Science Magazine Podcast

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Music

Host -- Robert Frederick
Hello and welcome to the *Science* Podcast for January 9th, 2009. I'm Robert Frederick. This week: how people mispredict their responses to racism; understanding how sounds affect the interactions among disease-carrying mosquitoes; and a new series about evolution, with our first installment about the origin of life on Earth. All this and more, plus a round up of the latest science stories from our online daily news site, *Science*NOW.

Promo
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Music ends

Host -- Robert Frederick
There's an apparent paradox when it comes to racism: racial prejudice is strongly condemned, but blatant acts of racism still happen regularly. According to Kerry Kawakami and colleagues, racism may persevere in part because even people who say they would take action against a racist act instead may do nothing at all. In a paper in this week's *Science*, Kawakami's team reports the results of their experiments investigating participants' anticipated responses and their actual responses to racism. I spoke with Kawakami from her office at York University in Toronto, Canada.

Interviewee - Kerry Kawakami
I think what our research examines is differences between how people expect or predict that they'll respond to racism, and how they actually respond. And so, while people think that they'll be appalled by racism and punish or censor a racist, in actual fact, when they're placed in that situation, they're not offended by it at all, and it makes no difference in their behavior or they way that they respond towards racists.

Interviewer - Robert Frederick
What type or types of racism did you and your team test?

Interviewee - Kerry Kawakami
We specifically examined racism towards blacks.

Interviewer - Robert Frederick

And how did you and your team go about testing this racial behavior?

Interviewee - Kerry Kawakami
I think it's probably easiest if I kind of run you through a typical situation in which the subjects of ours would experience.

Interviewer - Robert Frederick
Please do.

Interviewee - Kerry Kawakami
So, let's say imagine yourself, that you're in a room waiting for an experiment to begin. And you're sitting there, and there's another black person and another white person, and both of them, you assume, are just other subjects waiting for the experiment to begin.

Interviewer - Robert Frederick
And you, as the test subject, are white or black?

Interviewee - Kerry Kawakami
You're non-black, but you're just a typical student at York University.

Interviewer - Robert Frederick
Okay.

Interviewee - Kerry Kawakami
And, York's a very multicultural school, so it can be from a number of different races or ethnic cultures. And so, while you're waiting for the experiment to begin, the black, the other black, who you assume is a student stands up, says, "Oh, I forgot my cell phone," and he walks out the door. But as he's walking out the door he gently bumps the other white person on the knee. As soon as he's out the door the white person says to you a very racist comment. The black person returns into the room, and you're asked to fill out an emotion questionnaire, and we assume this is just part of the experiment, that, you know, throughout the experiment we're gauging your emotions to see how you respond to social psychology studies. And then we say, "Well, why don't we just start the study," and he asks you, the subject, to choose a partner. So, you can either choose the white racist or the black person. So, if you imagine yourself in that situation, most people assume, "Oh, I'd be so offended, so angry and upset by what that white person said to me, this racist comment, and I would choose the black person to work with." So, that's what, when we asked subjects to place, imagine themselves in that situation, that's exactly what they say, "I'm very upset by this, you know, by this racist comment, and I'm not, I'm avoiding working with this white racist". So, most of them choose to work as a partner with the black person. When we actually placed another group of subjects in the same situation, and they actually experience it, we find that people aren't upset in that situation at all, and a slight majority choose the white person. And, when we compare that situation with a similar situation in which the same things occur, but the racist comment is not said by the white person, there's no difference. So, the racist comment, even when it's an extremely racist comment, has no effect on the person's emotions or

their choice of partner.

Interviewer - Robert Frederick
So, in imagining the experiment…

Interviewee - Kerry Kawakami
…in the forecast – yeah.

Interviewer - Robert Frederick
…people were more likely to say, "Oh, gosh, I don't want to work with that white racist, let me work with the black person."

Interviewee - Kerry Kawakami
Exactly, exactly.

Interviewer - Robert Frederick
But, when they actually went through it the reverse was true.

Interviewee - Kerry Kawakami
Yeah, most people just, there's a preference for the white person, and when you compare it to no comment condition, the racist comment that this white person has said has no effect on your choice or your emotions at all.

