Science Magazine Podcast
Transcript, 15 June 2012
http://podcasts.aaas.org/science_podcast/SciencePodcast_120615.mp3

Music

Host – Kerry Klein
Welcome to the *Science* Podcast for June 15th, 2012. I'm Kerry Klein.

Host – Sarah Crespi
And I'm Sarah Crespi. This week: Europe's oldest cave art [10:35], the relationship between grasshopper stress and plant decomposition [00:53], and….

Interviewee – Gretchen Vogel
In most of the world, nobody counts what people are dying of or how many people are dying. Nor, in most places in the world, are births counted [20:04].

Host – Kerry Klein
Plus, a few stories from our online daily news site [27:39].

Promo
Support for the *Science* Podcast is provided by AAAS: the American Association for the Advancement of Science. Advancing Science, Engineering, and Innovation throughout the World for the Benefit of All People. AAAS—the Science Society—at www.aaas.org.

Music ends

[00:53]
Host – Sarah Crespi
Herbivores, through their irrepressible munching on the greenery, have a regulatory role on the plant community. In turn, predators higher up the food chain indirectly influence plants by regulating the herbivores that eat them. But the indirect effects don't end there: predators, by their mere existence, induce fear and stress that change the body chemistry of their prey, which in turn influences the soil community when the prey animal dies and is decomposed by the underground ecosystem. Dror Hawlena and colleagues were able to test the impact fear-inducing predators have on soil by measuring how the microbes handled plant litter decomposition after the prey, in this case a scared grasshopper, had been absorbed. I spoke with Hawlena from his office in Jerusalem.

Interviewee – Dror Hawlena
So indeed, it sounds a little bit weird, and even a little strange to expect that the presence of the predator will affect soil community function or plant litter decomposition, but if you think about it in a more structural or mechanistic way, then if the herbivore in the system have a regulatory role of the plant community – and we know that they do – so if by changing the way that this herbivore is functioning in this respect – it can be changes in the prey behavior or the prey physiology – then you might expect to find changes on

the plant community, and therefore, on the soil community structure and this function of plant litter decomposition.

Interviewer – Sarah Crespi
Right. So you're saying that if a predator controls the behavior of the prey by just, you know, basically predation, then, you know, they may or may not eat the plants or go to certain areas. But you found an even deeper connection there.

Interviewee – Dror Hawlena
Yes. We are looking at the physiological responses of the prey to the risk of predation. So in other words, the prey is being stressed by the predator, and this stress effect is actually changing the way that the body of the prey is functioning. What we found in previous research that they increase their body metabolism, and as a result they change their body composition. So they have more carbon and less nitrogen within the body. So what we expected that if those grasshoppers die, then they will change the input of nitrogen and carbon to the soil community and create some differences in the way that the soil community will function. And it will affect in the future the way this microbial community is actually treating other inputs of biomass into the soil, such as plant litter, which is the highest input of biomass that is getting into the soil.

Interviewer – Sarah Crespi
So you measured the physiological effect of fears or stress that a predator causes in prey, and further, how those predator-induced changes affect the microbial communities after they decompose the prey species – the grasshopper's gone. Let's talk about how you measure these things in the lab.

Interviewee – Dror Hawlena
Maybe we should start with the field?

Interviewer – Sarah Crespi
Sure.

Interviewee – Dror Hawlena
Okay, so in the field we put cages on naturally growing vegetation, and in this way we could control how many trophic levels we have in those cages. So to one of the cages, we added a grasshopper and to the other cage in each pair, we added grasshopper and spider, and this way we created two trophic levels and three trophic levels effect, and then we compare between the two. So we allow them to grow within those cages with and without a predator. And it's important to note here that we wanted to separate the numerical effect of predation, or basic selection for certain prey, by gluing the mouth part of the spider. And in this way the spider could just scare them and not really eat them. And this is important because we wanted to look just at the fear factor, the fear effect, and not the numerical effect or the selection effect of predation. But, anyhow, approximately two months after we put the grasshopper in, we took them out from the cages, and then we just took them to the lab and add them to microcosms with soil from the field. So we have soil with grasshopper from a predation treatment and from no

predation treatment. And then we measured soil respiration, or, in other words, carbon mineralization. And we did so until those grasshoppers were fully decomposed. And then we added much bigger biomass of plant litter. Just to give you an estimation of the differences, so we used 3.5 milligram of grasshopper, and then we added 500 milligram of plant litter.

