically.

0:22:44.2 CM: Both. On the one hand, it's great because we now know that runaway temperature increases in the range of 5 degrees are probably pretty unlikely, but 3.9 degrees is no joke. At that temperature, you can still have storms and floods with catastrophic impacts. What this does is it gives us data that could and should be used by countries, cities, and even towns to prepare for climate change.

0:23:13.6 SC: So that's outdoor temperatures. We're gonna talk about indoor temperatures next. Let's take room temperature superconductivity. This is another milestone that's been a long time coming. What was the achievement this year?

0:23:27.1 CM: Scientists have spent decades looking for materials that conduct electricity without any resistance at room temperature. These materials could transform technologies like MRI machines and particle accelerators, and they could save the vast amounts of energy that we waste every time electricity moves through wires. And we've had super conductivity at super cold temperatures, near absolute zero for almost a century. But this year, scientists discovered the first material that can conduct electricity without resistance at room temperature, a hydrogen and carbon-containing compound squeezed to a pressure almost as great as that at the center of the Earth.

0:24:12.3 SC: It's at room temperature, but the pressure is obviously in no way close to normal.

0:24:17.5 CM: That's right. Pressure is the key. In high pressure physics, scientists smash materials in a diamond anvil to produce pressures millions of times higher than those at sea level. In 2019, German scientists did this with a mix of lanthanum and hydrogen, yielding superconductivity at temperatures just under the freezing point of water. This year, scientists in the United States topped that result with a hydrogen, carbon, and sulfur compound that conducted without resistance at 287 degrees Kelvin, which is the temperature of a chilly room. So far the new superconductors fall apart when that pressure is released, but scientists are hoping to find a way around that.

0:25:05.3 SC: The next runner-up we're gonna talk about snuck in under the wire. You might remember the Deep Mind AI from a few years ago when it was featured on our year-end list for beating champions of the game, of Go. And that one was called AlphaGo. Now, with the new moniker AlphaFold, it's credited with solving the protein folding problem. Okay, Catherine, what is the protein folding problem?

0:25:31.2 CM: The protein folding problem is one of biology biggest challenges, how to predict the precise 3D shape that a string of amino acids will fold into as it becomes a working protein, and that's really important because a protein's precise shape determines its biochemical functions. This new program, which predicts the shape of proteins could help researchers uncover mechanisms of disease, develop new drugs and even create drought-tolerant plants and cheaper biofuels.

0:26:07.6 SC: How do they show that an AI has beat the protein folding problem?

0:26:11.8 CM: So the way we actually know how certain proteins are folded is through traditional imaging techniques like X-ray crystallography and cryo-electron microscopy. Those are all well and good for certain kinds of proteins, but it's a really laborious process, and to this day, detailed atomic maps exist only for about 170,000 of the 200 million known proteins. So researchers have started predicting a protein structure by modeling the amino acid interactions that govern its shape, and every year since 1994, there's been a competition to predict these shapes. And this year, AlphaFold took the gold. [chuckle] Its predictions were so accurate that it was often almost as good as what was seen through X-ray crystallography.

0:27:04.1 SC: Okay, one more, Catherine, and we're talking about another late breaking research success. This is CRISPR in the clinic. CRISPR is a genome editing technology that was actually selected as our breakthrough in 2015, and now we're marking its first use in the clinic. What's happened?

0:27:23.1 CM: This year, scientists treated several people with sickle-cell disease, that's a disease in which your red blood cells block blood vessels causing severe pain, organ damage and even strokes. They also treated patients with another blood disease called beta-thalassemia, low levels of hemoglobin, leave them feeling weak and often exhausted, to treat these patients. Researchers removed immature blood cells known as blood stem cells. They then used CRISPR to enable production of the fetal form of hemoglobin, which can counter the effects of some of these diseases. Next, the patients got chemotherapy to wipe out their disease blood stem cells. The CRISPR-treated cells were infused back into their bodies. Then after nearly a year, in one case, the sickle-cell patients are making lots of fetal hemoglobin. One patient, a young mother... I heard this really moving interview with her, she says the treatment changed her life.