Interviewer - Robert Frederick
Is there research, either by your team or others, that accounts for why the test subjects would choose what were apparently "racist partners" in this experiment?

Interviewee - Kerry Kawakami
No, this is the first experiment that's actually examined predictions related to racism towards other groups. And the subsequent studies that we're now currently running in our lab – we're looking at possibly three explanations for why this is occurring. One is that maybe they're just feeling very threatened by the situation, I mean, because the racist comment is quite extreme, and they're just suppressing their emotions, so they're just trying to control everything. So, what we're doing right now is we're taking measures of threats, physiological measures of threat, and also measures of cognitive control, to see whether people are just kind of shutting down and freezing.

Interviewer - Robert Frederick
So, the distress of being in the experiment itself may have led to the variability and how people choose the…

Interviewee - Kerry Kawakami
Or, the threat of being in a situation in which, you know, racism is so overt and so threatening that they might just shut down and just not respond, or pretend that they're not responding, yeah.

Interviewer - Robert Frederick
Okay.

Interviewee - Kerry Kawakami
Another possibility might be that they're perceiving, when you're actually in that situation you perceive the black person's behavior differently. So what we assume was just a gentle "bump" by the black person as he's leaving the room might be perceived as a very aggressive behavior by a white person. So, if, let's say that there were two white people in the room, and one white person just gently bumped the other white person – that might be, you know, excusable in a minor incident. But, when we see a black person, in this minor transgression, doing the exact type of behavior it might be perceived as being much more aggressive. And, so because the behavior seems much more aggressive the, you know, the insult that racist slur might be perceived as being much more justified. So, past research has demonstrated that, you know, we perceive black behavior as much more extreme and often much more aggressive than white similar behavior. And so, it just might be perceived as much more justified in the situation. And the third alternative explanation that we're looking at is that a lot recent research has demonstrated that, while people think that they're nonprejudiced and their really controlled deliberative responses suggest that they're nonprejudiced, their more inner nonconscious feelings show really negative associations with blacks. So, we harbor these really negative feelings that we don't even often let ourselves be aware of.

Interviewer - Robert Frederick
So, when people have a chance to deliberate about something they'd say, "Oh, I wouldn't do the racist thing…"

Interviewee - Kerry Kawakami
Exactly.

Interviewer - Robert Frederick
…but at the spur of the moment…

Interviewee - Kerry Kawakami
Exactly. When they're not controlling, or they don't think it's about race, then they'll just let their negative emotions and attitudes might drive their behavior or their lack of response to negative things that are actions against blacks.

Interviewer - Robert Frederick
When might we hear more about this?

Interviewee - Kerry Kawakami
Hopefully soon. We're running, we're running a number of different studies right now because the results were really quite surprising – we thought that they would be somewhat muted, but that people aren't responding at all is really quite shocking to us. So, we're, we're running a number of studies right now examining what possible explanations might explain these kinds of findings.

Interviewer - Robert Frederick
Can this result be generalized to all types of racism around the world – or is it limited just to this particular racial behavior?

Interviewee - Kerry Kawakami
No. We're actually running studies related to male and female slurs. So, when a male makes a sexist remark against a woman will that be reacted to in the same way? So, I think it's not just a racial thing, but it's, when people believe that they're egalitarian and fair, and they're nondiscriminatory, and those are the, you know, the explicit ideals that they promote – those can be quite different from what their actual inner nonconscious attitudes and emotions are.

Interviewer - Robert Frederick
Well, Kerry Kawakami, thank you very much.

Interviewee - Kerry Kawakami
Thank you.

Host -- Robert Frederick
Kerry Kawakami is lead author of a paper on how people mispredict their responses to racism. Read the paper and a related Perspective in this week's *Science*.

Music

Deputy Editor -- Barbara Jasny
What will make news in 2009? One good candidate is the biobank.

Host -- Robert Frederick
Barbara Jasny is *Science*'s deputy editor for commentary and is here with a policy update.

