Science Magazine Podcast
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Music

Host – Kerry Klein
Welcome to the *Science* Podcast for January 18th, 2013. I'm Kerry Klein.

Host – Sarah Crespi
And I'm Sarah Crespi. This week: an innovative imaging technology [00:56], identifying individuals from their genomes [11:43], and the hype over a hormone… [19:32]

Interviewee – Greg Miller
You'll come up with all kinds of things being sold online: it'll improve your love life, help you close business deals, and just generally make your life more awesome.

Host – Kerry Klein
Plus, a few stories from our online daily news site [27:30].

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Music ends

[00:56]
Host – Kerry Klein
In a digital camera, more megapixels means better resolutio—the ability to zoom in on an image and gain more information. But in many images, more pixels also means more redundant information and, thus, more required storage space. This week, John Hunt and colleagues describe a high-efficiency imaging tool that aims to collect only the bare essentials of an image. Where conventional cameras work pixel by pixel, the new tool instead breaks down a scene by wavelengths of light. The catch? The detector is made from so-called metamaterials--specialized substances which, so far, are only calibrated for the microwave part of the spectrum. I spoke with Hunt about the mechanics and practical uses of this technology.

Interviewee – John Hunt
Microwave wavelengths are the wavelengths that your cell phone uses to communicate, for instance. We still think of them as a type of light. They're not light that we can see, though. And this imager that we've designed in this experiment uses no moving parts, no lenses, and uses only a single detector. It's equivalently a single pixel. This is made possible by combining two developing technologies. First, we use metamaterials that

allow us unique control over light waves, and we use another technique called computational imaging, which generalizes how we think about and collect images.

Interviewer – Kerry Klein
Okay, so let's start with the basics. What exactly is a metamaterial and what sorts of metamaterials did you use here?

Interviewee – John Hunt
So you can think of a metamaterial as a type of composite, a composite material like, say, fiberglass. In the case of fiberglass, you combine two different materials – a woven glass thread cloth and a plastic resin – and by combining them and structuring them in a careful way, you come up with a new material that has different mechanical properties, different from and better than either of the two parts. So in metamaterials, we do the same sort of thing. We make a composite of different structures – different metals, different plastics – that gives us not mechanical properties but optical properties. We can control the way that light refracts and reflects through this material in unique ways. So one of the properties of metamaterials is that they tend to rapidly change how they respond to different colors or different frequencies of light. In previous experiments, this has sometimes been a limitation. For instance, in the cloak – which is a pretty famous metamaterial device – it actually limits the operation range. It only works for one frequency, one color of light. But in the current metamaterial imager, we're actually leveraging this behavior as a way to collect more information from the scene without using moving parts or without multiple pixels.

Interviewer – Kerry Klein
So how do more conventional imaging technologies work, say, a hand-held point-and-shoot camera?

Interviewee – John Hunt
In a basic point-and-shoot camera, you have a lens that focuses light from different parts of a scene to different pixels on the detector array, so that every point in the scene that you want to image is mapped by the lens to a different pixel. So if you want to have a million pixels in your final image, you have to have a million different detectors on your detector array. If you want to image at longer wavelengths and optical wavelengths, such as a microwave wavelength with this imaging system that we've designed, it's made to work, you can't use these millions and millions of pixels anymore because the resulting array of pixel detectors becomes far too large and costly to use easily. So, instead, what people typically do to image at microwave wavelengths is they take a single detector and they move it from point-to-point across sort of a virtual detector array, so that eventually they sample the light at every point that they would have put a pixel at if they could have made an array of many, many pixels. The problem with that approach is that it's very slow to move this single detector, or array of detectors, across this plane. It requires complicated gears that are expensive and take up a lot of space.

Interviewer – Kerry Klein

And how does your metamaterial aperture work in contrast to these more conventional technologies with their own sets of limitations?

Interviewee – John Hunt
The first difference is that there's only a single detector, and we never move it. And the way that we make an image with this system is we have a metamaterial screen, which is covered in patches of metamaterial elements, which are each transparent to different wavelengths of light. So this means that for every color or wavelength of light coming from the scene, it's sampled by different patches of the aperture before it gets to the detector. If you want to collect a lot of data from a scene, you have to, in a sense, multiplex the way that you're sensing. So one way of doing that, the way that it's done in traditional cameras, is you have many different pixels. Pixels are spatially separated from each other. Instead of doing this sort of spatial detector multiplexing, what our system does is sort of frequency multiplexing so that each frequency or wavelength of light that comes into that imaging system samples a different portion of the scene. And then we use some very elegant math, which is developed in the field of computation imaging, to turn that data into a two-dimensional picture of all the scattering elements in the scene.

