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Music

Host – Sarah Crespi

Welcome to the *Science* Podcast for January 13th, 2012. I'm Sarah Crespi.

Host – Kerry Klein

And I'm Kerry Klein. This week: the health and climate effects of reducing methane and black carbon emissions [00:48], how female leaders influence young girls [10:54], and a genetic look at the peopling of the Aleutian Islands [20:10]; plus, a few stories from our online daily news site [30:32].

Promo

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[00:48]

Host – Sarah Crespi

While carbon dioxide is the main driver of human-induced climate change, clamping down on other pollutants can impact the climate and public health at the same time. Drew Shindell and colleagues used computer modeling to look at thousands of possible pollution interventions and determined the most effective measures for protecting human health and mitigating climate change. Shindell spoke with me about some of these measures and how they differ from carbon-dioxide-only interventions.

Interviewee - Drew Shindell

What we really wanted to do in this study was to see if there were practical measures – using existing proven technology – that could benefit both air quality and climate change in a substantial way.

Interviewer - Sarah Crespi

Great. So, let's talk about some of the details of this study. You look into targeting non-carbon dioxide pollutants. What were the two main ones that you focused on?

Interviewee - Drew Shindell

We focused on tropospheric ozone – so ozone down near the surface that's one of the main components of smog – and black carbon, which is basically soot.

Interviewer - Sarah Crespi

So you looked at ozone and black carbon, and why did you choose them?

Interviewee - Drew Shindell

Those are the only two agents known that both degrade air quality and contribute to global warming. So, there are plenty of things that do one or the other, but those are the only that do both.

Interviewer - Sarah Crespi

Most people know that smog is bad for your health, and what about black carbon?

Interviewee - Drew Shindell

Black carbon is probably even worse for health – it's part of particulate matter, which is regulated in some countries, including the United States. And, when they are very small particles, as black carbon usually is, then they can get drawn very deep into the lungs and cause lots of different cardiovascular problems – lung cancer, lots of adverse health effects like that.

Interviewer - Sarah Crespi

And so, when you went into this study, were you looking for things that had health effects and climate effects?

Interviewee - Drew Shindell

There had been general studies in the literature that said, “Look, there are these things that are known to contribute to bad air quality and to contribute to climate. So are there ways where you could reduce those and get a substantial difference in both, which would make it sort of more palatable to kind of deal with these problems?” So we specifically chose those things that contributed both to black carbon, ozone formation and haze forming, and health impacts.

Interviewer - Sarah Crespi

So you picked your targets, and then you looked at the best way to tackle them. What are some of the measures that you suggested that people use to cut down on these pollutants?

Interviewee - Drew Shindell

There is a series of different measures that have been used, at least somewhere in the world, and are known to work. And these include things like—for methane, which is one of the main precursors of tropospheric ozone—capturing leaks from pipelines and storage tanks; capturing it instead of either releasing or flaring off methane that's produced naturally in coal mining and in oil and gas production; and capturing methane from city landfills. For black carbon, the main measures had to do with controlling emissions from diesel vehicles – so tight standards on those kind of vehicles; and changing from kind of traditional cook stoves where people put a few rocks together and burned wood; and this kind of very inefficient combustion is what produces black carbon.

Interviewer - Sarah Crespi

So, some of those require political intervention and others are things that people could do at home, I guess. Do they have equal weight in terms of the effect they'll have on climate change and health?

Interviewee - Drew Shindell

That really depends on where you are looking in the world. And, in places like the United States or Europe, the regulations are already fairly strict on many of these types of sources, so our diesel emissions are already fairly low and are heading downward. We don't use traditional cook stoves. What we do still have are things like emissions from landfills and from livestock. What they have in the developing world, in many cases, is still very inefficient burning. And so, in those regions, then the vehicle standards and the change from traditional cook stoves to modern fuel supplies are the main ways to move ahead.

Interviewer - Sarah Crespi

So, just like these interventions will differ across different parts of the world, you'll also see different impacts if they were put in place. Can you talk about those?