Deputy Editor -- Barbara Jasny
Biobanks are repositories of biological materials and medical data including everything from DNA to disease symptoms. Scientists hope that availability of resources covering large populations of individuals will yield new insights into disease and how it links up with genetics, environment, and lifestyle.

The United Kingdom's major biobank project is underway, seeking to recruit half a million British middle-aged and senior individuals and track their health stats over their lifetimes. But so far only one in ten of the 2.5 million people invited have signed on to the effort. Part of the reason, according to a UK Biobank council survey, is over concerns about the security of the data, although other factors were cited as well.

A similar biobank being planned in the United States would involve members of Kaiser Permanente. Though the initial funding covers 200,000 participants, Kaiser Permanente hopes to expand to 500,000 by 2012. That would make the project much larger than

other U.S. biobanks. Other planned initiatives include a 250,000-person study based at Vanderbilt University's medical school and 20,000-person studies at Wisconsin's Marshfield Clinic and Minnesota's Mayo Clinic. Kaiser Permanente officials say their project will stand out because of the ethnic diversity inherent in the northern California population from which the biobank will draw. Also considering a large-scale biobank project is the U.S federal government's own National Institutes of Health.

U.S. participants may feel more confident taking part in such projects now that the Genetic Information Nondiscrimination Act has become law. It prohibits employers and insurers from discriminating on the basis of genetic information.

Host -- Robert Frederick
That was deputy editor Barbara Jasny with a policy update from *Science* and the AAAS Center for Science, Technology, and Congress.

Music

Host -- Robert Frederick
The familiar buzz of a flying mosquito...

[buzz sound -- then smack -- "Got it!"]

...can be absolutely maddening to us and can also be foreboding as many of the insects are blood-sucking and transmit deadly diseases. But to other mosquitoes, that sound is a love song. In a paper published online by *Science*, Laura Harrington, Ron Hoy, and colleagues report how one species of mosquito, *Aedes aegypti*, which transmits yellow fever and dengue performs a mating duet. Both males and females adjust the speed of their wing beats so their harmonics or overtones match at about 1,200 Hertz. That's a surprise because researchers had thought female mosquitoes were deaf. The research also suggests what may be a useful approach for controlling mosquito populations. I spoke with Harrington and Hoy from Cornell University in New York. Here's Ron Hoy.

Interviewee - Ron Hoy
We investigated the way that mosquitoes interact with each other during courtship. Mosquitoes court and mate on the fly of course, on the wing. The interaction is acoustic, that is the males and females are producing sounds, and it turns out that during the interaction, when they're very close to each other, they're singing a duet. But, it's not a simple duet. The male and female are actually adjusting their flight tones so that there's a matching, and hence we call our paper harmonic convergence. So, it's basically a conversation between the sexes.

Interviewer - Robert Frederick
So, Laura, what's important about understanding how this species of mosquito courts?

Interviewee - Laura Harrington

Well, this is an area that's largely been ignored by scientists for decades, and there really hasn't been much work done on the mating behavior, and especially the biology and behavior of male mosquitoes because they don't take a blood meal, so they haven't been considered important. And, as we think to the future and novel control strategies, especially ones that involve genetic modification or sterilization of males and release them to the field, it's really critical to understand the mating process and mating behavior. And, also, of course, these mosquitoes are deadly vectors of human pathogens.

Interviewer - Robert Frederick
What would be the strategy then for reducing the populations of these disease-vector mosquitoes?

Interviewee - Laura Harrington
Well, one strategy that is currently underway is to either reduce or replace the population. You can sterilize males and release them, and when they meet with wild-type females in nature, those females do not reproduce. The problem is is when you get in there and start modifying males--playing around with the genes and tweaking things--they often become less fit. And so we think that through this process, this acoustic assessment, females can potentially be determining whether a male is sexy enough or not.

Interviewer - Robert Frederick
So, you'd need to ensure that the sterile males could still generate the right tones?

Interviewee - Laura Harrington
That's right. And that they give the appropriate signals and sing to the female, and actually tell her that they are a fit male and a good mate.