Interviewer – Kerry Klein
Taking a step back, you describe this metamaterial screen as being made up of patches that are receptive to different wavelengths of light.

Interviewee – John Hunt
That's right.

Interviewer – Kerry Klein
How does this patchwork help process spatial information?

Interviewee – John Hunt
So the way, in general, that the metamaterial aperture encodes spatial information into our individual measurements is by focusing light from different points in the scene onto our single detector. And for every frequency that we tune our detector to, the metamaterial aperture focuses a different set of points from our scene down onto that detector. So we make a sequence of measurements for different frequencies, and we get a sequence of different intensity measurements that correspond to the sum of the points in the scene that are being focused onto the detector for each frequency.

Interviewer – Kerry Klein
Ah. So you're not measuring all wavelengths of light at the same time. Instead, you're tuning the system to only detect one wavelength of light at a time, and then you're running through these wavelengths sequentially to make a robust image.

Interviewee – John Hunt
That's exactly right. The detector is tuned to one frequency after the other sequentially, but because this is all electronic, it can be done very quickly. The metamaterials

themselves are static; we don't change them. But what we do change is the wavelengths of the light that we feed in to our metamaterial aperture.

Interviewer – Kerry Klein
So what kinds of scenes have you been able to image so far?

Interviewee – John Hunt
So right now we're imaging pretty controlled scenes. We're imaging scenes that we've artificially constructed in rooms that have no reflection. So we cover the walls and floor and ceiling in a room with a non-reflective material. That way we can put things in the room and we can only see those objects; we don't see any of the walls or other objects. This system works at microwave wavelengths, so you can't see things like the sun, necessarily. What you can see are any metallic or shiny objects that reflect microwaves. In addition, right now the system only images in a single plane. It's kind of like a radar plot. We have one dimension of range and one dimension of angle in our resulting images. We're working right now on extending the system to make full three-dimensional images where we would have two dimensions of angle and one dimension of range. And we'd be able to locate all scattering objects and shapes in a three-dimensional volume.

Interviewer – Kerry Klein
So for right now, there's no way to adjust the focus or depth of field of an image?

Interviewee – John Hunt
Well, in a sense we actually have a very large, perhaps infinite, depth of field. We can see objects at almost any range between one and five meters, for instance; we don't have to focus at one depth. That's one of the interesting advantages of this system.

Interviewer – Kerry Klein
Does that mean then that all objects in the field of view are equally in focus, and that there's no sense of depth at all?

Interviewee – John Hunt
Actually what we do have, one of our two dimensions in our image is a depth dimension. So we can tell where things are in distance, and we can tell where things are left and right. We can't tell where things are up and down. And that's because our aperture right now is a one-dimensional aperture. It's just a thin strip. In order to have information about the up and down direction, we have to make that 1-D aperture a 2-D panel-type aperture, which we're working on right now.

Interviewer – Kerry Klein
And so how long does it take to actually collect the data and process an image?

Interviewee – John Hunt
The collection time is something like 50 milliseconds, and the processing time to generate an image from that collected data is approximately 50 milliseconds. So the time

to capture and generate one frame is a hundred milliseconds, and we can do that at about 10 times a second.

Interviewer – Kerry Klein
So what are the practical uses for this technology? How do you envision it ultimately being used?

Interviewee – John Hunt
So this kind of technology would be useful for any application where you'd like to have a cheap, small, microwave or infrared imaging system. So for instance, if you wanted to build an imager into the body of a car so you could do collision-avoidance imaging, or for security imaging at a checkpoint, if you wanted to just have an imager built onto a wall, or for instance if you wanted to have a cheap handheld device that could see through walls to find wires and pipes. Current systems cost millions of dollars to image at these frequencies, and this potentially could replace those systems with a very cheap, very lightweight, portable system.

Interviewer – Kerry Klein
Do you see this kind of detector ever being viable at other wavelengths?

Interviewee – John Hunt
Well, some of the math and ideas would certainly apply, and already is being applied to other areas such as optical. But the current type of metamaterials, for instance, they don't scale to optical frequencies. We could use these same ideas to make an optical imaging system, but we would have to change some of the hardware.