Interviewee - Drew Shindell

Sure. What we have for the methane measures is methane lives for around a decade in the atmosphere – so the impacts of those tend to be felt worldwide. When we look at the BC measures, BC only lasts a matter of several days in the atmosphere, so those impacts tend to be much more local. And some of the impacts BC has, in particular, when it falls on snows or ice, it darkens those surfaces, reduces their reflectivity, and so those surfaces warm even more than the global average. So regions where you're reducing BC – where the sources are especially large in Asia, especially south Asia, and also parts of Africa – those regions would tend to see the greatest benefits in both local reduction of warming and in public health.

Interviewer - Sarah Crespi

So, another aspect that you took into consideration in this study was the cost of implementing these and savings or potential earnings from making these changes. How does money factor in?

Interviewee - Drew Shindell

Well, that's one thing that really separates some of these measures from CO₂ measures. In many cases, the methane measures especially are very attractive financially. Because instead of taking methane, it would be released from say a mining or fossil fuel extraction operation of any sort, you can capture that methane and you sell it. Methane is a valuable commodity – it's the main ingredient of natural gas. And then, when you factor in also the avoided damages from climate and the avoided damages to human health, the cost effectiveness of these measures tends to be extremely large. In most cases, the benefits that accrue from these measures actually outweigh the implementation costs. For BC measures, it's often the same. It can be challenging to envision implementing something like changing cook stoves to billions of people that use these, but the benefits are really quite profound.

Interviewer - Sarah Crespi

You also discuss the effects on crops, and that is also part of your cost calculation?

Interviewee - Drew Shindell

Yes. One of the things that ozone does – in addition to damaging human health – is it reduces ecosystem productivity. So this can have effect on both natural ecosystems and on agriculture, and we calculated the effect on agriculture – again it's billions of dollars worth of damages – well, these are about 50/50 from the methane measures and the black carbon measures.

Interviewer - Sarah Crespi

So you found that there are certain costs associated with reducing outputs from various processes, but that the cost in crops and selling methane and other kinds of solutions would offset those?

Interviewee - Drew Shindell

Right. Typically the benefits for reduced damage to agriculture and to health and if you value the climate benefits, as well, these offset – more than offset – the costs; however, the usual problem arises in that the benefits don't accrue to the people that would have to pay the cost. So, if it's a big mining operation, they're not the ones that are growing crops. In some cases, even for the company involved, these measures would pay for themselves. You know, they reduce the loss of their product. But, if you invest \$50 million, and you get \$70 million back, we think we think it's a great idea; whereas some of the big companies think, "Well, if I have \$50 million, I can open a whole new field and make \$100 million. So why do I want to do something with such meager returns?" So, even something that pays for itself, doesn't necessarily get done when there's a limited supply of capital. They have other things they'd rather do with it.

Interviewer - Sarah Crespi

Well, you talked about carbon dioxide reductions a little bit. And how do these pollutants fit in with plans for carbon dioxide reduction?

Interviewee - Drew Shindell

Well, these are largely separate and complimentary to reductions in carbon dioxide. Given their fairly short lifetimes in the atmosphere of these pollutants, they don't have such a drawn out impact the way CO₂ does. And that's what gives them powerful leverage in the near term when you don't have powerful leverage from CO₂ reductions. But that means in the long term what happens to climate is really going to be a function of CO₂. Reductions from CO₂ are primarily from things like power plants – things like that that are extremely efficient combustion and therefore don't emit lots of black carbon. So they're really independent sources, and they have effects on independent time scales.

Interviewer - Sarah Crespi

So we've talked a lot about the health effects and the economic impacts of these changes. What effects would reducing black carbon and ozone have on the climate and what kind of time scale?

Interviewee - Drew Shindell

The effects of black carbon and ozone reductions on climate would start very rapidly. So, for something like black carbon, one of the things it will do is disrupt the hydrologic cycle. So, as soon as you stop emitting it, you know, the same week the atmosphere responds, and you would have a reduced disruption of rainfall patterns starting virtually immediately. With global mean temperature, you know, the time scale is really set by the ocean, which can take on the order of a decade or two to really feel a good portion of the response.

Interviewer - Sarah Crespi

Great. Well, Drew Shindell, thank you very much for speaking with me today.

Interviewee - Drew Shindell

Oh, it was my pleasure.

Host – Sarah Crespi

Drew Shindell is one of the authors of a research article on cost-effective, healthful, pollution prevention in this week's Science.