Interviewer – Sarah Crespi
Big difference.

Interviewee - Dror Hawlena
And then we repeated the same process. We continued to measure soil respiration, or carbon mineralization. At the end we compared the cumulative carbon production from those cubes, from those microcosms.

Interviewer – Sarah Crespi
And so you found that there is a big difference between whether or not the grasshopper had lived with a predator?

Interviewee – Dror Hawlena
Yes. So we found that those tiny changes in the body composition of those grasshoppers, we found that the carbon-to-nitrogen ratios of the grasshopper body was about 4% different between the two plots, between the two treatments. So they had less nitrogen when they were reared risk of predation. And after doing the two-step experiment in the lab, we found approximately a three-fold differences in mineralization of the larger biomass of plant litter.

Interviewer – Sarah Crespi
It's a really surprising finding. So the stress induced by the spider on the grasshopper, even with its teeth glued shut – it can't eat the grasshopper – that that stress translates into a change in body composition for the grasshopper, and that this change in body composition when the grasshopper dies affects the microbial community underneath and its ability to process plant litter that comes even later. What do you think might be the mechanism at work?

Interviewee – Dror Hawlena
By adding a little nitrogen to the system, you actually allow the microbial community to release extracellular enzymes, and in this way those extracellular enzymes can start to break down complex compounds within the soil to a simpler one. So you can create some kind of positive feedback in which you actually break down more and more complex compound and allow to produce more and more enzymes. And those enzymes continue to work, because they work within the matrix of the soil. So you actually – a small addition of nitrogen can create much bigger effect in mineralization of the organic biomass within the soil, and therefore the different ways that the microbial community responded later to plant litter that went inside the soil was totally different.

Interviewer – Sarah Crespi

Well, so what other kinds of things can cause this change in the carbon-nitrogen ratio of grasshoppers? Is this something that, you know, maybe a change in seasons would do to them? Or is it most likely something that would only happen in the presence of predators?

Interviewee – Dror Hawlena
That's actually an excellent question, because in our study it's definitely predation, because this is the only factor that we manipulated. So we used predator-prey interaction as the model interaction. But stress physiology is very conservative, so you can find almost similar responses among different taxa, or across different taxa. But also it's really important to note that different stressors such as drought, heat, or competition, or social stress can produce similar physiological responses, and, therefore, we expect to find almost exact same responses from the physiological point-of-view, and as a result probably from the ecosystem point-of-view.

Interviewer – Sarah Crespi
So stress on the animals is just bad for the microbial communities. Is that kind of the general finding then?

Interviewee – Dror Hawlena
Yes, but I have to say that this is only example of the way that we think about this problem and how those processes can actually cascade down to the soil. But, for example, in the case of grasshoppers, because stressed grasshoppers release more nitrogen in their waste material, the waste material can actually generate a different response, or even an alternate response. The challenge in the future will be to take those novel ideas about how the risk effect or other stressors can change the regulatory role of the herbivore in the system in affecting ecosystem functioning, and to see how all the different pathway can explain variation in the ecosystem function in nature.

Interviewer – Sarah Crespi
So you mention in your paper that beyond this relationship between stressed animals and the microorganisms in the soil, this also tells us something about the impact of the loss of predators on ecosystems. Can you talk a little bit about that?

Interviewee – Dror Hawlena
What happens here is that if the mere existence of a predator within the system can actually change the role of the prey of the herbivore in the ecosystem in affecting a very important life supporting services such as the nutrient cycling, microbial activity, and so on and so forth. If we lose those predators from the system, we might change the function of those ecosystem. And until now, it was an assumption that predators are important because they are charismatic animals and because they regulate the herbivore population numerically, but they were not considered important for the ecosystem functioning of the biogeochemical process.

Interviewer – Sarah Crespi
Well, Dror Hawlena, thank you so much for talking with me.

Interviewee – Dror Hawlena
Thank you very much.