Interviewee - Ron Hoy
In fact, it's one of the surprising outcomes of our study is that we provided the first experimental evidence that females can actually hear because there's been some debate in the field whether or not females are at all paying attention to the sounds. And, our experiments are the first to probe the hearing of females, both in behavior, from watching her perform acoustic behavior that depends on her hearing, and then physiologically, that is, one of our coauthors, Ben Arthur, he inserted electrodes into the ear of the mosquito to record the electrical response to sound.

Interviewer - Robert Frederick
So, other than altering their flying path how else did the mosquitoes alter their behavior? Ron, we'll start with you.

Interviewee - Ron Hoy
Well, first of all, in the wild they undoubtedly alter flight paths, but our experiments were done with tethered mosquitoes. The alternative would be to chase flying mosquitoes around,with a microphone very close, and as you can imagine since they're on the wing it's hard enough to swat one, let alone chase it with a microphone. So, our graduate student, Lauren Cator, tethered mosquitoes. So, with that as background, what we did

was we fixed the position of a female--she's hanging in the air, she's flapping her wings, a microphone is right next to her--and now, we bring a tethered male very close to her. And, we call it a "simulated flyby." So, we are able to measure how close we are, and when we find that the male is brought within a centimeter or two of the female, there is an acoustic interaction, that is, the males and females start varying their flight tones. And, this active space of a couple of centimeters, is crucial because as soon as you move the male then away from the female that modulation stops. So, now we know that this behavior is really dependent on their being able to hear each other at close range, at a range where in fact the male could see and grab the female for an actual mating attempt.

Interviewee - Laura Harrington
So, the male will grasp the female, and they will copulate in an event that occurs very quickly, about ten seconds. They copulate in flight. And, as far as we can tell, the females will not mate again with another male, and we actually tested females that had already mated, and they did not modulate with males when we played back the male sounds. So, this is an important event for the female to accurately assess the male and determine if they're "studs" or "duds," and if they'll have a successful reproductive output as an outcome of the mating.

Interviewer - Robert Frederick
And exactly what are they listening for?

Interviewee - Ron Hoy
So, when you bring a male close to the female they start modulating their flight tones. And, at some point, fairly quickly, there is a matching of tones. That matching, however, occurs at harmonic frequencies, around 1,200 Hertz, 1,200 cycles per second. And, for the male, that's twice his wing flap rate, for the females it's three times her wing flap rate. And they adjust, hit that tone, and hold it for a few seconds, and then when we move the male away they go back to kind of a resting flight. So, that's why we called it harmonic convergence – because there's a convergence of frequencies, but that convergence occurs not at the fundamental frequency, or the wing flap rate, but at a harmonic frequency. Okay, so here's an example of a male singing by himself.

[sound]

Interviewer - Robert Frederick
Okay.

Interviewee - Ron Hoy
And, here's an example of a female singing by herself.

[sound]

Interviewer - Robert Frederick
Okay.

Interviewee - Ron Hoy
So, here's a sound when the matching is going on.

[sound]

Interviewee - Ron Hoy
Now, unless you have an incredible musician's ear you probably can't pick out the harmonic matching because when two mosquitoes are flying necessarily you have the fundamental there as well. The harmonic frequencies are certainly there, but the harmonics are softer.

Interviewee - Laura Harrington
So, in contrast to that there is just one other published study with a different species of mosquitoes, a nonmedically important species of mosquito, they matched at instead of a harmonic they matched at the fundamental, which is near the wing beat frequency.

Interviewee - Ron Hoy
So, what's really new here is that in *Aedes aegypti*, unlike the species that Laura just told you about, the matching is occurring in harmonic frequencies, at 1,200 Hertz, which is beyond the accepted hearing ceiling for mosquitoes. And, that's what's new: that we are able to show a behavioral interaction at frequencies unknown in any other mosquito species. And, this includes previous studies in *aegypti*.

Interviewer - Robert Frederick
So, where do you go from here with this new understanding of how these disease-vector mosquitoes hear and adjust their flapping rate for courtship. Laura?