Interviewer – Kerry Klein
Great. Okay, well John Hunt, thank you so much.

Interviewee – John Hunt
Thank you.

Host – Kerry Klein
John Hunt and colleagues write about innovative imaging in a Report this week.

Music

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This week's podcast is sponsored by Audible.com. Audible has over 100,000 audio books, including titles like The Swerve: How the World Became Modern, by Stephen Greenblatt, or Predictably Irrational: The Hidden Forces That Shape Our Decisions, by Dan Ariely. Right now, Audible is offering a free audio book download of your choice, just for checking them out. When you sign up for a free trial at audiblepodcast.com/sciencemag you get a free book and you support the *Science* podcast. If you choose not to continue the trial, you can cancel and keep the audio book. That address again is audiblepodcast.com/sciencemag.

Music

[11:43]
Host – Sarah Crespi
Our genes are not our destiny, but they do make up a large portion of our identity. So, given their inextricable relationship with who we are, how can we donate our genes to science anonymously? In a Report this week, Melissa Gymrek and colleagues successfully linked surnames to donated genetic sequences in large research databases like the 1000 Genomes Project. I spoke with her about the methods used and the consequences of such outings for genomics research.

Interviewee – Melissa Gymrek
So our approach relies on cross-referencing data from several sources in order to determine surnames from these datasets. A key to our technique is that each of these sources is freely available to the public. So on one hand, we use large, publicly available genetic genealogy databases, which store more than a hundred thousand records in which individuals post a set of genetic markers on the Y chromosome along with their surname. We then downloaded publicly available whole genome sequencing datasets and used an algorithm developed in our lab to pull out the results of these Y chromosome markers. We simply cross-referenced these results against genealogy databases to find a surname matching the same Y chromosome profile.

Interviewer – Sarah Crespi
This study looks exclusively at the identity of male sequences. Why so much of a focus on the Y chromosome?

Interviewee – Melissa Gymrek
So the Y chromosome is very special, in that in most cases, it is inherited along with the last name in males. Therefore, if you share the same Y chromosome with someone, you likely share a last name with that person. So this means that you yourself do not need to submit your DNA to one of these companies in order to be identified; all that is needed is a relative with a shared Y chromosome. So if your father, your brother, or even your distant cousin submits DNA, it could be used to identify you.

Interviewer – Sarah Crespi
So this technique has been used before looking at these genealogy Web sites. And what's different about what you've done here?

Interviewee – Melissa Gymrek
Yes, actually it's been used before. One example is in the case of sons of anonymous sperm donors. These individuals were able to purchase a kit from genetic genealogy companies to type their Y chromosome markers. Then they simply submitted their results to these databases. They found a surname match and were eventually able to trace back their biological fathers. The difference in our case is we're looking at completely anonymous datasets that are publicly available and using our tool to pull out these Y

chromosome markers from whole genome sequencing datasets, and therefore recovering the identity of these datasets.

Interviewer – Sarah Crespi
Let's back up a little bit here. Earlier you said in your method that you pull out the surname of the person. That's not actually an identity; it's actually just a last name. How do you get down to the actual person?

Interviewee – Melissa Gymrek
Exactly. So we found that if we combine several additional sources of metadata – such as the age and the state of the individual – if we combine those three species of information, we can usually narrow it down to about 12 individuals in the United States.

Interviewer – Sarah Crespi
Past studies have looked at outing people who have genetic material in these genealogy services, but you looked at scientific datasets – those that are made available through organizations like the NIH. Was there any difference between your ability to find a person's name in a genealogy service versus somebody who's in a scientific dataset or a whole genome sequence project?

Interviewee – Melissa Gymrek
Yes. So I would say the two cases of data give us different flavors of data to work with. So data from the genetic genealogy services return results from a predetermined panel of markers. Then, successful surname recovery depends on if a record for someone sharing your Y chromosome markers and your surname is in the database or not, and also if the panel of markers is enough to specifically identify that specific record and the unique match. On the other hand, DNA sequencing datasets return results only for whatever markers happen to have been sequenced. So for some samples, we can recover most of the commonly used markers, and in those cases we have nearly the same chance of recovering a surname as in the case of datasets from the genealogy companies. But for other datasets, only a few markers happen to be covered, and so therefore only a few markers can be examined. Both the number and quality of DNA sequencing datasets and the number of records in these genetic genealogy databases, is only expanding. So therefore in the future, it will only become easier to apply this technique.