Music

[10:54]

Host – Kerry Klein

The gender gap. It's an issue that crops up in areas like academic performance, job opportunities, and career aspirations, and the puzzle of how to reduce this gap is the subject of research all around the world. This week, a team of researchers reports what they call a "randomized natural experiment" in India, where a recent policy requires that a certain number of rural villages must elect a female leader. Just how this affirmative action influences young adolescent women, as well as their brothers and parents, was the subject of study for Lori Beaman, who spoke to me from her office at Northwestern University.

Interviewee - Lori Beaman

Political affirmative action policies have been pretty widely adapted around the world in the hopes of increasing the number of female politicians that are in office. One of the motivations for these kinds of policies is to improve the long-term opportunities for women in politics and also in other domains. So, in this research, we're interested in how a quota policy in India – where one-third of village councils must be headed by women – how this affects the long-term outcomes, such as girls' aspirations for their education, as well as their career.

Interviewer - Kerry Klein

Well, let's step back then and just talk about, in general, what are the sort of career paths and typical adult lifestyles of men and women in India?

Interviewee - Lori Beaman

Well, there's, of course, a lot of heterogeneity in what men and women do in India. It's a pretty large country. But, by and large, it's a pretty traditional society, especially in rural areas, which is the context that we're studying. So, to give you a sense, men are often subsistence farmers or agricultural laborers, and domestic work will fall primarily in the hands of women. So, to give a more concrete example, from our data, 75% of parents – both mothers and fathers – said they wanted their girl to be a housewife or whatever their in-laws prefer. Girls are also less likely than boys in order to say that they want to complete secondary school or to study on for a more advanced degree.

Interviewer - Kerry Klein

So there's a pretty significant gender gap here in terms of education and career attainment.

Interviewee - Lori Beaman

Right.

Interviewer - Kerry Klein

So, in the beginning, you mentioned this quota policy in terms of the leaders of a number of rural villages. So, tell me all about that – when it started, how it got started, and sort of what state that's at.

Interviewee - Lori Beaman

So the quota system was put in place as a result of a constitutional amendment in 1993 that basically gave local levels of government more power as a decentralization act. And with that constitutional amendment also came quota policies for both women as well as disadvantaged groups within India. So the policy that we're studying in West Bengal was implemented for the first time in the 1998 elections and has been ongoing since then.

Interviewer - Kerry Klein

And so, where your team comes in is to take, you know, these villages where women have become the leaders from this quota policy and to sort of study the effects of these female leaders on the village itself. So how did you tackle that?

Interviewee - Lori Beaman

India is an excellent context in order to look at what is the impact of a political affirmative action policy on longer term outcomes, especially for girls, since first of all it's an enormous policy implemented at a national level – so it's a policy which is kind of really interesting to study in its own right. But it also allows us from a statistical point of view in order to uncover the causal impact of female leaders on these outcomes. And the reason for that is that West Bengal, as well as some other states, chose to implement the policy in a randomized fashion. So, the areas which have to have a female leader are randomized for any particular election, and this allows us to be able to say something

about the causal impact since then we know – at least for before the policy was implemented – that the places with or without female leaders were the same on average.

Interviewer - Kerry Klein

And so, you were actually submitting questionnaires to a lot of these villagers.

Interviewee - Lori Beaman

Right.

Interviewer - Kerry Klein

Tell me about that.

Interviewee - Lori Beaman

Sure. So, in 2006 and 2007, after there had been two full electoral cycles of reservation, we decided to collect data in 495 villages in one district in West Bengal on a variety of different outcomes in order to look to see if this reservation policy is affecting the provision of public goods, villagers' perceptions of women's ability to lead, and we also collected information on parents' aspirations for their children, as well as adolescents' own aspirations for their career and education.

Interviewer - Kerry Klein

Right. The thoroughness in your data collection is just really quite striking. I mean, you were surveying about their level of education; their career aspirations; time spent on household tasks; desired age of marriage; and, as you said, also asking the parents about their own desires for their children. So what were the most meaningful patterns here that emerged in these towns where female leadership was prevalent?

Interviewee - Lori Beaman

What we found is that in areas that had female leaders for two electoral cycle was that girls became more ambitious in their stated aspirations relative to boys – and that includes aspirations about whether or not they want to complete secondary school, the age at which they want to get married, whether or not they would want to become a village council president – and we also see that parents improve their aspirations for girls relative to their sons, as well. Interestingly, and I think perhaps most striking, we also find an analogous change in actual outcomes. So, we see that the initial gender gap in educational attainment disappears in places that had been reserved for a female politician for at least 10 years.