0:28:26.4 SC: This is a small sample size and an intensive process. Is this gonna be available to people more broadly any time soon?

0:28:36.0 CM: Unfortunately, CRISPR requires high-tech medical care and could cost one million or more per patient per treatment, and that could put it out of reach for many people in Africa, in particular, where most people with sickle-cell disease live.

0:28:52.6 SC: Okay, Catherine. Thanks so much for talking over the runners and the breakthroughs with me. Amazing work on this.

0:28:57.8 CM: This was so much fun. Thank you for the opportunity, Sarah.

0:29:01.5 SC: Catherine Matacic is an online editor for Science. Everyone should check out the rest of the runners-up online, and we also have a very moving set of obituaries for researchers had died this year from COVID-19. You can find links to all this content at sciencemag.org/podcasts. Stay tuned for books editor Valerie Thompson. We're gonna talk about some of the top books from the year and a book that we missed.

[music]

0:29:31.1 SC: Now we have books editor, Valerie Thompson. She's gonna share some highlights from our book reviews this year. Hi Valerie.

0:29:38.4 Valerie Thompson: Hi, Sarah.

0:29:40.6 SC: This has been, in my opinion, a good year for books. There have been so many times where this section has caught my eye. The first one, the Alchemy of Us, this is something I've actually wanted to pick up. I haven't had a chance to read it. What made it stand out to you?

0:29:55.3 VT: This book, The Alchemy of Us: How Humans and Matter Transformed One Another by Ainissa Ramirez. This book is so great. So it looks at how a number of notable materials were invented and then how in turn those materials went on to shape human culture. She writes, for example, about the invention of the phonograph and how it changed the way that music was enjoyed. So the first way that it changed the way that music was enjoyed is you didn't have to go somewhere and listen to music with other people. You could listen to it on your own. Another way is that instruments like the cello and the violin and the guitar, which produce really soft tones they're hard for early phonographs to pick up. And so louder instruments like the piano and trumpets and trombones, all started to dominate recorded music.

0:30:42.4 SC: So people who are a little bit snobby about recorded music were right, that it was limiting and not necessarily the real thing for everyone.

0:30:51.5 VT: Yeah. It just changed the type of music that was being produced. And one of the other cool things was that it enabled cross-fertilization across musical cultures. So between jazz and blues and rock and roll, even during a time when the musicians themselves were segregated by race politics.

0:31:08.2 SC: On this note of race politics, music technology is the only time this comes up in the book.

0:31:15.0 VT: Yeah. So she gets actually more pointed about race and racism in the chapters on the photographic film. She highlights here how early photographs of black people were often under-exposed because dark skin absorbs more light than white skin. And it's interesting because Kodak knew that it was a problem, but they didn't reformulate their product until furniture makers and confectioners started to complain that customers couldn't see the difference between wood species and chocolate varieties.

0:31:41.2 SC: Wow.

0:31:41.9 VT: Yeah. And it's interesting because this is something that was then re-perpetuated with the rise of digital photography, with the early facial recognition technology, is they weren't seeing black people's faces.

0:31:54.6 SC: I can't believe that this has happened twice. I'll definitely have to check out this book. Next up, we have something regular listeners might come to expect from our books editor.

0:32:04.6 VT: So this book Feasting Wild: In Search of the Last Untamed Food, it is by Gina Rae La Cerva, who's a geographer in environmental anthropologist. So as you said, I'm a sucker for good food writing. So any greatest hits list that I put together is gonna include a food book. So this one, it tackles a big question. So what does it mean to eat wild food? And she looks at it from a bunch of different perspectives and scales and weaves together these historical perspectives and ecological data and interviews with people who prepare and sell and consume wild foods.

0:32:38.2 SC: Okay, travel, exotic foods. Where do we start?