Interviewer – Sarah Crespi
What are these online genealogy services used for, besides figuring out paternity and that kind of thing?

Interviewee – Melissa Gymrek
They're mainly used by individuals and families that are interested in genetic genealogy. Members of the same family might upload their results and compare to members of related families or to members of their own family.

Interviewer – Sarah Crespi

Really interesting. Not being able to promise anonymity to scientific subjects – people in a study – is a really big problem for health research and other kinds of studies. Is this going to be a bigger problem as we do more in sequencing? It gets cheaper, faster, and more prevalent.

Interviewee – Melissa Gymrek
So I think the problem of promising anonymity is definitely not going to go away, and it's important for scientists and participants both to be aware of these risks. And we think that it's helpful to point out these risks now before this is discovered by people that would wish to use the data maliciously. So what we really hope is that this study will eventually result in better algorithms and better policy guidelines and better legislation to help mitigate some of the risks.

Interviewer – Sarah Crespi
So what do you mean by better algorithms?

Interviewee – Melissa Gymrek
So you can imagine some security algorithms that could be used to protect the data. We tried to think of a number of technical solutions that might prevent our attack, but really in the future, there could be futuristic attacks that could get around any kind of a barrier that we could put up against using data from the Y chromosome. And there will likely be techniques in the future that can use other parts of the genome, rather than the Y chromosome, in order to identify individuals. I think we really need to learn to deal with the fact that we cannot ever make data sets truly anonymous, and that I think the key will be in regulating how we are allowed to use this genetic data to prevent it from being used maliciously.

Interviewer – Sarah Crespi
So you talk about legislation and maybe some algorithmic methods for protecting or providing security for this data. But what about the ability to share this data? Should it be constrained in some way?

Interviewee – Melissa Gymrek
So we believe that data sharing is crucial for continued progress in science, and we're actively thinking about solutions to the problem of anonymity. We don't believe that the solution is to block access to either of these genetic genealogy databases or to public human datasets. I think rather the key is in thinking of new ways to regulate how this information can be used in order to make sure that it's not used maliciously, but is rather used to further progress in science.

Interviewer – Sarah Crespi
And let's talk a little bit about why that's a bad thing. What's the problem with being identified with your own genome?

Interviewee – Melissa Gymrek

So the big example that comes to mind is something like insurance companies. If insurance companies can know who you are, know your DNA sequence, they can determine if you're predisposed to certain disorders, and they can use that information against you to raise your premiums and to make your life bad. You can think of scenarios like that where these are people that you don't want getting a hold of your genetic data that might be able to get a hold of it.

Interviewer – Sarah Crespi
Right.

Interviewee – Melissa Gymrek
So a key in that case will be regulation against doing so. A current example is GINA that prevents health insurance companies from using this information. But there are still many things, such as life insurance and even car insurance, that are not covered by this act that could theoretically use this information.

Interviewer – Sarah Crespi
Great. Well, Melissa Gymrek, thank you so much.

Interviewee – Melissa Gymrek
Thank you.

Host – Sarah Crespi
Melissa Gymrek and colleagues write about tracking down anonymous genetic donors in a Report this week in *Science*. In the issue you can also find a related Policy Forum by Laura Rodriguez and colleagues and a News story by John Bohannon.

Music

[19:32]
Host – Kerry Klein
Drugs that promise greater social skills, a better love life, and a more successful career sound like they should be touted in late-night tv ads—and yet, those are exactly the claims made by some, doctors and otherwise, about the hormone oxytocin. Science writer Greg Miller spoke with me about the infectious excitement surrounding oxytocin, and why some temper that excitement with caution.

Interviewee – Greg Miller
This story is about the enormous interest in oxytocin, which is a hormone made in the brain that has a lot of really interesting functions in the body, and, in particular, in social behavior. It seems to promote bonding and cooperation and the ability to interact with other people and figure out what other people are thinking. And so recently clinicians have gotten really interested in oxytocin as a potential treatment for conditions like autism, where social behavior is impaired. And there are a bunch of big clinical trials getting underway to try to test oxytocin as a treatment for a wide range, actually, of psychiatric and neurodevelopmental disorders. And some people see this as a really

promising development, and other people I talk to think that maybe we're moving too fast with this.