Host – Sarah Crespi
Dror Hawlena and colleagues report on food webs and soil communities this week in *Science*.

Music

[10:35]
Host – Kerry Klein
As seen in Werner Herzog's film, "Cave of Forgotten Dreams," Chauvet cave in France houses what have been considered to be the oldest known cave paintings in Europe. But this week, researchers claim to have found older art in a cave in northern Spain. Its age of roughly 40,000 years would place its creation at a time when the earliest modern humans in Europe were mingling and perhaps competing with resident Neandertals. Lead author Alistair Pike spoke with me about their novel method of dating these paintings, and began by explaining why cave art is so difficult to date.

Interviewee – Alistair Pike
There are several problems with attempting to date cave paintings. One of the problems is that the paintings are in isolation – they're on the wall of the cave – whereas most archaeological artifacts are in the ground associated with other materials. So you can always find something that you feel you can date reliably and then imply the age of the other artifacts by association. And we don't have that for cave paintings. But the other problem is that most of the archeological chronologies are provided by radiocarbon dating, and that requires organic carbon to be present. And many of these cave paintings, and certainly all of the engravings, don't have any radiocarbon, or any carbon, present in either their binders or the pigments themselves.

Interviewer – Kerry Klein
And as far as I understand, sometimes these paintings have been updated over many generations, over many thousands of years, and there's all sorts of environmental contamination, things like that?

Interviewee – Alistair Pike
Yes, we think so, although that's also very difficult to unpick, because the other problem with radiocarbon dating is that it's prone to contamination. And quite rightly, you have to take very, very small samples to avoid damaging the paintings themselves, and that means those samples, any contamination will affect those dates by a great deal. So there are some cave paintings that have radiocarbon dates that are very different for different portions of that painting. And that could either be a result of contamination of those samples, or it could, in fact, be that people have come back some years later – or sometimes thousands of years later – and repainted existing paintings.

Interviewer – Kerry Klein
So your method of dating these cave paintings not only doesn't utilize carbon, but you actually are dating the calcite deposits over the paintings. So how does this method circumvent these other problems?

Interviewee – Alistair Pike
Okay, well the way the method works is you get – and you've probably all seen these when you go into caves, you see stalagmites and stalactites forming – is that you get calcium carbonate that's precipitating out of the water, sort of flowing down over the surfaces of the cave. And these bring it with it uranium, which is radioactive. And it incorporates, as it forms these stalagmites and stalactites, small amounts of this uranium, which then decays radioactively. And it's the measurement of this radioactivity that allows us to work out at what point in the past these calcite layers formed.

Interviewer – Kerry Klein
Does this dating method also bring with it its own uncertainties, its own problems?

Interviewee – Alistair Pike
Yes, it does, because our assumption is that the isotope of thorium that we measure, which is the radioactive decay product of uranium, has only come from the decay of the uranium that precipitated with the calcium carbonate. But, of course, caves are pretty dirty places, and you get lots of sediments and muds that get incorporated with this, and they bring them some of this isotope of thorium. So we have to measure the amounts of contamination by detritus. It's fairly straightforward to do that, but it does mean that some of our data we have to reject and say these are too contaminated to be able to calculate a reliable age.

Interviewer – Kerry Klein
And so then the ages that you eventually come out with are the ages of these calcite deposits, which can, in some cases, be much, much younger than the paintings themselves.

Interviewee – Alistair Pike
Of course. And, in fact, we have examples where we have paintings which we know to be Paleolithic – so we know they're at least 15,000 years old – and we've got stalagmites that have formed six or seven hundred years ago on top of them. So our dating method really is only ever giving us minimum ages for the paintings. But that's still useful if we look at the very oldest end of the possibilities, because understanding that these paintings must be earlier than this particular point can tell us a lot about who did the paintings and maybe why they did them.

Interviewer – Kerry Klein
Right. So you were just crossing your fingers throughout the study that you have some old enough calcite deposits to make decent minimum ages.

Interviewee – Alistair Pike

Yes. Unfortunately, it's kind of a blanket-bombing approach where we've gone and we've taken 50 samples, and then we find out that really our new understanding of the chronology of cave painting relies on four or five of those samples.