Interviewee - Laura Harrington
This study has really opened up a whole new area for us to explore. And, I think as far as future directions, one direction that we hope to head in is to develop this as a tool for assessing transgenic males. So basically, determining if they are sexy enough for wild-type females. And, another area is really trying to understand if there's a way to interrupt, or perhaps even acoustically disrupt these sorts of interactions in the field and potentially reducing vector populations.

Interviewer - Robert Frederick
…by playing some sort of harmonic frequency?

Interviewee - Laura Harrington
Possibly.

Interviewee - Ron Hoy
Well, actually, so I need to step in here. If you do it at 1,200, blended it in some way, but 1,200 Hertz is the peak of sensitivity for the human ear. So, if you played a pure 1200 frequency tone, this would give you the worse case of tinnitus that you've ever heard of.

So, unfortunately that harmonic convergence occurs right dead center for human hearing. So, you may disrupt the mosquitoes, but you'll drive the human crazy.

Interviewer - Robert Frederick
Which is exactly what the mosquitoes do when they fly by!

Interviewee - Ron Hoy
Yeah, right! Right! exactly! So that's not in the paper, but we thought we could add that.

Interviewer - Robert Frederick
Okay, that sounds good. Well, Laura Harrington and Ron Hoy, thank you very much.

Interviewee - Laura Harrington
Thank you.

Interviewee - Ron Hoy
You're welcome, it was fun.

Host -- Robert Frederick
Laura Harrington and Ron Hoy are senior authors of a paper on the harmonic convergence in the love songs of the *Aedes aegypti* mosquito. Find the paper online at www.sciencexpress.org.

Music

Host -- Robert Frederick
The year 2009 marks the 200th birthday of Charles Darwin and the 150th anniversary of the publication of his famous book, *On the Origin of Species*. To commemorate these occasions, *Science* magazine is presenting a special series that will take a broad look at key developments in evolution and in human culture. Starting off the series is an essay by Carl Zimmer who writes on the origin of life on Earth. I spoke with Zimmer from his home office in Connecticut.

Interviewee - Carl Zimmer
This essay is about one of the most fascinating questions in all of biology—really of all science—how did life begin? And, what's really fascinating is how we're living at a time when scientists are actually downright optimistic about trying to answer the question. They've got all sorts of tools at their disposal now that they didn't have a generation ago. And we're going to see a lot of really important advances in the next few years about figuring out where we came from.

Interviewer - Robert Frederick
Now, Darwin himself didn't write much on the origin of life, did he?

Interviewee - Carl Zimmer
No, he, Darwin did not write much at all about the origin of life. And, when you consider

just how much Darwin wrote, between his books and his letters and his notebooks, that's really saying something. And Darwin is actually quite explicit about why he had very little to write about the origin of life. He felt that it was the kind of question that he couldn't answer – he really believed that a really crucial part of understanding how life evolved was to look at life today and see the processes that are going on today. And that's one of the ways that he came up with his ideas about natural selection – just by looking at life as we see it today and how some individuals get to reproduce and others don't. He felt that you really couldn't use that method to understand how life began because if, say, life was going to start from some chemicals, they wouldn't get a chance, because they're living things here already, and they would just eat it all up.

Interviewer - Robert Frederick
So, because he couldn't see it he wasn't willing to even speculate about it.

Interviewee - Carl Zimmer
He only speculated once or twice, just in private, and in his letters he wrote a very famous passage about how life might have begun in a warm little pond, and that was about as far as he would let it go. What's funny is that, you know, it now turns out that maybe indeed warm little ponds were where life began.

Interviewer - Robert Frederick
Now, "*the* origin of life" – just the words themselves would suggest that all life since then evolved from that first living thing, doesn't it? Perhaps in this warm little pond, or not?

Interviewee - Carl Zimmer
Well, all life on Earth today as we know it seems to share a common ancestor. And there are a lot of reasons to have this belief. One is simply that all of life uses DNA to store its genetic information, except for a few viruses. And they use that DNA to produce molecules – RNA and proteins. They use the same genetic code to make those proteins from those genes – it's all the same. And so that strong evidence that all life on Earth shares a common ancestry, and so, if you want to know where life on Earth today came from, it's probably a single event. Now, that doesn't mean that maybe some other weird kind of life got started on Earth and then died out, or maybe it's hiding somewhere, we don't know about it, and there could have been life on other planets. But, really what scientists are focusing on, when they want to understand the origin of life, is the origin of life on Earth today as we know it.