Interviewer – Kerry Klein
So oxytocin really has a lot of hype in the science community right now, not just in the areas of psychiatry and social behavior. I mean, can you just give a few examples of some of the more outrageous claims being thrown around about oxytocin?

Interviewee – Greg Miller
Yeah, sure. If you just Google oxytocin nasal spray, you'll come up with all kinds of things being sold online. It'll improve your love life; turn a shy person into the life of a party. It'll help you close business deals, and just generally make your life more awesome.

Interviewer – Kerry Klein
Wow! Well, so, let's start from the beginning. How did oxytocin first get on our radar? You know, how did we learn that it's such an important hormone in our body?

Interviewee – Greg Miller
Yeah. It was first studied for its role in reproduction. It plays a really crucial role in childbirth and enabling milk to be released during nursing. And it was first studied for those reproductive roles. And then not too long after that in the '60s and '70s, researchers got interested in whether it might play a role in reproductive behavior, as well, and found that it does, in fact, play a role in mother-infant bonding and bonding between males and females in the species that have kind of monogamous bonds.

Interviewer – Kerry Klein
And so then, you know, what we're talking about here specifically is the hype in the field of psychiatry. How did we get from that original research to this surge of interest in social behavior?

Interviewee – Greg Miller
Yeah. So about 10 years ago – 10 or 15 years ago – people started looking into whether oxytocin also had a role in human social behavior, and there were some really interesting studies coming out suggesting that it did, in fact. And if you gave people a snort of oxytocin nasal spray, they became more trusting and were more likely to cooperate in the kind of economic games that people often play in neuroeconomics experiments. And so there were a whole bunch of those studies coming out suggesting that it did kind of have this pro-social effect in humans. And it didn't take long for that to kind of catch the eye and the imagination of clinicians who were interested in potentially using it as a treatment for things like autism.

Interviewer – Kerry Klein
And then, you know, as you said in the beginning, there are many scientists who support these claims, and then there are many that really recommend caution. You know, where does this tension, this dissent, come from?

Interviewee – Greg Miller
Yeah. So on the one hand, almost every psychiatric disorder that there is has an impact on people's social lives. Humans are inherently social creatures and so much of our brains are involved in parsing and understanding and navigating the social world around us. And so it's maybe not surprising that when, you know, something goes wrong in the brain, social relations and social cognition is one of the things that breaks down. And right now, we don't have any good drugs that directly address those social aspects of these disorders, and that's one of the really debilitating aspects of them. So on one hand, that's where the enthusiasm for this comes from is that we just don't have any really good alternatives right now.

Interviewer – Kerry Klein
Right.

Interviewee – Greg Miller
On the other hand, we don't have a lot of research on the long-term effects of taking oxytocin, which is presumably what people would do if this ever became a treatment that's widely used. And in fact, there's some recent signs that maybe oxytocin isn't all cuddles and hugs, like some of the mass media coverage has suggested. In some of the human work, there's evidence that, well, maybe oxytocin makes you more cooperative and more social with people you already know, or people who are on your team if you're playing a game, but makes you more aggressive and maybe a little more hostile towards outsiders. And that's the kind of thing that might kind of make sense from an evolutionary point-of-view, but isn't necessarily what you would want if you were coming up with an ideal treatment to make people more social. There's also a big question about what are the long-term effects on the developing brain? And there, there's again just kind of shockingly little research that's been done. There was one study that came out this fall in voles that actually tried to mimic the clinical trials that are getting underway for autism, giving repeated doses to adolescent male voles for several weeks. And in the short term, it had the effect that everybody else has seen and made them kind of more social toward their mate and seemed to increase their bonding behavior. But when the males grew up, they had abnormal behavior and tended to ignore their mate, suggesting that their bonding with their mate had been disrupted. So there are lots of caveats. It's just one study, and voles aren't humans, but it does kind of raise the question of what the long-term effects of oxytocin might be, particularly in young, developing brains. And we just don't know that, because the work hasn't been done.

Interviewer – Kerry Klein
So what's going to be involved in these upcoming clinical trials?

Interviewee – Greg Miller
There's a really big one getting underway this spring at the University of North Carolina in Chapel Hill that'll give oxytocin nasal spray to 300 children between 3 and 17 years old. That one, people say, will be really helpful in clarifying exactly what oxytocin does, and how safe it is, and what effect it has on social behavior. They'll be looking at a

whole bunch of measures of social behavior. So that's the big one for autism. There are other smaller studies in various stages for autism, and dozens of others for other disorders – everything from schizophrenia to alcohol abuse.

