# This Week in Virology

*with Vincent Racaniello, Ph.D. and Dickson Despommier, Ph.D.*

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# Episode 6: Latest outbreaks of polio, west Nile and eastern encephalitis, Hendra and norovirus

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**Vincent Racaniello**: This Week in Virology, episode six for October 29, 2008. I'm Vincent .

**Dickson Despommier**: And I'm Dick .

**Vincent**: We're back in Dick's office after missing him for a week. Where were you Dick?

**Dickson**: I was up in Maine attending a meeting called Pop!Tech. It's sponsored by the National Geographic society and Steelcase and a whole bunch of socially committed companies to social change for the better. So this meeting that's in its twelfth year asked me to give a talk on vertical farming and I did and I met a lot of interesting people and I heard some fascinating talks on a range of topics from neural networks and political choice to how to teach a 16 year old kid to play a Bach piece from scratch. He had some knowledge of this, of course, but the director of the Boston Symphony was there to give wonderful lessons to this kid and it was the most enjoyable thing I ever heard.

**Vincent:** Any viruses?

**Dickson:** Actually Ian Lipkin was there from our school in Columbia University. He talked a lot about viruses, how to detect them, how to use viral chips; how the modern technologies have advanced our ability to detect emerging infections in various places and in fact Laurie Garrett was there, also, and she teamed up with Ian Lipkin. They had a very nice presentation.

**Vincent:** And Laurie Garret is the journalist, of course, who has written a book called *The Coming Plague*.

**Dickson:** She's got three P's. She won a Pulitzer; she won a …., and she won a….. -- those other two prizes begin with P also and she has three of them.

**Vincent:** Very good. Well we'll put a link in the show notes so people can see what's up. I know they put videos of the talks up on their web site. Maybe we'll see yours some day, or Ian's.

**Dickson:** Of course.

**Vincent**: I had a talk last week with Saul Silverstein as you know. I'm happy to see you here again. Today we have a potpourri of topics we are going to talk about. There has been a lot in the news lately. The first thing I want to bring up is polio. We talked about polio a few episodes ago.

**Dick**: That was our second episode.

**Vincent:** It was an article yesterday in *The New York Times*. Did you know *The New York Times*

is the paper of record. It records everything. I also heard they are going to go out of business because the ad revenue has declined so much that they can't sustain the paper anymore. I don't know if it's true.

**Dickson:** Oh my God! They just built a brand-new building. Renzo Piano will be very disappointed.

**Vincent:** I don't know what the circulation of the paper is. I suspect the web site does fine in terms of ad revenue.

**Dick**: It's in the millions.

**Vincent:** Anyway, there was an article yesterday about polio increasing and spreading to new countries and becoming endemic. So right now polio is endemic and that word means a virus is circulating in that country and does not have to be reintroduced continuously. It's endemic in four countries: Afghanistan, Nigeria, India and Pakistan. The number of cases in these countries has increased this year compared with the same time last year.

**Dickson:** Any particular reason for that, Vince?

**Vincent:** We don't know. Now there are different reasons why there continues to be polio in each these countries. Let's go over that. The easy one is Nigeria where they stopped immunizing a few years ago. Do you remember that?

**Dickson:** I do.

**Vincent:** The reason they stopped immunizing is because they decided that the vaccine is a western product and they didn't trust it, so for one year no one was immunized. And this, of course, this allowed the virus to come back into the country and cause polio, but more importantly to spread to other countries. So even though they resumed immunizing in Nigeria, they haven't been able to stop the epidemic and now it is a full blown epidemic. Now it's spreading to other countries in Africa so, for example, there were two cases in Ghana that had been polio-free for five years. It is probably coming from Nigeria. There are lots of new countries in Africa that had not previously seen polio for a long time.

**Dickson:** That's all they needed was another disease to worry about, huh?

**Vincent:** I think in Nigeria the issue is that they haven't yet been able to overcome the ill advised decision to stop immunizing for one year. Listen to this number: at this time in 2007 October there were 210 cases of polio in Nigeria. So far this year there are 728. That may not seem like much, but these are cases of paralytic disease and for every case of paralytic disease there are between one and two hundred people infected that don't show symptoms, the so-called asymptomatic infection. So there are a lot of people infected and spreading this. So that's Nigeria. Afghanistan and Pakistan have polio because there are wars going on there. There's armed conflict.