Interviewer – Kerry Klein
Right. So you were dating the paintings in a number of caves in Europe. So which caves did you study in particular?

Interviewee – Alistair Pike
We looked at 11 caves in Northern Spain in the areas of Cantabria and Asturias. And then we really focused in on three caves, which are actually quite famous caves because they have really lots and lots of these kind of paintings. And they were the caves of Tito Bustillo, Altamira, and El Castillo. And these are UNESCO World Heritage Sites.

Interviewer – Kerry Klein
And where did you find the oldest dates?

Interviewee – Alistair Pike
Well, the oldest dates come from El Castillo. They are on hand stencils and disks which were made by spitting or blowing red mineral pigments against the wall so that you would leave a negative outline of a hand or a large red blob.

Interviewer – Kerry Klein
And exactly how old did these paintings appear to be? What were the people like that lived at that time?

Interviewer – Alistair Pike
Well, our results show that these paintings are older than 40,800 years, and we don't know how much older than that. They could have been painted shortly before 40,800, or they could have been painted tens of thousands of years earlier. And that makes our interpretation of these results very interesting, because humans arrived about forty-one and a half thousand years in this region. And Neandertals disappeared at around 42,000 years ago. So if that painting existed, let's say, 43,000 years ago, then we would have to conclude that it was painted by Neandertal. But we cannot at the moment with this result demonstrate that is the case. And an alternative theory is, in fact, that humans either were already painting caves before they arrived in Europe and they just brought the tradition with them, or that very, very shortly after they got to Europe, they started painting caves for some reason.

Interviewer – Kerry Klein
Well, we'll come back to that. But first, actually, so this date for El Castillo Cave is actually older than Chauvet Cave, which has been previously believed to be the oldest cave art found in Europe. But their cave art was aged using radiocarbon dating. So where does this leave the field of archeology? How do we reconcile these two dating techniques? Do we need to go and re-date all of our important artifacts?

Interviewee – Alistair Pike
I don't think our dating results actually mean that our understanding of the radiocarbon chronology is wrong, because we're not dating things that radiocarbon could date. But I do think that what it's showing is that these things happened a lot earlier than previously thought. And so we now need to fit our kind of ideas about the origins and evolution of human symbolic behavior into a much longer chronology than we previously had.

Interviewer – Kerry Klein
So let's go back to Neandertals then. So you really only bring up this idea in passing in your study, but, you know, how seriously should we take the possibility that Neandertals could have created these paintings? You know, is that at all likely?

Interviewee – Alistair Pike
Well, I'm fairly certain that Neandertals had something to do with it, but there are two ways you can view our dates. The first one is to say, well, if we look at the evolution of, let's call them art objects, we find them in Africa a hundred to seventy thousand years ago in the form of engraved ostrich eggshells, and little bits of red ochre that have been engraved, and shell beads, and so on. And then you find cave painting in Europe that seems to be happening in Europe before it happens in Africa. And there's one theory that says actually in Africa, there wasn't a huge competition with humans for resources, and so cultural innovation may have happened rather slowly, whereas if modern humans arrived in Europe – which was currently occupied by Neandertals – then in order to survive, and as a result of the competition for resources with Neandertals, cultural innovation, the rate of cultural innovation, would have increased, which would explain why we get things. We find the earliest musical instruments in Europe, we find the earliest figurative sculptures, and we find the earliest cave paintings in Europe. So one might argue that although, you know, Neandertals didn't necessarily do the painting, they were responsible for the humans who encountered them in some way for developing this as a kind of cultural symbolic behavior. The other alternative, of course, is that the painting was done significantly before the calcite crust formed at 40,800, in which case it would have to be done by Neandertals.

Interviewer – Kerry Klein
So really, there's a lot of uncertainty here. There are a lot of really exciting possibilities. How are we going to begin to figure out just who created these cave paintings?