Interviewer - Robert Frederick
What exactly are scientists doing now to try to get at that question, an understanding of the origin of life?

Interviewee - Carl Zimmer
Well, scientists are doing all sorts of different things to figure out how life began. And, for example, some of them are trying to figure out what were the raw ingredients on the early Earth that could have given rise to life. You know, when the Earth first formed it's

not as if, you know, DNA just spontaneously arose; you would have had some simple building blocks – things like formaldehyde, for example. So, the question then becomes how do you take those raw ingredients, and how does life emerge from them?

Interviewer - Robert Frederick
What's the latest thinking on how these various inorganic elements became the DNA that is now part of every bit of life on Earth today – except for those viruses you mentioned?

Interviewee - Carl Zimmer
Well, a lot of scientists – there's a hypothesis called the "RNA world hypothesis" that a lot of scientists are supporting these days. So, RNA is the single-stranded version of DNA, and in our cells today one of its uses is as sort of a copy of our genes which is used as a template to build proteins. In fact, RNA can do lots of other things in our cells. So, for example, they can carry out lots of chemical reactions, they can actually help to build proteins. So, the RNA has this capacity to store genetic information and also to act like a protein, to carry out chemical reactions. And so, some scientists have been arguing for quite a while actually that perhaps the early life forms on Earth didn't have proteins and didn't have DNA – they started out just with RNA in little cells, little membranes. And, there's been a lot of research recently, in fact, just in the past year, that has gone a long way to giving more support to the RNA world hypothesis. And in my essay in *Science*, I write about some of those advances, including producing RNA molecules through basic chemistry from the ingredients on the early Earth, and some research into even actually creating life from scratch, based on RNA, RNA life in the lab.

Interviewer - Robert Frederick
How long before that actually happens – where scientists can actually make life in the lab? Are you willing to make a prediction on that?

Interviewee - Carl Zimmer
Well, the real leader in creating RNA life from scratch is Jack Szostak at Harvard Medical School. And he has very slowly and patiently been moving towards this goal, over the past 20 years, basically. He's not there yet, but I wouldn't be surprised if within 10 years he gets there – if there has been a new kind of life created in the lab by, say, 2020. But of course there are still some major obstacles to overcome in terms of having RNA molecules that can actually do the full range of things that is necessary to keep something alive. It's not enough just to have RNA that can stick on little building blocks to build other RNA molecules. Those other RNA molecules have to do some important jobs as well. So, he's got a ways to go. But, it will be a very interesting thing to watch.

Interviewer - Robert Frederick
Carl Zimmer, thank you very much.

Interviewee - Carl Zimmer
Thank you.

Host -- Robert Frederick

Carl Zimmer is the author of *Microcosm: E. coli and the New Science of Life*. Read his essay on the origin of life on Earth in this week's *Science*. You can find other content about Darwin and follow our year-long series online at www.sciencemag.org/darwin.

Music

Host – Robert Frederick
Finally today, David Grimm, editor of *Science*'s online daily news site, *Science*NOW, joins us to talk about the latest science news. Hi, David.

Interviewer - Robert Frederick
Welcome back. Happy New Year!

Interviewee - David Grimm
Happy New Year to you!

Interviewer - Robert Frederick
So, what stories do you have for us this year?

Interviewee - David Grimm
Well, Rob, we're going to talk about how a building is like a pond; how twisters get their spin; and finally, how a hormone helps us identify old friends.

Interviewer - Robert Frederick
Well, let's start with how a building is like a pond. Is this something to do with an optical illusion?