0:32:41.6 VT: I'll start with one of the most exotic things that she eats during her travels, which is actually an edible bird's nest that is found in Borneo. So these little swiftlets make these nests that consist of 95% pure saliva. But it's interesting 'cause they're moving into this phase where it's not exactly wild anymore. So they will take these purpose-built structures or old empty houses and they'll install these little things that play recordings of bird calls and attract the swiftlets to those buildings, and they farm these nests for human consumption.

0:33:18.9 SC: So it's wild, maybe less so than some of the other foods in the book.

0:33:23.7 VT: She also talks about things that are more straightforward and wild. So it's fun because the story unfolds like a travel log, which if you've been stuck inside your house for months, it will either drive you crazy or it will be like a vicarious release, I guess. She goes to Copenhagen and she eats at Noma, which is this high-end restaurant that's known for serving foraged foods. And she goes to the Democratic Republic of Congo where she investigates the bush-meat trade.

0:33:48.4 SC: Bush meat, wild caught animals have been linked with the transmission or the leap of diseases from animals to people. Does she touch on that?

0:34:00.7 VT: Yeah. She does and I think that is what makes this particularly timely. She looks at this with great nuance. This problem with bush meat is it also has a very strong cultural component. And so she talks to people who eat it and for whom it is part of their cultural practices. That element is something that we need to consider, even as we try to limit the spread of these zoonotic diseases in wild food markets. We have to really think about and acknowledge that cultural component.

0:34:27.0 SC: Very cool. I'm very excited about this book that you brought to my attention, The Great Indoors. This is about basically our life right now, spending so much time sequestered in our homes. What more is there to learn about inside spaces?

0:34:41.4 VT: Yeah. So like you said, this one feels appropriate. It's called The Great Indoors: The Surprising Science of How Buildings Shape Our Behavior, Health, and Happiness. And it's written by science journalist Emily Anthes. It's interesting 'cause it encourages us to think about whether or not the built environment is really serving our needs. She focuses on the behavioral implications of indoor design in a bunch of different contexts. Can we improve surgical outcomes with better designed operating rooms? Can we implement humane design strategies in our prisons? Can we leverage technology to help the elderly stay independent for longer?

0:35:13.6 SC: What about me, Valerie? What about my house? How can my house be made better?

0:35:19.9 VT: I was gonna talk about open-office floor plans, which I think might apply to our homes now, which have become de-facto offices. But open-office floor plans are a big loser in the design department. Not only do they significantly reduce in-person interactions which is very counter-intuitive. And then also people who work in open offices take more sick days than employees that have their own private work spaces.

0:35:44.3 SC: Working from home sounds better than that.

0:35:46.5 VT: Yeah. I think it's definitely better. But yeah, this book was obviously written in pre-pandemic times, but it does have some insights that are worth thinking about, which is to remember that a lot of the health improvements that we saw, for example, in the early 20th century, they weren't because we had a bunch of new spectacular medications, they were because of the sanitarian housing reforms that we made, design reforms that we've made that made us all healthier. And so that's something worth thinking about moving forward.

0:36:17.6 SC: 2020 has been an amazing year for science in terms of accomplishments with respect to Coronavirus, but it's also been troubled by policy issues and in-fighting. And two of these books get at that. One of them is a biography of Andrew Wakefield.

0:36:35.8 VT: This book is called The Doctor Who Fooled the World, and it's written by journalist, Brian Deer. It tells the story of the fraud perpetuated by the British physician Andrew Wakefield who falsely claimed that the MMR vaccine could cause autism. And Deer was largely responsible for exposing that fraud through his reporting for the Sunday Times. So that included undisclosed financial conflicts, cherry-picked patients, falsified data. In the book, he describes each facet of that deception and its repercussions.

0:37:04.0 SC: Really interesting, especially now when we're all a little bit worried about vaccine hesitancy.

0:37:09.6 VT: This one will come with a caveat though. Deer's writing is... It's a little colorful. I don't know. It's a little irreverent for the topic, in my opinion. The book is very good and it's a very important story, but the style didn't really resonate with me.