Interviewee – Alistair Pike
Well, I think we should just go back and do lots more of the same. And, you know, we looked at 50 paintings, but there are thousands and thousands of them, not just in Spain but in Southern France and in Italy, as well. So we intend to go back and take some more samples from now similar type of symbols – so where we see hand stencils and these kind of dots and disks, and we can avoid the kind of animal figures and things which we don't have any evidence of them being very, very early – and start to see whether we get any dates that are older than 40,800, 41,000, and so on, and that will then begin to tell us whether or not it's definitely Neandertals that did this art, or whether or not we'll still have this ambiguity, because unfortunately, these are only ever minimum ages for the art.

Interviewer – Kerry Klein
Right. Well, great, what an interesting study. Alistair Pike, thank you so much.

Interviewee – Alistair Pike
Thank you very much.

Host – Kerry Klein
Alistair Pike and colleagues discuss Europe's oldest cave art in a Research Article this week.

Music

[20:04]
Host – Sarah Crespi
If you are born at home and die at home, is your life counted? Reliable numbers on births and deaths worldwide are hard to come by when hospital head counts and government registers are the main means of tracking the ebb and flow of populations. It may sound morbid, but counting every death in the world can be good for our health. I spoke with *Science* news contributing correspondent Gretchen Vogel about her story on controversial death counts and their impact on public policy.

Interviewee – Gretchen Vogel
In February, *The Lancet* published a paper with some new estimates of how many people in the world are killed by malaria each year, so malaria mortality numbers. And those numbers were vastly higher than most previous estimates. That was interesting on one side, and then as I did some reporting on the story that I was writing about it, I realized, oh, it was raising some hackles. Several people I talked with had very strong reactions to the paper, and felt like the numbers were far too high. The numbers were, indeed, about twice as high as the WHO's previous estimates had been. And the main difference was in adult deaths in Africa. So the new numbers said that many, many more people – many, many more adults in Africa – were dying of malaria than people had previously assumed or calculated.

Interviewer – Sarah Crespi
But you took on the topic of counting deaths – all deaths – worldwide beyond just malaria statistics. What are some of the benefits of having an accurate accounting of all deaths?

Interviewee – Gretchen Vogel
So when I was doing my reporting on the malaria story, I thought why are these numbers so different from each other? What's going on here? And one of the reasons that people want to have good numbers is that it helps them to decide where to spend a lot of the global aid money that goes to trying to improve health in poor countries, for example, or in rich countries. You have to know what diseases are affecting people most so you know where best to spend your money. You can also tell over time as you observe trends

whether things are going up or down, whether some of the things you're spending your money on are making a difference or not, and whether that's money well-spent.

Interviewer – Sarah Crespi
So what are some of the big problems with trying to track these deaths? What's the big hurdle?

Interviewee – Gretchen Vogel
In most of the world, nobody counts what people are dying of or how many people are dying. Nor in most places in the world are births counted – nobody's counting how many people are born. In rural areas where there isn't much healthcare – much access to healthcare – most people die at home without ever having seen a doctor. And in the case of malaria, for example, if you make it to a doctor – if you have malaria and you make it to a health facility – malaria is a curable disease; you probably don't die of it. So, by definition, the people who are dying of malaria are hard to count, because they're not reaching any official health facility and no one's there to count them.

Interviewer – Sarah Crespi
Right. So how do researchers make these educated guesses? What are some of the methods that they use?

Interviewee – Gretchen Vogel
They start with the official death tallies that governments do try to keep, but those – especially as I said in rural areas and in places where healthcare is sparse – those numbers have a lot of gaps. Essentially, there's plenty of places where births and deaths – when children under five die, they've never been recorded, neither their births nor their deaths; they're nowhere on any statistics. So something like 17% of births are recorded officially in Tanzania is one of the numbers that I heard. Neither do people have an incentive to register their new baby with the officials. You know, there's no benefit to them; they don't get a Social Security number or something. And so they use additional techniques to try and fill in those gaps. And some of the techniques they use are surveys – one called verbal autopsy where health workers go and ask randomly selected houses that are selected to be representative of the bigger population whether there have been any recent births or deaths. If they find a household where someone has recently died, a second health worker goes and asks the family member what happened, what the circumstances surrounding the death were, what some of the symptoms were. That is then analyzed by either a physician, or sometimes by computer, to try and make a diagnosis of what killed the person.

Interviewer – Sarah Crespi
And then those are used to count up malaria deaths, or other kinds of deaths?