Interviewer – Kerry Klein
So there are quite a number of studies on sort of both sides of this debate. You know, after these clinical trials are through, what's to say that oxytocin won't live up to the high hopes of its supporters?

Interviewee – Greg Miller
It may. I mean, we have to see. One thing to keep in mind is that a lot of the studies so far that have come up with encouraging findings in people with autism and other disorders have been pretty small studies – usually just a couple dozen people – and they've been done in a lab with a single dose of the hormone. So they give the person a single dose, and then there's a team of researchers using standardized lab tests to see if they can measure any difference. And the real question is whether you'll see those kinds of effects in a more real-life situation where people are taking it day after day and going about their lives, and whether it'll have an improvement in that situation. That's really the big question, and that's what big trials like the one getting underway in North Carolina should help us answer.

Interviewer – Kerry Klein
Great. Well, Greg Miller, thank you so much.

Interviewee – Greg Miller
Thank you.

Host – Kerry Klein
Greg Miller writes about the promise and perils of oxytocin in a News Focus in this week's issue.

Music

[27:30]
Interviewer – Sarah Crespi
Finally today, David Grimm, online news editor for *Science*, is here to give us a rundown of some of the recent stories from our daily news site. First off, Dave, we have a story about how we tell stories.

Interviewee – David Grimm
This is how we tell stories about an activity called sexual cannibalism. This is a behavior in the animal kingdom where it's usually females that actually eat the male after mating. And this is commonly seen in spiders and other arthropods such as praying mantises and crickets. What's interesting about this behavior is not just the behavior itself, it's actually how scientists describe it. And this new study suggests that there's a bit of a bias in how researchers report the behavior.

Interviewer – Sarah Crespi
So what's the bias here? I mean, is the problem the word cannibalism?

Interviewee – David Grimm
No. It's actually the words used to describe the female. When the researchers conducted an analysis of the scientific literature, they looked at 47 studies published between 1984 and 2009. They found that the females in these encounters were often described using aggressive words, like "aggressive" or "attack". Other common labels included words like "predatory," "voracious," "rapacious," while the males were described in much more sort of banal terms or even passive terms, terms like "escape," "sacrifice," "avoid."

Interviewer – Sarah Crespi
So the scientists are editorializing, perhaps, the behavior of the insects on display here.

Interviewee – David Grimm
Well that's what these researchers are saying. They're saying that there's these subtle biases that are cropping in the literature that suggests that the females are aggressive while the males tend to be more passive, or in terms of the word sacrifice, actually heroic.

Interviewer – Sarah Crespi
So why is it important to be careful or to make sure you don't make judgments about the animals?

Interviewee – David Grimm
Scientists put a lot of stock in these words. They actually help them define and describe animal behavior. And they hope that these words are sort of normalized over various scientific studies. So if there is discrepancies in the words or the words indicate motives on the part of the animals that actually don't exist, it could actually muddle our understanding of animal behavior, and in this case, certain aspects of animal reproduction.

Interviewer – Sarah Crespi
Right. So it's good storytelling but maybe not good science.

Interviewee – David Grimm
Right.

Interviewer – Sarah Crespi
So next up we have a story about a surprising link between genes and behavior in mice.

Interviewee – David Grimm
Right, Sarah. This is another animal behavior. This is a really cool behavior by mice, specifically the oldfield mouse, which digs a pretty complicated burrow. It's 200 centimeters long, has two tunnels, and even has an escape hatch, which is pretty cool. But not all mice construct such complicated burrows. In fact, the deer mouse has a pretty

simple burrow. It's a short, single crawlway. And these are two very different behaviors. And the researchers in this new study showed that, very surprisingly, that the differences in this tunnel-building can actually just be linked to a handful of genes.

Interviewer – Sarah Crespi
So how do they go about studying the tunnels and the genes behind them?

Interviewee – David Grimm
Well, they actually went out into the field – and you actually can see a pretty cool slideshow on the site of some of their field research they did. They actually filled some of these tunnels with hardening foam so they could actually see what the architecture of the tunnels was above ground. They took these two types of mice back to the lab, and they found that the mice were building very similar tunnels in the lab as they were out in the wild, which suggests that there was a very strong genetic component to the types of tunnels they were building. It wasn't just an environmental. In fact, there may be no environmental component to it. So that was their first hint that these behaviors are really genetically determined. And then to figure out exactly what genes are responsible, they did a bunch of crosses with the mice. They also used a genetic technique that linked the aspects of the various tunnel designs to specific locations on the genomes of these mice. And what they found was that there were three gene regions that underlied tunnel length, and there was one gene region that dictated whether the mice built an escape hatch.