**Dickson:** And the control measures break down during those times.

**Vincent:** It is very difficult to immunize everyone. If we could get in and immunize I think we could conquer in those countries. Now in India 486 cases so far, 326 in 2007.

**Dickson:** Is there a regional distribution to this?

**Vincent:** There is an area of India called Uttar Pradesh in the west and they have a big problem.

**Dickson:** Oh yes; very famous, very famous.

**Vincent:** There they have been immunizing very intensively but apparently the vaccine is not working and in the past many reasons have been put forth to explain this. Maybe the diet is somehow interfering with the virus. Remember the virus you ingest and it replicates in the intestines, or maybe other pathogens in the intestine are interfering. *The New York Times* said that diarrhea is a big problem. If these kids have diarrhea when they get the oral vaccine then it all comes out.

**Dickson:** It washes right on through without attaching.

**Vincent:** I imagine there might be a lot of diarrhea in this region. It's a problem that needs to be solved. Here in the *Times* article they suggested the India Academy of Pediatrics has endorsed using the injectable vaccine for those who can afford it. The injectable vaccine is killed so it does not depend on replicating in the gut. It's just injected into your muscle. I think this would solve a lot of the problems. The issue is that it's more costly. I think it's about a dollar a dose compared with about a penny a dose for the live vaccine. Do you know why it's more expensive?

**Dickson:** Because you have to have a team to give it?

**Vincent:** Also because not many companies make it. It's economy of scale. I've been at meetings where representatives from various companies have said that if you give us the green light we'll make enough of it to make it for a penny a dose. I think eventually the world will switch to using the killed vaccine because the live one can cause polio as long as you use it and there are still viruses circulating in the sewers long after you immunize with the live vaccine. Alright, next thing up: *Bloomburg.com This Week*: "West Nile Virus in California Swimming Pool." We talked about this a couple issues ago. Do you remember, Dick?

**Dickson:** I sure do.

**Vincent:** What's the issue here?

**Dickson:** Well, if you don't clean your pool and use a filter and just leave your pool sit there it will start to act like an ecosystem. Eventually the chlorine will evaporate off and it will attract unwanted visitors.

**Vincent:** It sure does. So in California people lose their homes; they lose their mortgages.

**Dickson:** Oh, wow. When it rains you still have a pool. It creates stagnant water and these mosquitoes just love that stuff.

**Vincent:** So, I'm not quite sure what this number means: they have 140 incidents there they've isolated virus from mosquitoes in the Los Angeles area. So this has been going up since we talked about this last time and this correlates with a 300% increase in home delinquencies in the county. Sixty percent of the mosquitoes captured at these pools were *Culex tarsalis* as opposed to *Culex pipiens*. Why is that significant?

**Dickson:** Not much. I think these two mosquito species share common habitats, so they are probably in competition with each other. They're both competent vectors for West Nile and in people, and in birds.

**Vincent:** They also say there have been 140 laboratory confirmed cases of West Nile in Bakersfield, which is another city of California, very hot and dry, 276% more than 2006. Bakersfield has the 4$^{th}$ highest US foreclosure rate.

**Dickson:** Oh my gosh.

**Vincent:** So they have a picture, which is an aerial photograph of a neighborhood which shows 17% of the 42 visible pools have turned green. This is where those mosquitoes are growing.

**Dickson:** The chemicals are gone and so are the people.

**Vincent:** This is going to continue. It's warm in California for quite a few months, right?

**Dickson:** It's an endemic infection in California.

**Vincent:** We'll see. We'll keep an eye on this. In sort of a related issue I found an article, "The Credit Virus Spreads Worldwide". This is about the credit crunch.

**Dickson:** Is that a RNA credit virus or RNA? I think it's a reverse cash flow virus.

**Vincent:** Isn't interesting how bad things are called viruses: computer viruses, credit virus now.

**Dickson:** Well it probably spreads like a logarithmic progression of where you start with one, then you get two, then four, then eight, then sixteen…

**Vincent:** Actually you're wrong, Dick.

**Dickson:** For once.

**Vincent:** That's how bacteria grow.

**Dickson:** Viruses just go whoosh.

**Vincent:** If you put a virus in a cell, you get lots. I don't mean to be insulting, but I teach that to my virology class and that is one of the distinguishing features that initially confused scientists because they were used to bacteria growing one, two, four. Viruses don't do that. One goes in the cell and millions or thousands come out. Computer viruses also need a computer to spread it, which is very much like the biological viruses.