Interviewee – Gretchen Vogel
That's right. So then all those numbers are put in the computer models that are developed to take into account all the different kinds of data that is out there, plus other factors that can influence health—how available healthcare is, whether it's monsoon

season or not, how prevalent different kinds of malaria parasites or different other diseases are. And they put all of those into huge computer models and see what comes out.

Interviewer – Sarah Crespi
So you talk about a couple of big, ongoing projects to better count the dead that are already showing interesting and controversial results. Can you talk about some of the examples from India's project, the Million Death Study?

Interviewee – Gretchen Vogel
Yes, that's a project in India that tries to collect better data on the ground. You can do a lot with these models that use statistical methods to fill in the gaps in the data collection, but what everybody agrees is that what's really important is to try and collect better data in the first place. And the Million Death Study is one effort to do that. They are tracking a certain number of households in India and carefully recording how many deaths and births there are in those households. And then any time they come across a death, they send someone to do a verbal autopsy. And, yes, a couple of surprising results have come out of that. They also came up with much higher death rates due to malaria than previous estimates, and they also found that many more adults were dying probably of malaria than anybody had guessed earlier. They also found that lots more people were dying of snakebites than most people had expected. It turns out that snakebite death estimates were kind of all over the map, but the Million Death Study turned up some very interesting patterns that suggested there could be ways to prevent snake bite deaths by concentrating antivenom in certain areas where snake bite deaths seem to be a major problem.

Interviewer – Sarah Crespi
And those snakebite numbers are really high, right?

Interviewee – Gretchen Vogel
Fifty thousand in India alone in 2010, and some previous estimates had been that the worldwide mortality due to snakebites was 50,000.

Interviewer – Sarah Crespi
So that's an example of how, you know, better numbers can inform policy. But if these numbers are debatable, what impact does that have on policymaking?

Interviewee – Gretchen Vogel
Yes. The experts are a little bit divided on that. Some say that it's a detriment, and it can be confusing, and the debate undermines the authority of the public health community. But others say the numbers, the fact that they're different from each other, emphasizes the fact that all of them are estimates. And a lot of people say the global health community needs to acknowledge the fact that we need to know more about global mortality, and that maybe more resources need to go to try to get better numbers on the ground. There are several projects that are trying to do that. It's hard to do, and no one's found any magic method to help countries boost their recordkeeping essentially. People

have done some tests. New technologies are making a difference. People say that cell phones and internet connections are making it easier for people in remote areas – for healthcare workers, for example, or village leaders, or whoever – to report numbers of deaths and disease cases, and that that's making a difference. But most people agree that there's a ways to go.

Interviewer – Sarah Crespi
Well, Gretchen Vogel, thanks so much for talking with me.

Interviewee – Gretchen Vogel
Thanks very much.

Host – Sarah Crespi
Gretchen Vogel is the author of a News Focus on the global death toll in this week's *Science*.

Music

[27:39]
Interviewer – Kerry Klein
Finally today, I'm here with online news editor David Grimm, who's here to give us a rundown of some of the recent stories from our daily news site, news.sciencemag.org. So, Dave, in our first story we are getting a little bit closer to some primates.

Interviewee – David Grimm
Right. You know, for a long time researchers have said that the closest living relative we have on Earth is the chimpanzee, because chimps share 99% of their DNA – or almost 99% of their DNA – with us, which does make them our closest living relative. But according to a new study, chimps now have some competition from bonobos, which have had their genome sequenced for the very first time. And it turns out bonobos are just as close to us genetically as chimpanzees are.

Interviewer – Kerry Klein
So just how close is this DNA to our own?

Interviewee – David Grimm
Well, bonobos share 98.7% of their DNA with us, which is pretty much the same amount that chimpanzees share with us. But what's interesting about this 98.7% is that bonobos and chimps aren't sharing exactly the same genes with us. Even though overall the percentages are the same, it turns out that we share about 1.6% of our DNA with chimps that we don't share with bonobos, and we share 1.6% of our DNA with bonobos that we don't share with chimpanzees. Researchers aren't really clear what these differences entail, but there are some really interesting differences between chimps and bonobos. Bonobos tend to be a lot more social than chimpanzees. And when scientists have looked at similarities in behavior, it actually seems like we share a lot more similarities in

behavior with bonobos than with chimpanzees. So it's possible that some of these differences in gene sharing could explain those differences.