Interviewer – Sarah Crespi
So is it surprising to researchers that this many genes are involved in this behavior?

Interviewee – David Grimm
Well, I guess the surprising thing is that we know that a lot of our behaviors are determined to a large extent by genes. And I think scientists have for a long time assumed that it was this very complicated interaction of potentially hundreds or thousands of genes that determine all the complex things that we do every day. And to just find a gene that plays a role in how long a tunnel is, or whether a tunnel has an escape hatch, really seems to suggest that this may be a little bit more simple than we thought, that there may just be a handful of genes that determine our behaviors. And we may actually be able to link specific behaviors to specific genes, which would be really cool and could even shed light on the genetic basis of some of our own behaviors.

Interviewer – Sarah Crespi
Really interesting. So our last story is on an oddly behaving planet.

Interviewee – David Grimm
Well, Sarah, we're not sure it's a planet. It's something mysterious. And this is something that's orbiting a bright star called Fomalhaut that is in the constellation the Southern Fish.

Interviewer – Sarah Crespi

And the Southern Fish is a Pisces, the smaller Pisces, and it's been known about since Ptolemy's time.

Interviewee – David Grimm
Right. And there's actually some very recent interesting history that actually deals with this particular star. It turns out that in Hubble photos taken from 2004 to 2006, astronomers saw a faint, slowly moving speck of light. Some suspected it was a planet. But it had a very long and non-circular orbit, so it was really unusual if it was a planet. And it's sort of remained a mystery ever since. Well, just last week at a meeting of the American Astronomical Society, researchers say that they've determined that they believe it actually is a planet. They're calling it Fomalhaut b.

Interviewer – Sarah Crespi
And so there's a debate about whether it's a planet, what its orbit is like, and there's also a debate about its path in the coming decades.

Interviewee – David Grimm
Right. Well, so if this actually is a planet, it orbits its star every 2,000 years. So it's got a very long orbit. But there are some unusual things about it, if it is indeed a planet. First of all, there's no radiation coming from it, as far as astronomers can detect, which would mean that it's not a large planet as some originally thought, but it would actually be a lot smaller and less massive than a planet like Jupiter. But it also puts out a large amount of light, which is unusual. You wouldn't expect it for such a relatively small object. And the team that is making the claim that it's a planet believes that this contradiction could be explained if the planet was embedded in a large cloud of dusty material. And that gets into what the future of this planet might be. It turns out that if it actually is a planet and surrounded by this cloud of dust, it would actually smack into this cloud in 2032, and that would cause a lot of activity in its atmosphere, which astronomers might actually be able to observe. It also may give a little bit more clue about whether it's actually a planet, or some scientists are still arguing is a cloud of dust or debris in its own right.

Interviewer – Sarah Crespi
Well, let's check back in in 2032.

Interviewee – David Grimm
It's a date.

Interviewer – Sarah Crespi
What else is on the site this week, Dave?

Interviewee – David Grimm
Well, Sarah, we've got a story for *Science*NOW about new insights into the impacts of elephant poaching in Africa, the largest study ever done on the impact of poachers and what it's having on various populations in the continent. Also a study about new insights into how leprosy spreads in the body. For *Science*Insider, our policy blog, we've got a story about the first samples taken from Lake Vostok. Also a story about the latest on

research into gun violence – how that is being pursued in the United States in the wake of some recent tragedies. Finally, for *Science*Live, our weekly chat on the hottest topics in science, this week's *Science*Live is about whether or not we can conquer climate change. What it would take. And next week's *Science*Live is about exascale computing. So be sure to check out all of these on the site.

Interviewer – Sarah Crespi
Thanks, Dave. David Grimm is the editor for *Science*'s online daily news site. You can check out the latest news, and the policy blog, *Science*Insider, at news.sciencemag.org, where you can also join a live chat, *Science*Live, on the hottest science topics every Thursday at 3 p.m. U.S. Eastern time.

Music

Host – Kerry Klein
And that concludes the January 18th, 2013 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