Interviewer - Kerry Klein

Now, what about the male adolescents in these towns? Any changes there?

Interviewee - Lori Beaman

Right. So, actually that's an excellent point. So, we're finding that there's a decline in the gender gap, but it's entirely driven by improvements in girls' aspirations and educational attainment, and we're not seeing that boys are made any worse off, which is an important point when we're thinking about affirmative action policies where you

might think that one group is benefiting at the cost of another. And here we are seeing just that girls are made better off, while boys are the same in places with or without female leaders.

Interviewer - Kerry Klein

I mean that is something that I would think about actually – the negative opinions of the affirmative action. I mean, were there any clear disadvantages to this system?

Interviewee - Lori Beaman

Right. So, when we started this study, we certainly had in mind that there was a potential for backlash against women. In other work that we've done as a team looking at the same question using the same data, we interviewed men and women to try to get a sense of whether or not their view of women's ability to lead has changed. And so, we used a technique, for example, where we had a village speech, and we had a man and a woman deliver the same speech, and then we would randomize which version of the speech was given to the villagers. And we actually found that, particularly for men, that their view of whether or not women could serve as good leaders was dramatically improved in places that had female leaders and that we didn't see any sort of evidence of a backlash, as what you might worry about.

Interviewer - Kerry Klein

Now, going back to the improvements in women's education and career goals, what do you think are the underlying causes here? Is it as simple as these women leaders were role models for the young girls, or is there something more subtle and complex there?

Interviewee - Lori Beaman

We believe that the female leaders were serving as role models for the younger girls in their villages. Another plausible explanation is that the women leaders were actually just implementing different types of policies. So, for example, they were implementing policies which made girls more likely to go to school relative to boys, or they're improving women's labor market opportunities and therefore that changes girls' aspirations. We don't think, though, that this is what's going on because we also looked at the career and educational outcomes for women that were just a little bit older than the adolescents – so, women age 16-30 – who presumably would have also benefited from these kinds of policies if they were at play. But we don't see any difference in areas with or without female leaders for this population. We also don't see any changes in the quality or quantity of educational infrastructure – so, we administered a test to nine-year-old boys and girls in all of these villages, and we don't see any sort of change in test scores, which should give us a sense of the quality of the education that they're receiving. So, given that we largely ruled out the alternative explanation that it's a direct effect from policies that female leaders are implementing that their male counterparts don't, we think then that it's likely to be a role model effect.

Interviewer - Kerry Klein

And do you think that this effect would result in both short- and long-term changes?

Interviewee - Lori Beaman

Yeah, so the short-term effect is, probably the most striking one is, just from the direct effects on the program where you have a lot more villages now with a female leader. In other work, we also found that places which were previously reserved for a woman were also more likely to elect a woman once that seat became unreserved – that is once men and women were able to compete for that seat. So we see the short-term outcomes in terms of the domain of politics, and we also through the aspiration result, I think, get a sense that this next generation might lead to a kind of more broader changes in girls’ career and educational outcome.

Interviewer - Kerry Klein

Great. Lori Beaman, thank you so much.

Interviewee - Lori Beaman

Thank you.

Host – Kerry Klein

Lori Beaman is the author of a Science Express article this week entitled, “Female Leadership Raises Aspirations and Educational Attainment for Girls: A Policy Experiment in India.” You can find it online at www.sciencexpress.org.

Music

[20:10]

Host – Sarah Crespi

On a map, the curving archipelago of the Aleutian Islands draws a dotted line between Alaska and Siberia and separates the Pacific Ocean from the Bering Sea. Because of their inaccessibility, these islands have been called an ideal laboratory for studying human migration patterns. I spoke with contributing correspondent Michael Balter about what genetic and archeological evidence have to say about the history of the Aleutian people and why the islands are such a good migratory model to work from.