Interviewer – Kerry Klein
So what does this tell us about the common ancestor that we all share?

Interviewee – David Grimm
Well, evolution tells us that the common ancestor of bonobos, chimps, and humans gave rise to all of us about 5 to 7 million years ago, and that chimpanzees and bonobos diverged from each other about a million years ago. And the fact that we seem to have sort of pieces of chimp and pieces of bonobo in us suggest that this ancestral population that gave rise to all of us was very diverse. The researchers actually calculated it. It had about 27,000 breeding individuals in it – I'm not sure how they got that number, but that's really interesting to know. And the groups that evolved into bonobos, chimps, and humans all sort of retain different pieces of this ancestral population, which is why you can have these three species that are very closely related but aren't necessarily sharing all of the same genes in common.

Interviewer – Kerry Klein
So I suppose the study of bonobos is now going to play a much bigger role in learning about human history.

Interviewee – David Grimm
Exactly. You know, a lot of scientists had said that we really should ignore bonobos when we think about human evolution, just because we know so much about chimps and chimps seem so highly related to us. Now that bonobos are in the same pool, researchers are saying we really need to pay a lot more attention to them when we're thinking about where we came from.

Interviewer – Kerry Klein
Alright. And this leads nicely into our next story, which is also about genetics – the genetics of aging.

Interviewee – David Grimm
Right. And, Kerry, this story isn't just about genetics, it's about something called epigenetics. And epigenetics involves modifications that are made to DNA. There's something called chemical methyl groups which can attach to pieces of DNA. And they kind of act like a mute switch off, andwhich means that they sort of turn down the volume of a gene. So if you've got a gene that maybe protects you against cancer and you get it methylated, then perhaps you might not be as good at battling cancer as you were before. That's just a hypothetical. Everybody seems to have different patterns of methylation, and different genes sort of being turned off and turned on by these chemical modifications. And the question is, is this something that changes over our lifetime? Do our methylation patterns change as we get older?

Interviewer – Kerry Klein

So how could we figure out whether or not there's a correlation between methylation and age?

Interviewee – David Grimm
Well, these researchers took a fairly simple approach to that problem. They said, well let's look at the methylation patterns of a newborn baby and compare it to the methylation patterns of centenarians – these are people that are a hundred years old or older – and they looked at a man who is actually 103 years old. And really interestingly, they found that the baby had a significantly higher level of methylation in his DNA than the old man did, which does suggest that – at least based on these two individuals – that methylation seems to decrease over time.

Interviewer – Kerry Klein
Now how do we even detect DNA methylation in the first place?

Interviewee – David Grimm
Well, that's a great question. The researchers use a test they call the WGBS test. What they basically do is they extract white blood cells, and they add a chemical called sodium bisulfate, and this turns the methylated DNA into another chemical which can be detected, and the researchers sort of created a map based on all of this data.

Interviewer – Kerry Klein
And so what does this tell us about disease? You gave an example earlier about cancer. Could this help us at all understand the basis of age-related disease?

Interviewee – David Grimm
Well, you know, what was really interesting was, you know, besides finding out that this old man had a lot less methylation than the baby did, it turns out this methylation was absent in genes that were important for disease. So, for example, the centenarian, the old man, had a loss of methyl groups on genes that increase the risk of cancer. And remember how I said that methyl groups often sort of act as a mute switch. So if you've got this gene that could potentially cause cancer, and then you have a mute switch on it, well then it's okay because you're sort of taking that gene out of the equation. But all of a sudden if you get older, the methylation disappears and you've got this active gene that's going to potentially cause cancer, then your chances of developing cancer could be increased. And that could explain why as we get older, diseases like cancer and diabetes tend to increase.

Interviewer – Kerry Klein
And our last story tells us that even wild animals don't always finish their dinner.