Interviewee - David Grimm
Well, yes, it's an optical illusion for some insects and some animals. And these animals rely on what's called polarized light. Now, when light originally emanates from the Sun, the waves are very chaotic, they go in all different directions. But once the sunlight goes through our atmosphere, or even goes into bodies of water, it becomes polarized, meaning all the waves orient themselves in a specific direction. And some animals pick up on this as a way to find a body of water, say, some waterborne insects look for bodies of water to lay their eggs. And the problem is is that as we humans have come on the scene we've built a lot of artificial things, like buildings and cars and even gravestones, and these dark, shiny surfaces create polarized light the same way Earth's atmosphere or bodies of water do, creating what scientists call "polarized light pollution."

Interviewer - Robert Frederick
And that causes these insects and animals to think that they're not seeing a building, but they're seeing a pond?

Interviewee - David Grimm
Exactly. In this new study the researchers tested a variety of artificial structures, and what they found is that with any smooth and dark structure they looked at, like a glass-

covered building or even a black garbage bag, the surface returned stronger polarized light than water did. And when the surfaces were shiny the effect was even more pronounced. And so the result is that to some insects and some animals these structures look more like water than even water does.

Interviewer - Robert Frederick
That sounds like bad news for these animals and insects.

Interviewee - David Grimm
Well, that can be bad news for a lot of animals because those that rely on water for finding food or for nesting can be confused by these structures. And, in fact, the researchers found evidence of stoneflies laying eggs on asphalt, and water beetles laying eggs on the roof of a red car. And normally both of these insects lay their eggs in the water, so this is obviously very bad for procreation for these animals. And that's bad news for the entire ecosystem because anytime one species makes a mistake, especially a dramatic mistake that could really affect its reproduction, that can have effects on the entire food web.

Interviewer - Robert Frederick
Well, from taking chaotic rays of light into polarized light to understanding the chaos behind a tornado's spin. How do twisters get their spin?

Interviewee - David Grimm
Well, that's been a longstanding question for scientists that study tornadoes. And the idea with this new study is that storm clouds can have various sizes of water droplets in them – they can have anything from small drizzle-like droplets to large raindrops or even hailstones. And scientists have wondered if there's some sort of correlation between the size of these droplets and whether a storm cloud will just become a severe thunderstorm, or whether it will spark a deadly tornado.

Interviewer - Robert Frederick
So, they obviously didn't investigate this "in the wild," I presume.

Interviewee - David Grimm
No, this study deals with supercomputers and simulation, so these researchers actually didn't go out in the middle of a tornado to do this research, but what they found was really interesting. What they did was they simulated a bunch of potential tornado-producing clouds – some that had large hailstones, some that had large raindrops, some that had small raindrops, or a combination thereof – and what they found was that, when the droplets inside these clouds were very large, the surrounding air began to take on this familiar cyclonic pattern that we associate with tornadoes. And the reason the researchers think that is is because these larger droplets of water tend to resist evaporation. And with less evaporation you're having less cooling of the air beneath the storm, and that warmer air basically feeds the tornado – it feeds this burgeoning cyclone, and allows it to spin faster and faster until what you've got is a tornado. And with the smaller droplets of water they tend to evaporate in droves, and so you, you have this

cooling effect, which basically shuts down the cyclone. So, even though this is just a simulation, it's pretty strong evidence for how the size of the water droplets inside a cloud can really help researchers understand whether or not a tornado is going to develop.

Interviewer - Robert Frederick
Is that going to help forecasters – so they can tell people to get out of the way?

Interviewee - David Grimm
Well, scientists hope that it will. I mean, obviously that's one of the key purposes of this kind of research, but experts say that there's still a lot of other things that probably influence tornado formation besides just the size of water droplets. So, while this is an important step, there's a lot more that we need to learn about how tornadoes form before we can really get into accurate forecasting.

Interviewer - Robert Frederick
Well, from conditions that will help researchers spot a tornado forming to how a hormone helps us spot old friends. Haven't I seen you before?

Interviewee - David Grimm
You have, Rob. And the reason you recognize me might be due to the brain hormone called oxytoxin. And this is a hormone researchers have described as a powerful social chemical. And the reason they say that is because, when they've studied voles, for example, or other mammals, they found that the hormone seems to be key to very social behaviors. For example, in voles, males with higher levels of oxytoxin are more likely to be faithful to their mates.