**Dickson:** A computer virus is more like a bacteria in terms of its reproduction than a virus?

**Vincent:** No, I think if you go into a computer and that virus triggers a thousand copies of itself in your emails. So I think it's much like a virus. And then there are viral videos, which spread with wild popularity. So the computer information age has borrowed this term from biology, since viruses were here long before CPU's and memory.

**Dickson:** Indeed. And they'll be long afterwards.

**Vincent:** They will be. There will be animal hosts long after the humans are far gone. We have borrowed one thing from the computer age in the field of virology. I'll throw this by you and see what you think.

**Dickson:** As a non-virologist I'll be happy to give you what I think.

**Vincent:** Even if you weren't. Viruses are the ultimate spammers. Now, you know what a spammer is?

**Dickson:** I do. You're probably talking about introns and exons.

**Vincent:** No, it just throws millions of itself out, unwanted.

**Dickson:** And hopes that one of them succeeds?

**Vincent**: Yes. Exactly. It's the same with an email spammer who throws out millions of emails in hopes one of them makes money. So I'm borrowing that term from the computer people and we're going to use it in virology. What do you think of that?

**Dickson:** I love it.

**Vincent:** Ultimate spammers. I didn't make it up, by the way; Neal Stephenson in *Cryptonomicon*, excellent book.

**Dickson:** *Cryptonomicon*; sounds like a Superman anti-thing.

**Vincent:** No, it's about cryptography; very interesting. He seems to understand biology because he made that comment about viruses.

**Dickson:** By the way, you know who else; bankers seem to be attracted to molecular biology for the same reason. There are a lot of interesting bankers out there, like this guy, Baruch Benacerraf, who was a banker before he was an immunologist because similarities in the two fields. It takes a special mind to see that.

**Vincent:** There was a time in the 50's when molecular biology was a brand new field and the subject initially of bacteriophages -- viruses of bacteria -- and some of the earliest bacteriophagologists were physicists. Max Delbruck, Leo Szilard; they were physicists. I feel they had this analytical view of things, very quantitative. That was perfect for the early days of molecular biology.

**Dickson:** They looked like crystals; they looked like they had some sort of physical properties.

**Vincent:** Very good for biologists. Very good for a physicists. That's very interesting. Now, the next story we have for today.

**Dickson:** We wander sometimes, but it's good. The wandering virologists.

**Vincent:** I tell you Dick; if I could record all my conversations, so many would be interesting. I had a conversation in the car this morning with a friend of mine about pharmaceutical companies and layoffs. We should probably have him on one day because he has some interesting ideas. In Massachusetts a man died of mosquito-borne triple E virus.

**Dickson:** The Eastern Equine Encephalitis; a flavivirus.

**Vincent:** He died, a 73 year old man. He died, 73 years old. They think he caught it in Maine or New Hampshire.

**Dickson:** Hah. Hah, hah. Naturally not in Massachusetts.

**Vincent:** So what do you think of that, Dick?

**Dickson:** Tis the season. This is not an unusual finding. In fact I think in our original program on west Nile virus I mentioned the fact that New Jersey has 21 counties and each one of them has a mosquitoes control board It's not to control west Nile virus and not to control malaria which we don't have anymore. It's to control eastern equine encephalitis because New Jersey has a big horse racing industry and they have a lot of horse racing areas in New Jersey where they are raised besides Kentucky. You'd think Kentucky was the home for this, but actually New Jersey doesn't do so bad. So you get down to the southern part of New Jersey around Atlantic City, Monmouth county has the Monmouth Race Track. Mosquitoes carry eastern equine, so they have to be on the lookout for this all the time. Unfortunately in New Jersey it is carried by the salt

marsh mosquito that has a flight range of 25 miles.

**Vincent:** Huge.

**Dickson:** It's an enormous flight range.

**Vincent:** What would he have been bitten by in Maine and New Hampshire?

**Dickson:** Some form of salt marsh mosquito. *Aedes solicitans* is the one that they are worried about there.

**Vincent:** So this is quite rare, right?

**Dickson:** Rare in humans; very common in wild animals. It's a bird disease. It's carried by migrating birds and that's the reason why there's a season for this. There's a spring and a fall season for the transmission of equine encephalitis. The birds give it to the local mosquitoes. Then the local misquotes bite horses and other things. And of course they have a preference for horses. You know you're lucky because eastern equine encephalitis is usually a horse disease: the word equine. And there's a western part to this, too, by the way. There's another local virus down in the West. They're mosquito-borne, too. People don't usually get in the way of it but if they do it doesn't matter how young or how old you are, they usually end up dying from it. Very serious.