Interviewee - Michael Balter

The Aleutians were first colonized beginning about 9,000 years ago. And then, it took about five or six thousand years for these early Aleut colonists to get all the way from the east – near the Alaskan peninsula – all the way out to the western Aleutians, which is a distance of about 2,000 kilometers. This is the world’s longest archipelago. Although there were two groups that eventually colonized the islands, they did so thousands of years apart, so they really didn’t have any competition. And the people who were living on the Aleutian Islands – and even the people who still live on them today – probably can trace their ancestry back all the way to the very first colonists back, you know, 9,000 years. So you have kind of a very clean, pristine kind of archeological and particularly genetic picture with very little competition from anybody else.

Interviewer - Sarah Crespi

The islands were continuously inhabited for thousands of years, and then suddenly they lose a ton of population during World War II. Can you tell us a little bit about that part of their history?

Interviewee - Michael Balter

It's particularly remarkable that we have been able to, or that researchers, at least, have been able to trace the genetic history of the Aleuts because their life on the islands was disrupted very seriously during World War II. Soon after Pearl Harbor, the Japanese invaded the far western islands of Attu and Kiska and evacuated the Aleuts from those islands and put them in concentration camps on Hokkaido Island. The Americans responded by building a military base on Adak, that was when it was first founded, and by evacuating all of the rest of the Aleuts from all of the islands – mostly to sort of abandon canneries in southeast Alaska and along the coast there. It was quite a tragic situation for the Aleuts, and most of them never made it back to their native islands. But, they do remember where they came from. So, despite this incredible disruption to their culture and to their lives, we're still able to trace their ancient history today.

Interviewer - Sarah Crespi

There were multiple waves of settlers on these islands. What does the genetic and archeological evidence say about them?

Interviewee - Michael Balter

Well, there appears to have been two different waves of migration into the Aleutians from the Alaskan Peninsula, in other words from the east. The first group is referred to as the Paleo-Aleuts, and they are the ones who first came onto the islands beginning about 9,000 years ago. They pretty much came as soon as the glaciers lifted. It was then, all of Alaska and the Alaskan Peninsula were glaciated up until at least 12,000 years ago, so nobody really could get out there. So, beginning about 9,000 years ago, corresponding with what we know about these climatic changes and the withdrawal of the glaciers, you begin to get archeological evidence for the Paleo-Aleuts. And they pretty much had the islands to themselves until all the way up until about 1,000 years ago, and then you had another group, a second group, come in called the Neo-Aleuts. And they began to colonize from the east also. And the Paleo-Aleuts and the Neo-Aleuts coexisted together for several hundred years. The genetics seems to suggest that they mated, that there was admixture between the two groups, and that modern day Aleuts are some kind of a genetic mixture of these two original waves of population. And we have the evidence of this not only archeologically – there are some certain tool type differences and cultural differences between the two groups – we have differences between them genetically, they can be told apart because they have somewhat different mitochondrial DNA profiles; and we can also tell them apart from their skulls. So, the earliest Aleuts, the so called Paleo-Aleuts, had longer, narrower skulls kind of more like European type skulls, and whereas the Neo-Aleuts had rounder skulls kind of more typical of modern day Asians.

Interviewer - Sarah Crespi

One was there for a lot longer than the other. What was known about the lifestyle of the ancient people?

Interviewee - Michael Balter

Well, the most important thing about both the Paleo-Aleuts and the Neo-Aleuts is that they were incredibly well adapted to a maritime existence. We know they had kayaks 2,000 years ago because we have evidence of that. We don't have boats any earlier than that, but there is an assumption that that was how they got around the islands, just basically pedaling kayaks that they made from driftwood or from whalebone that they then covered with the skins of sea lions or seals or other sea mammals. And they were expert fisherman and fisherwomen probably. Archeologists think that they were the best-adapted group to the sea to a maritime existence of all of the groups that existed in the far north in those early days. And so, everything that they did – everything that they ate and their entire lifestyle – centered around the sea.

Interviewer - Sarah Crespi

Well, I think there is something in the article about how the weather and the availability of food affected when the islands were settled.

Interviewee - Michael Balter

That's right. So, you know, they started 9,000 years ago in the east. They got to Adak by about 7,000 years ago, and they got to the westernmost islands – Attu and Kiska, for example – about 3,500 years ago. So it took a while for them to get along there. And it appears to have happened in kind of spurts of migration, and these spurts of migration do appear to correspond to cold spells. And that could mean one of two things or both. Generally, the sea is most productive of marine life and fish and things like that when it's colder. The other thing that apparently happens during colder periods is the winds die down. High winds are generally correlated with kind of warmer conditions, and when the seas are colder the winds tend to die down – and that might have made it easier for the Aleuts to make it from one island to the next. So we know, at least, those two factors that appear to correlate with these waves of migration.