Interviewee – David Grimm
Right. This isn't just a problem of people in Western countries. This is a study that has to do with a large cat named the puma – although you may know it by many of its other names, like panther, or mountain lion, or cougar. And what's amazing about the puma is it has this super-wide range. Pumas are found everywhere from Southeastern Alaska to

almost the southern tip of South America – so these really wide ranges. But we don't actually know a lot about puma behavior, despite the fact that they exist in so many places. So what researchers did over the past couple years is they caught some pumas living in Southern Chile, and they strapped GPS radio collars on them. And this allowed them to track pretty much everywhere the pumas went. And then they found places where the pumas had just made a kill and wandered off. And they looked at the carcasses. They actually looked at about 433 puma-killed carcasses – not puma carcasses. The pumas they studied, which was in a region about six times the size of the District of Columbia, had abandoned more than 2.5 metric tons of meat every month. So they're really leaving a lot of leftovers when they make a kill.

Interviewer – Kerry Klein
So can we have something to compare this to? What do some other animals leave behind?

Interviewee – David Grimm
Well wolves, which researchers have studied in Yellowstone, leave behind about 85-156 kilograms of meat for every 100 square kilometers of their range. And just to compare to pumas, that's about one-third to two-thirds of what's left by pumas, so wolves aren't nearly as generous in their leftovers as pumas are.

Interviewer – Kerry Klein
So what happens to these leftovers?

Interviewee – David Grimm
Well that's the really interesting part of this story. These leftovers actually seem to play a really important role in the ecosystem. The researchers didn't just find the carcasses, they found a lot of animals eating on the carcasses, especially a lot of bird species, a couple mammal species, and even a lizard – although I think the lizard was actually maybe eating insects that had been attracted to the carcass. But one of the birds that was attracted to the carcass and was eating the meat was the rare Andean condor, which is a threatened species. And so the suggestion is that a lot of these species, especially a lot of these species that might be sort of on the brink of going extinct, are really dependent on this meat that's left over by these big cats.

Interviewer – Kerry Klein
So there really are a lot of indirect effects of the puma on the ecosystem then, than simply predator-prey relationships.

Interviewee – David Grimm
Right. It's not just that the puma are killing species, which actually could be good for certain species—the deer, for example, they can sort of grow out of control and start starving if there's not a predator to keep them in check—but it's not just that, which we'd already sort of suspected, it's this sort of thing that we didn't really think about too much before, which is how many scraps they're leaving after they take down prey.

Interviewer – Kerry Klein
Alright. And what else have we had on the site this week?

Interviewee – David Grimm
Well, Kerry, we've got a story about rabies and vampire bats. Everybody loves vampires, so of course we have to do a story about it. Also a story about why eunuch spiders are better fighters. For *Science*Insider, our policy blog, we've got a story about a new effort by politicians to basically legislate out the impacts of climate change, to sort of deny climate change by passing bills that would sort of not take any account of future global warming into future policy decisions. Also for Insider, we've got a story about a new open-access journal with a very unusual pay model. And finally, for *Science*Live, our weekly chat on the hottest topics in science, this week's *Science*Live is about the science of fatherhood, how paternal behavior varies from species to species. And next week our chat is about the science of organ donation - what are researchers learning about why our body rejects organs, and what is the future of organ transplantation? So be sure to check out all these stories on the site.

Interviewer – Kerry Klein
Great. Thanks, Dave.

Interviewee – David Grimm
Thanks, Kerry.

Interviewer – Kerry Klein
David Grimm is the online news editor of *Science*. You can check out all of our news at news.sciencemag.org, including daily stories from *Science*NOW, and science policy from *Science*Insider. While you're there, be sure to check out *Science*Live, a live chat on the hottest science topics every Thursday at 3 p.m. U.S. Eastern time.

Music

Host – Kerry Klein
And that concludes the June 15th, 2012, edition of the *Science* Podcast.

Host – Sarah Crespi
If you have any comments or suggestions for the show, please write us at sciencepodcast@aaas.org.

Host – Kerry Klein
The show is a production of *Science* Magazine. Jeffrey Cook composed the music. I'm Kerry Klein.

Host – Sarah Crespi
And I'm Sarah Crespi. On behalf of *Science* Magazine and its publisher, AAAS, thanks for joining us.

Music ends