**Vincent:** I stumbled on these disease maps. There's a US Geological Survey web site that has disease maps, but they're limited to mosquito borne diseases. And if you compare the Eastern and Western it's geographically -- very restricted-- so it must be because of the vector.

**Dickson:** And the birds. The flyways; it's all due to the flyways.

**Vincent:** Now this man was unfortunate because he was old and that's why he died most likely.

**Dickson:** No, no, no. Little children die from this.

**Vincent:** Little children and old, but not in between.

**Dickson:** Yeah, no. We would die from this. This is a very bad virus, no matter who gets it. There's no cure.

**Vincent:** Then why are there so few deaths? Here there were six deaths from 2004 to 2006.

**Dickson:** Well, because the mosquitoes that prefer animals can usually find them. So they'll bite rodents or birds or horses in this case -- cattle.

**Vincent:** How does a mosquito prefer one host over the other?

**Dickson:** Exactly. You know we have a guy working right over here at Columbia University, Richard Axel. He got a Nobel Prize for his work on smell. That was in the mouse. He has now redirected his attention to how mosquitoes detect odors. Maybe we should have him on here to tell us why a mosquito would have a preference since they start out detecting CO2 and then once they get up close they detect other odors and based on those other odors they either bite you or they don't. It's a very interesting system.

**Vincent:** One would imagine that this would be a point of intervention.

**Dickson:** No kidding. In fact Richard has already determined that DEET, which is the major rub-on anti-mosquito device; we have nothing else, right. It's in these commercial products like OFF.

It's basically the DEET that's the repellant. It confuses their sense of smell. In fact it blocks their entire repertoire of smell. It blocks the whole system, so they don't even find anything. They end up starving to death or going to somebody without DEET.

**Vincent:** So probably this old man was in the woods.

**Dickson:** Or near the shore. Maybe he was a bird watcher. There are a lot of people out in the fall watching migratory birds because there are very few places left where you can actually find a wilderness-like environment to see the birds landing and behaving normally. You know this guy Peterson has a bird watching guide. Guess where he said is great for watching birds, along the entire the entire Eastern seaboard of the United States.

**Vincent:** Are you a bird watcher?

**Dickson:** I am because I do a lot of trout fishing and I don't catch a lot of fish so I watch a lot of birds. He says Central Park in New York City is a great place to go bird watching because it's the one little patch of green in an otherwise paved-over environment. Cape May, New Jersey is another place like that. So those people are attracted to those regions, especially during the migration routes and times, and eastern equine encephalitis is a problem and every now and then someone gets nailed, but mostly it's a local horse disease.

**Vincent:** I'm still not sure I understand the host preference, but maybe we'll come back to it another time, if a lot of mosquitoes carry the virus why more people aren't infected. I know it's a preference and it's a smell thing.

**Dickson:** Yeah, so how do you tell which one they pick? The easiest way to do it is a PCR reaction on blood proteins inside the female mosquito and you can tell what host that was by just looking at that.

**Vincent:** Good idea. Clearly one should survey the mosquitoes extensively. That would be quite interesting.

**Dickson:** No question

**Vincent:** And we have the technology to do it.

**Dickson:** We do and Rutgers University, by the way, in New Jersey and several other places, too; University of California at Davis. There are a few out in the Midwest; I think the University of Michigan as well..

**Vincent:** They do these surveys.

**Dickson:** They do routine surveys.

**Vincent:** Is there any way we can find out the results of these surveys.

**Dickson:** I'm sure they have web sites for this.

**Vincent:** Web sites; we'll look at it.

**Dickson:** We should get in touch with them.

**Vincent:** Our next story is from Australia, an Australian newspaper, but it's a British mother and child, and it happened in Britain, but it's reported in the Herald Sun, which is the biggest selling Australian newspaper. This young lady, 32 years old, had a baby. About the time she had the baby she developed a fever sore on her mouth and shortly after they brought the baby home the

baby died from what they call here herpes simplex infection. So apparently this is the first time this young lady ever had a fever sore and do you know why that would make the baby particularly susceptible?