Interviewer - Sarah Crespi

Really interesting. So, you've talked a lot about how the islands were settled from east to west. But, when you think about the history of the settlement of the Americas, the people who first settled these continents were coming from the west going to the east. How does that fit in with what we know happened on the Aleutian Islands?

Interviewee - Michael Balter

Yeah, well that's a very interesting point. The so-called Bering Straits land bridge, which became available to people from Siberia and from Russia basically, beginning about 15,000 years ago – maybe as early as 20,000 years ago, but for sure 15,000 years ago – the sea level was much lower and that was a land bridge through which people were crossing. And that is the, you know, major way that we know that the Americas were settled, that beginning about 15,000 years ago people from Asia came over that land bridge, got into Alaska, got down into Canada, North America, all the way down to South America, all the way down to Chile. The prehistoric and ancient Aleuts, like everybody else, came over the Bering Straits land bridge – they came into Alaska, and then they

probably kind of hung around in Alaska for a while. And, as soon as they were able to get past those glaciers, they began colonizing the islands. So they kind of came the long way around. And we know that from radiocarbon because the earliest radiocarbon dates are about 9,000 years ago in the very east of the Aleutians at a site called Anangula Island; then, we have about 7,000 years as the earliest site on Adak, which is in the central Aleutians; and then 3,500-4,000 years is the earliest sites in the far western Aleutians. So we have that radiocarbon evidence, but we also have genetic evidence. And amazingly, despite the fact that so few Aleuts actually really live on these islands anymore because they were evacuated from the islands during World War II, nevertheless, you know, most Aleuts know what islands they were originally from. And, if you look at their genetic profiles, their mitochondrial DNA, you see a clear gradient once again going from east to west that corresponds almost exactly with what we know from the archeology. So, it's quite a strong correlation there.

Interviewer - Sarah Crespi

In a more general sense, what does the story of the Aleutians and the islands tell us about the story of all people?

Interviewee - Michael Balter

The Aleutians appear to have been colonized through a mechanism called kin migration where you have a population on an island, and then a smaller family group kind of breaks off, and it goes over to the next island or a couple of islands away. And that pattern is pretty clearly shown in the genetics of modern and ancient Aleut populations. And this was a point that is particularly made by Michael Crawford of the University of Kansas who did a great deal of the genetic work that we've been talking about. Crawford thinks that this might also have been the major mechanism by which the peopling of the Americas took place – that you had migrations into both North and South America and then people spread by family groups going off from major populations. Now, that's a little bit more controversial and not very well established, but it does appear to hold for the Aleutians.

Interviewer - Sarah Crespi

Well, Michael Balter, thank you very much for speaking with me today.

Interviewee - Michael Balter

You're very welcome.

Host – Sarah Crespi

Michael Balter is a contributing correspondent for Science. He discusses new research into the settlement patterns of the Aleutian Islands in a News Focus this week.

Music

[30:32]

Interviewer - Kerry Klein

Finally today, David Grimm, online news editor of *Science*, is here to give us a rundown of some of the recent stories from our daily news site. So first, Dave, is a story that I saw online earlier this week and was very excited to discuss because, frankly, who is not fascinated by carnivorous plants?

Interviewee - David Grimm

Everybody loves meat-eating plants, and this meat-eating plant is unusual even among meat-eating plants, which are all pretty unusual themselves. This is a really strange-looking plant. It's called *Philcoxia*. And it's this purple-flowered plant that grows in patches of white sand in the central highlands of Brazil. Now, what's unusual about it is its leaves actually grow underground, which when you think about it doesn't make a lot of sense because leaves are supposed to photosynthesize, and why would you put them under the soil where sun really can't get to them? And that's the mystery that started this study off in the first place.

Interviewer - Kerry Klein

So it sounds like a relatively unassuming plant – it grows underground, we wouldn't really think much of it, probably doesn't have the spikes that a Venus Flytrap would have.

Interviewee - David Grimm

Right.