Interviewer - Robert Frederick
Yeah, I, I thought this was the chemical that helped babies bond to mothers.

Interviewee - David Grimm
Yeah, that's been shown in mice, and even in humans oxytoxin appears to have an affect. In fact, a study done last year showed that the hormone appears to help us maintain our trust in others, even when those other people betray us. So, in this new study researchers wanted to know what other effects does oxytoxin have on us?

Interviewer - Robert Frederick
And actually seeing you causes oxytoxin to be released in my brain?

Interviewee - David Grimm
Well, not exactly. Here's what the researchers did. They took 44 men, and they gave half of them a nasal spray spiked with oxytoxin, so to increase their oxytoxin levels; and, they gave the other half just a placebo spray. And then what they did was they showed these men about 170 pictures, and half these pictures were pictures of people's faces, and half of the pictures were pictures of objects like buildings or pieces of art—something like that. And then what they did was they waited a day, and then they showed the men all the same pictures they had showed them before, but they also threw in about 70 new

photos – 70 new faces and new objects. And what they found was that the two groups were about the same in being able to tell whether they had seen that photo of a specific object before, they were equally good at saying, "I saw that building yesterday, or I saw that piece of art yesterday, or I didn't see that picture of a statue yesterday". But, when it came to people's faces there was a significant between the group that got the oxytoxin and the group that didn't. And the group that got the oxytoxin had an accuracy rate of about 46% in telling the researchers, "Yes, I've seen that face before," whereas the subjects that didn't get the oxytoxin were only about 36% accurate. And what this tells us is that we don't just have one type of memory, because clearly there was a difference between the people remembering objects, and the people remembering faces. And they suggest we have this sort of social memory where part of our brain maybe is better at remembering a face, which is important for human society – obviously you want to remember people you've met before, or even people you met a long time ago – and that oxytoxin seems to be important in this ability.

Interviewer - Robert Frederick
So, does that imply the reverse case – say, that people who have a hard time with social functioning are somehow lacking this oxytoxin?

Interviewee - David Grimm
Well, that's one idea. There has been speculation that people with autism or other social disorders may have a defect in their oxytoxin, maybe in their oxytoxin production, that prevents them from either bonding with people or even recognizing people. And the researchers that did this study say that's their next step – they want to look at the role of oxytoxin in some of these disorders.

Interviewer - Robert Frederick
Okay. Well, thanks, Dave.

Interviewee - David Grimm
Thanks, Rob.

Interviewer - Robert Frederick
So, what other stories are you looking into for *Science*NOW?

Interviewee - David Grimm
Well, Rob, we're looking into a story about where exactly the first Americans came from. And we've also got reporters at the AAS in Long Beach, California, this week – this is the annual meeting of the American Astronomical Society. And they've been writing some very cool stories about black holes and even about a three-dimensional reconstruction of a supernova explosion, and there's a really cool picture of that on the site. And we're also posting a bunch of items on our new policy blog, *Science*Insider. We're following, for example, President-elect Obama's selections for his cabinet, and what effect they're going to have on science. In fact, we had a really nice scoop a couple of weeks ago where we were the first news outlet to report that John Holdren was going to be Obama's science advisor. And the blog follows a lot of other important science

policy developments – everything from bioterrorism to even what Bush's current science advisors are saying about the last eight years of science under the Bush administration. So, be sure to check out the site, as well as the science policy blog.

Host – Robert Frederick
David Grimm is the editor of *Science*NOW, the online daily news site from *Science*. You can check out the latest science news, and find a link to the *Science*Insider blog, at sciencenow.sciencemag.org.

Music

Host -- Robert Frederick
For now, that wraps up the January 9th, 2009, *Science* Podcast. If you have any comments or suggestions for the show, please write us at sciencepodcast@aaas.org. The show is a production of *Science* Magazine and of AAAS, the Science Society. The content is provided by the news and editorial staff of *Science*, and Jeffrey Cook composed the music. I'm Robert Frederick. On behalf of *Science* Magazine and its publisher, the American Association for the Advancement of Science, thanks for joining us.

Music ends