0:37:24.3 SC: Oh yeah, I get it. Speaking of the year we've had, there's already a book on it.

0:37:30.3 VT: As crazy it sounds, there's actually already a number of books about COVID-19 in the market, but I wanted to mention Nicholas Christakis' Apollo's Arrow. Christakis is a physician and the director of Yale Human Nature Lab, and he synthesizes all the complex interactions that play in this crisis. So from the epidemiology to the immunology to human behavior, social networks, that kind of thing.

0:37:52.4 SC: Was it hard to read a book about basically your life right now.

0:37:57.0 VT: It was very surreal to read things that were happening in March, to see them in a book already, it was very strange to read that. For people who have been consuming a lot of information about Coronavirus, I don't know that there's gonna be a lot of surprising information, especially for scientists in particular. But I think it is a nice synthesis of everything that we know so far and gives historical and cultural context. Apparently, disasters typically have effects. They increase marriage rates, and they increase birth rates, and they increase divorce rates. Kind of these repercussions that we'll probably be seeing in years to come, but we can look to this data from the past to say, "Here's what we can expect. Are we seeing that now?"

0:38:39.7 SC: What about a book that we didn't cover this year? Is there anything that you wish that you had commissioned a review on?

0:38:46.8 VT: Yes. For this one, definitely, Real Life by Brandon Taylor. Most of the books we cover are non-fiction. This is a brilliant work of fiction that follows Wallace who is a queer black bio-chem grad student, as he navigates academia at a predominantly white Midwest institution. I think what makes this book especially important for a scientific audience is its incisive indictment of the subtle and sometimes not so subtle hypocrisies that pervade institutions that think of themselves as progressive. So his supervisor is really condescending, he's fetishized as the only black student in his program, other members of his cohort question the basis for his admission. It's a bleak portrait of academia, and unfortunately, I'm sure it will resonate with people from marginalized groups. But it's really important, and I think it's done in a way that is just all but impossible to do in a non-fiction analysis.

0:39:45.2 SC: Yeah. We mostly see that information coming out of Twitter or on our science careers column, people will do a first person accounting, but you're not gonna get the holistic effect combined into one person.

0:39:57.7 VT: Exactly. It's a wonderful book. It was shortlisted for the 2020 Booker Prize. So it's not just of scientific interest, just broadly very good.

0:40:06.7 SC: Okay. I'm gonna have a lot of good reading options over the next few months. Before I let you go though, Valerie, can you share a Kids Science book from this year?

0:40:15.0 VT: So the one I wanted to highlight was called, You're Invited to a Moth Ball: A Nighttime Insect Celebration by Loree Griffin Burns.

0:40:22.5 SC: So I want to go to moth ball immediately. I don't know if I'm supposed to dress up like a moth or just go find a bunch of moths. What's the story?

0:40:31.5 VT: So the book teaches kids how to attract moths to a homemade backyard viewing station that you make with light colored bed sheets and smearing fruit on the trees, and you get these special UV lights and it attracts moths for kids to view. So I thought it would make maybe a fun quarantine activity.

0:40:50.1 SC: Oh yeah, definitely for a kid stuck at home, might as well go outside and get some moths.

0:40:54.5 VT: Yeah. The only thing the book doesn't talk about is, "What if you attract other things with your little fruit smeared on trees?" [chuckle] So I don't know. I'm not gonna be held responsible for that part, but...

[chuckle]

0:41:06.1 SC: Okay. Hose down your trees after you're done.

0:41:10.5 VT: Exactly. [laughter]

0:41:12.1 SC: All right. Thank you so much, Valerie.

0:41:13.7 VT: Absolutely.

0:41:14.7 SC: Valerie Thompson is the Books Editor for Science. We'll put links to all of these books on the podcast page at sciencemag.org/podcasts.

And that concludes this edition of the Science Podcast. If you have any comments or suggestions for the show, write to us at sciencepodcast@aaas.org.

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