Interviewer - Kerry Klein

What tipped us off that this was carnivorous?

Interviewee - David Grimm

Well, what the researchers did is they took a closer look at these leaves – which are really the only part of the plant that grows underground, the rest of it grows above the surface – and what they found was the leaves contain these sticky glands that have been seen in other carnivorous plants. So the researchers said, “Ah, ha, maybe these guys are eating meat.” To confirm that, they looked under the microscope at these leaves, and they noticed tiny roundworms called nematodes that were stuck to the leaves. Now, they couldn't – just based on that – confirm that the plant was actually eating these roundworms. They had to do a little bit more study. And what they actually did was they created this food chain in the lab where they took some bacteria, which apparently roundworms like to eat, and they fed them this heavy form of nitrogen. And the reason they fed them this heavy form of nitrogen is because if you have this heavy form it's actually easy to track where it goes compared to just looking at normal nitrogen. And so, they fed the heavy nitrogen to the bacteria, then they fed the bacteria to the nematodes, and then they put the nematodes near the plant. And lo and behold, when they looked the next morning, the plant leaves were covered with nematodes. And, when they examined the plants a couple of days later, they discovered that the plants suddenly had a lot of heavy nitrogen in them, which means they must have eaten the nematodes – it's the only

way they could have gotten the heavy nitrogen. So this confirmed that this very unusual plant is also a meat eater, and it seems to make worms a pretty significant part of its diet.

Interviewer - Kerry Klein

How did they figure that part out – that it's such a significant part of their diet?

Interviewee - David Grimm

Well, the soil that these plants live in is really nutrient poor, and it's also very water poor, too. So, there's not a whole lot of other places these plants are going to get their nutrition other than the nematodes.

Interviewer - Kerry Klein

Do the scientists know how the leaves attract the nematodes?

Interviewee - David Grimm

They don't know that. That's one mystery they haven't solved yet – why do these nematodes migrate over to the leaves in the first place if they're just going to get eaten? And that is going to have to be answered by further study.

Interviewer - Kerry Klein

Hum. Something to look forward to. And next, we've got an effective climate change that would really never have occurred to me.

Interviewee - David Grimm

Right. Usually when you hear stories about climate change it's always bad news – the sea levels rising, the Earth getting hotter, more disease, a lot of bad things. This is the very rare, potentially positive climate change study, although it's only positive for a type of lizard known as the three-lined skink. And this is a small, bug-eating lizard that's native to southeast Australia.

Interviewer - Kerry Klein

Where it's already pretty hot.

Interviewee - David Grimm

It's already pretty hot. And indeed, researchers have already shown – not with just this lizard but with other reptile species – that when it's hot, and especially when the nest itself is hot, it can actually have very dramatic effects on a lizard's biology. The temperature of a nest can change a lizard's size, its speed, and even its sex.

Interviewer - Kerry Klein

Okay, so those are the effects that we already know. What's, what's new about this study?

Interviewee - David Grimm

Well, in this new study, researchers have found one more effect of a hot nest – and that is it seems to make lizards smarter. And the way they found this out is they took a look at

these three-lined skinks, they brought them back to the lab, and they made little nests for them in the lab. And they made some of the nests warm, they were about 22°C; and some of the nests cooler, they were about 16°C. And then, they gave the equivalent of a lizard IQ test. What they did is they had these plastic flower-pot trays. They turned them over, and they cut little holes into them, so that they could become little lizard hiding places. But some of the holes they blocked with this clear Plexiglas. So from the outside the lizard wouldn't know which holes it could run into and which ones it couldn't. And then, they kind of "spooked" the lizards, so that they would want to hide. And, at first, the lizards that were born in both the cool and the warm nests were as likely to run into an open hole as to one that was covered with Plexiglas. But the lizards that grew up in the warmer nests learned from their mistakes a lot quicker. As soon as they started bumping into this Plexiglas, they quickly learned how to avoid the false escape holes and only go for the right ones, whereas the lizards that grew up in a colder nest never really learned to make that distinction.

Interviewer - Kerry Klein

Okay. So this suggests that those that grow up in warmer conditions may have better survival skills. But, I could imagine that even too hot a nest could be detrimental, could just fry the egg, as well.