**Dickson:** Well, there's no maternal antibodies then is there?

**Vincent:** She had no previous infection, no immunity. Normally the mother would transfer antibodies to the fetus that would protect it for a month or so after birth until it could make its own immune response. Apparently in this case she was naïve and the timing was bad. Now, what I don't understand here are some inconsistencies, which call me to question this. Someone said she was probably stressed and that was why she probably developed the cold sore. Now, when you are stressed and you develop a cold sore, that's because herpes virus that has been hiding in your neurons is reactivated and she should have had maternal antibodies.

**Dickson:** Yes, she should have had maternal antibodies.

**Vincent:** Yes. There's something else going on in this story that we don't know about.

**Dickson:** Maybe it made her more susceptible to the virus to begin with

**Vincent:** The mother?

**Dickson:** Yep. It's possible, right? Stress does dampen the immune response.

**Vincent:** I suppose it could have been her primary infection, yes. So that would have been her primary infection. Maybe she caught it at the hospital.

**Dickson:** Show me one pregnant woman who isn't under stress.

**Vincent:** Yes. So you're right. Maybe it was her primary reaction, not a reactivation.

**Dickson:** Plus there is an immune diversionary response that goes on during pregnancy, not an immune suppression. We used to think it was a suppression; that the mother became suppressed in favor of the offspring, but it is actually a diversion of her immune cells that actually home in and help out around the placenta so she's being depleted, but it's not actually going out of her body. It's just going away from some of the sites.

**Vincent:** So she was more susceptible to infection.

**Dickson:** I can only tell you they are more susceptible to the common cold, to any mucous surface agent that would get in through those roots. I would say it's consistent with a first exposure to herpes virus.

**Vincent:** I'm surprised we don't see more of these infections.

**Dickson:** We have this big list of organisms, right, the TORCH test and a lot of those letters are viral in nature, right? So you have to worry about those things in a pregnant mother for the first time. So maybe we should add herpes to this list. But it is there isn't it? The H is for herpes?

**Vincent:** Yes. So the baby died of encephalitis or disseminated herpes. We don't know from the article, but it's not very pleasant.

**Dickson:** Absolutely not.

**Vincent:** It's probably not a bad idea that that at least pregnant women get immunized, but of course we don't have a herpes vaccine. Many companies have worked on them. In fact Friday --

here, you may be interested -- there is a seminar by David Knipe who is a herpes virologist from Harvard and he is going to be talking about  a herpes vaccine.

**Dickson:** Interesting. In France they don't have this problem, Vince. They immunize on one day of the year. It's called Bastille Day.

**Vincent:** A tough day for viruses, right Dick.

**Dickson:** Yes.

**Vincent:** Next story up is from Reuters, Africa, where apparently a new disease is causing hemorrhagic fever. Killed three people in South Africa. Others are apparently infected. This is what they are calling a new type of arenavirus. Do you know anything about arenaviruses, Dick?

**Dickson:** Well, since I'm not a virologist, but my guess is that these viruses are what you would catch if you went to a football game, because they only hang out in arenas.

**Vincent:** Are you a comedian?

**Dickson:** No, but my son is. I must tell you my son is a comedian, but I didn't get that joke from him.

**Vincent:** Arenavirus is a collection of RNA-containing viruses, similar to some of the ones we've talked about so far. They have membrane envelopes around them. Maybe the most famous arena virus is the Lassa fever virus.

**Dickson:** Actually I knew that, but I was holding back on you.

**Vincent:** No holding back, Dick; let it all out. Some day we need to tell the story of Lassa. Were you here at Columbia when Jordi Casals; he lived in the neighborhood, worked at Yale, got infected in his lab at Yale, was treated here at Columbia.

**Dickson:** I know that whole story, Vince, and can tell it to you. John Frame was the gentlemen whose nurse came from Lhasa, Nigeria, medevacd to Columbia University and I know all the details of that story.

Dick:  We'll do that another time.

**Dickson:** I would love that.

**Vincent:** That would be great. You're such a good story teller.

**Dickson:** Hopefully it will be a true story.

**Vincent:** Anyway, there is a new virus related to these arena viruses, but it's not the same as any of the known ones. How would they know that, Dick?

**Dickson:** I guess they could do a serological survey on this or they could actually sequence the viral genome.

**Vincent:** Apparently they sent samples to the CDC and also to Ian Lipkin's Lab here at Columbia -- right across the street we can see his building -- so these samples are there and he sequenced them and found it's a new virus and related to Lassa and arenaviruses.

**Dickson:** Do they know how they are transmitted, Vince, cause I do.

**Vincent:** Tell me how they're transmitted.

**Dickson:** They're transmitted through a multimammate urine dropping. *Natalensis* is the name of the rat.

**Vincent:** *Mastomys natalensis*.

**Dickson:** That's the one. At least up in Nigeria this is a very very common rodent, and the urine of that rodent if it gets in your area, if you are exposed to it before it dries out completely, you have a very good chance. Doesn't that sound like another viral infection we know about, Hantavirus? I don't know if rats can have hanta or not. I presume they can because they are rodents.

**Vincent:** I'm not sure. Certainly mice for sure. We should actually talk about that. The hantavirus incident that happened a few years ago in the US

**Dickson:** In Queens.

**Vincent:** Four Corners, which was the original one. Very interesting epidemiology.

**Dickson:** Oh, I totally agree. Again medical ecology figures hugely in this thing

**Vincent:** Again, you see there are new viruses always being discovered because probably as we get more and more people on the earth and they interact with animals more and more that's what happens. We have to have Steve Morse to talk about emerging viruses with us some day. Would he be happy to do this?

**Dickson:** He would love to. If anybody loves to talk, it's Steve.

**Vincent:** He likes to talk?

**Dickson:** He loves to talk. And he's a very good story teller.

**Vincent:** Excellent

**Dickson:** He and I actually give a course together here called emerging infections, so I listen to all these stories so I'm relating all of them.

**Vincent:** I need to go to that course.

**Dickson:** We would love to have you

**Vincent:** Are you lecturing this week?

**Dickson:** I'll look it up after the broadcast.

**Vincent:** The next story, Dick, is from Australia again and it's about the Hendra virus. Now Hendra virus is an interesting virus. This is a virus, which is found in flying foxes. Dick, what is a flying fox? Is it a bat?

**Dickson:** It is a bat. I've seen them up near Brisbane. They call them flying foxes cause they are about as big as a fox. They have a weird long face and they eat fruit. They're also called fruit bats. They're not carnivores. Thank God they're not carnivores cause they are huge, huge.

**Vincent:** The gist of this story is this virus, which we will talk about in a second, is found in flying foxes, so people in Australia are killing them because they are scared, but they are really

harmless bats. The article says, “Please don’t injure the flying fox; call this number and we’ll take care of it.” But Hendra virus is a recently discovered virus. It is a RNA containing virus with an envelope, a member of the paramyxovirus family, which also contains measles virus, mumps virus, very well know human pathogens. Hendra virus is an equine pathogen first isolated in 1994 during an outbreak of respiratory and neurological disease in horses and humans in Hendra, which is a suburb of Brisbane, Australia.

**Dickson:** Isn’t it interesting that all the viral names we have today are actually names of places: Lhasa, Ebola, Hendra, Hanta.

**Vincent:** Yes. It’s very common to do this; some places don’t want to be associated with the virus name, right?

**Dickson:** Like Norwalk.

**Vincent:** The Four Corners virus was then changed to Sin Nombre, which means ‘no name’ because of where the four states join.

**Dickson:** The tourist industry would have gone to hell with that

**Vincent:** They didn’t want to be associated with that. Yes, Hendra is from that suburb. Apparently this is a flying bat virus. The reservoir is the flying bat so occasionally these bats must bite horses and transfer the virus, or a mosquito transfers it.

**Dickson:** No I think it’s the urine problem.

**Vincent:** Then not a mosquito; certainly not. Excuse me for misleading our audience.

**Dickson:** In fact the flying foxes also carry another virus, which we have touched on and that‘s the Nipah virus.

**Vincent:** Nipah is another very related virus, which originated in a village in Malaysia where it came from pigs.

**Dickson:** Exactly, or which infected pigs. Actually it came from fruit eating bats.

**Vincent:** It came from pigs, cultured pigs. Cultured pigs!

**Dickson:** Domestic pigs? These are well-read pigs. Hah, hah, hah.

**Vincent:** They go to the opera… Domestic pigs, and it jumped into some of the pig farmers. These are two examples of zoonoses, virus infections that go from animals to humans. They can cause some nasty respiratory illness, and encephalitis, and they are good examples of new viruses.

**Dickson:** And SARS is in that category.

**Vincent:** Exactly. So people in Australia knowing that the reservoir is the flying fruit bat are kind of afraid and are killing the bats.