Interviewee - David Grimm

Right. Well, that's a really important caveat here. Even though these small gains in temperature seemed to be making these lizards "smarter" – which could also really be important for the survival, especially if they were trying to escape predators in the wild – there will probably come a point where the nests get so hot that it's very detrimental to the lizards' survival. So, even though this seems like a bit of good news, in the long term it will probably be bad news.

Interviewer - Kerry Klein

All right. And for the last story we've got some explosive news from a recent meeting of the American Astronomical Society.

Interviewee - David Grimm

Right. This is a meeting that's been going on this week in Austin, Texas. And it's produced a lot of stories, and there will be some other stories you can check out on the site. But this story is one of my favorites. It's about a galaxy cluster known as El Gordo, which is Spanish for "the fat one." And a galaxy cluster is an amalgamation of 50-1,000 galaxies, so it's this huge concentration of all of these sort of galaxies piled up along one another. And El Gordo is the biggest cluster of galaxies that's ever been found.

Interviewer - Kerry Klein

All right. So, we've seen clusters of galaxies before. What's unique about this one?

Interviewee - David Grimm

Well, there's a few things. First of all, this guy is very far away – it's 7 billion light years away, which means that when we look at it today we're actually seeing it as it was 7

billion years ago. Not only that, that's a time when the universe was only about half of its present age. So this is a galaxy cluster that formed pretty early in the evolution of the universe. El Gordo has a few other interesting features, as well. It contains X-ray emitting gas at temperatures of up to 200 million°C, which is pretty darn hot. It's also filled with a lot of dark matter. And the total mass of the cluster – just to give you a sense of how big this thing is – is 2 quadrillion times the mass of our own Sun. So this is a pretty big cluster.

Interviewer - Kerry Klein

Okay. So El Gordo is aptly named – it's huge. How did it get to be so big?

Interviewee - David Grimm

Great question. And what the researchers believe happened – according to new observations – is that El Gordo actually isn't just one galaxy cluster. It's actually the result of two clusters smashing into each other, which would have made it obviously a lot larger. What's interesting about this is, again, this would have happened at a pretty early time in the universe, and a lot of astronomers thought this was too early for a massive structure like El Gordo to form, even if it was the product of a collision of two smaller clusters. But the researchers say that simulations of the early universe show that the formation of something like El Gordo is possible, just barely possible, but possible nonetheless.

Interviewer - Kerry Klein

So, our theories of the formation of the early universe are saved for now.

Interviewee - David Grimm

Right.

Interviewer - Kerry Klein

So what else have we had in the news site in the past week?

Interviewee - David Grimm

Well, Kerry, like I mentioned, for *ScienceNOW* we've got a bunch of other astronomy stories coming out of this astronomy meeting in Austin, Texas, a lot of other cool stuff, so I encourage listeners to check that out. Also, a story about the smallest ear ever created – this is a nano-ear. And we'll have an item about how researchers made it so small and what it can be used for. For *ScienceInsider*, we've got stories about a new controversial proposal to end whaling around the globe. Also, a story about the Doomsday Clock – this is a clock that's maintained by the Bulletin of Atomic Scientists. It clicks closer to midnight as they think we're getting closer to global nuclear annihilation or annihilation of other types. They've just moved it another minute closer to midnight, and you can read about why that is. Finally for *ScienceLive*, our weekly chat on the hottest topics in science, this week's *ScienceLive* is about the controversial flu papers that have been making their rounds in the news. This is a controversy about whether scientists should publish results about modifying a virus that could be used for

bioterrorism. We'll discuss that. And for next week on *ScienceLive*, we've got a chat about doing science in Antarctica. So be sure to check out all of 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 for *Science*. You can check out the latest news and the policy blog, *ScienceInsider*, at news.sciencemag.org, where you can also join a live chat, as Dave said, *ScienceLive*, on the hottest science topics every Thursday at 3 p.m. U.S. Eastern time.

Music

Host – Sarah Crespi

And that concludes the January 13th, 2012 edition of the *Science* Podcast.

Host – Kerry Klein

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

Host – Sarah Crespi

The show is a production of *Science* Magazine. Jeffrey Cook composed the music. I'm Sarah Crespi.

Host – Kerry Klein

And I'm Kerry Klein. On behalf of *Science* Magazine and its publisher, AAAS, thanks for joining us.

Music ends