**Dickson:** The easiest way is to stay away from them. To keep you horses away from them is not so easy. And what do horses eat? Let’s say you have a fruit farm. Let’s say you have apple trees or pear trees. There’s a lot of that in Australia, by the way. There’s a lot of that long the coast. Obviously Brisbane is on the coast. I’ve actually visited this area because I did my sabbatical in Australia. I made it up to Brisbane. I went up that river and -- I’m blocking on the name of this river and they‘ll just kill me for forgetting it. It begins with M. This was a while back folks. This was

in 1986 so give me a break here. There's a big river that comes out in the middle of the city of Brisbane. It's quite beautiful. They do these boat trips up the river and at the end of the boat trip you end up in a Koala bear preserve. Along the way you see all these fruit bats hanging upside down in these trees, and every now and then one of them flies off and you can't believe how big they are. The wingspan of these fruit bats is about three feet. They are enormous. You can almost hear them flying. You can understand how people would be fearful. They look so intimidating, but they actually eat fruit. So there's no need to be afraid, but imagine now raising horses on a farm that has an orchard and it's the fall, and they call it the fall because that's when everything falls, including the apples. When the apples fall on the ground not only do the horses eat the apples, the fruit bats eat the apples. So lets say you're a fruit bat and you're sitting up in the trees and you're looking down and see an apple on the ground -- this happened to the mango farmers in Malaysia, too. The bat flies down onto the ground, grabs the apple and starts to eat it. The horses see it and say, "Now wait a minute; that's mine." Now, if you were a fruit bat and you saw an animal that size coming at you what would you do?

**Vincent:** You'd bite the horse.

**Dickson:** No you don't bite the horse, no you….

**Vincent:** You pee on it!

**Dickson:** You defecate and pee and fly off; that's exactly what you'd do. You're scared blankless as they would say ---you fill in that blank.

**Vincent:** So this is passed in that urine.

**Dickson:** So here it is on the apple or on the mango and the pig or the horse gets it and you get either Nipah or the Hendra virus in the other side.

**Vincent:** So the reason these infections are a concern is because with more introduction into humans the virus may change, so that now it can pass from human to human and become a terrible pathogen.

**Dickson:** That's right and we're worried about that.

**Vincent:** Which one was that?

**Dickson:** The H5N1

**Vincent:** Which we will talk about. Did you have your flu vaccine, yet?

**Vincent:** You know you can get it free here. I went last week.

**Dickson:** Did you.

**Vincent:** Yes. First ever.

**Dickson:** I got one about three years ago. Which strain did you get?

**Vincent:** The lady who gave it to me wouldn't tell me

**Dickson:** This is the trouble with this thing. You have to guess what the next one will be.

**Vincent:** It's probably a mixture of H3N2 and H1N1 strains.

**Dickson:** Ahh, so you covered the two.

**Vincent:** So that's Hendra. I think we should do one more thing, Dick, and then wrap this up.

**Dickson:** Alright.

**Vincent:** The past week there were several outbreaks of the Norovirus.

**Dickson:** Norovirus

**Vincent:** Do you know what Noroviruses are called?

**Dickson:** I know what it used to be called.

**Vincent:** What did it used to be called?

**Dickson:** It used to be called Norwalk virus and the reason it was called Norwalk virus is because that was where the first outbreak was. They had the name changed because I think Norwalk, Connecticut, started to resent the fact they had a disease named after them.

**Vincent:** This is quite a significant disease. This is a human pathogen.

**Dickson:** This is awful.

**Vincent:** Passed from humans to humans.

**Dickson:** I've had Norwalk virus.

**Vincent:** The disease is gastroenteritis. Copious vomiting and diarrhea.

**Dickson:** You don't want to eat for three days. You're sick and can't get out of bed.

**Vincent:** You do recover in a few days. It's a very rapidly developing illness; 24 hrs incubation, then you're better in two or three days.

**Dickson:** This is true.

**Vincent:** It is a virus that grows in your intestines, hence the gastroenteritis. And you shed it in your feces and in the vomit.

**Dickson:** Sounds like polio to me.

**Vincent:** Very easy to spread. Much more infectious than polio -- I shouldn't say infectious. When you're infected you have symptoms much more frequently than with polio.

**Dickson:** Can I ask you a question here?

**Vincent**: No, no.

**Dickson:** Can I give you an answer, then.

**Vincent:** Of course you can.

**Dickson:** The answer is Coxsackie, New York. Now what's the question"

**Vincent:** What virus was isolated in a small sleepy upstate New York hamlet?

**Dickson:** Of Coxsackie. So is there a relationship between the Norwalk virus and the Coxsackie virus because they are both enteroviruses.

**Vincent:** No, there's very little relationship. Coxsackie much less frequently causing gastroenteritis. But the Norwalk viruses are also RNA viruses. They have icosahedral protein shells so they're very stable and can easily pass through the stomach and the intestine which are not hospitable places. These viruses cause what people call stomach flu, which is an incorrect name because flu does not replicate in the stomach. It's gastroenteritis, viral gastroenteritis or non-bacterial gastroenteritis because some bacteria can also cause a similar disease. They are typically passed from one person to another by contaminated food so the past week there was an outbreak on a cruise ship where over a hundred people got infected. This is a very typical outbreak situation because the food handler is shedding this virus, doesn't wash their hands properly and can contaminate the food. You know what they have to do; go to their cabins and stay there until…

**Dickson:** What a fun tour that must have been.

**Vincent**: There was also an outbreak in a school, again, sixty or seventy kids. All of a sudden they all get sick at once because they all pick up the virus from a common source. You will see this now as the winter months come. You'll see it more and more in these kinds of settings. Also see them in hospital setting, unfortunately. There's no vaccine for this virus; there's no treatment. So what do you think you can do to prevent infection by these viruses?

**Dickson:** I would lean toward sanitation.

**Vincent:** Very good. Sanitization.

**Dickson:** Employees must wash hands before returning to dining room. I never see that last part.

**Vincent:** That sign in the restaurant.

**Dickson:** If you're from another country and you get a job as a food handler you might be able to read that sign but I'm sure you don't understand what it means.

**Vincent:** And that's in part because of Norovirus infections and some other viruses.

**Dickson:** Salmonella.

**Vincent:** Exactly. So Norwalk-like viruses. There are a few other RNA viruses that cause similar kinds of syndromes, but remember that it's viral gastroenteritis, not stomach flu. I think a pitcher in the World Series just the other day in the paper they said he had the stomach flu -- fever and diarrhea -- he went on pitch anyway. He probably had a Norovirus

**Dickson:** Hopefully he didn't give it to the rest of his teammates.

**Vincent:** He put it on the ball.

**Dickson:** Imagine winning the World Series and you pass around this bottle of champagne and the chances of everybody getting the virus. I wouldn't wish that on anybody and I'm a Mets fan.

**Vincent:** They aren't in the World Series.

**Dickson:** Of course they're not; I wouldn't wish that on the Phillies.

**Vincent:** Now it's time for our Podcast Of The Week. This is the first Podcast Of The Week. I

found one very recently by a physician, Dr. Ginger Campbell, and her podcast is called Brain Science Podcast. It's all about neurobiology and brain-related things. The reason I like it is because it is it well done. She has very interesting guests. She also has an aggregation site where she is trying to accumulate all the interesting podcasts and that is called SciencePodcasters.org and I'm asking her to put TWiV there. Right now there are just a handful right now; her own podcast. There's a Nature podcast, for example, and a few others. I'd like to be in that list so we get more traffic. Any virologist out there listening, if you want to join us, we'll arrange for you to call in and we'll have a chat with you. I'm teaching a virology course right now at Columbia. If you want to learn basic virology, I've put all my lectures up on iTunes. There are slides and the audio. I'll put a link in the show notes if you want to take that course, and I think you should take it, Dick.

**Dickson:** I do, too. I need it. Before you go any further here how far along are you in revising your book on basic virology.

**Vincent:** What Dick is referring to in a veiled way is my textbook of virology, which is called *Principles of Virology*. It's published by ASM Press. We'll put a link in the show notes. It is in its third edition now. It's complete and should be coming out within a few weeks. You can get it on Amazon or Barnes and Noble online. We'll have a link on website so you can find it that way. We get a little commission on that. It's a very nice book. Excellent illustrations, all color. This edition is in two volumes so you can carry it in your backpacks more easily. When I get my copies I'll give you a copy signed for free, Dick. How's that?

**Dickson:** And I'll give you one of mine.

**Vincent:** You've been listening to This Week in Virology. See you next time.

**Dickson:** Ok, Vince.