Ask-a-Biologist Vol 043 (Guest: Shelley Haydel)

Mud Science - Topic: Mud Science - Healing with Clays

Do you remember playing with mud as a child? Maybe you still do enjoy making a mud pie or two. It turns out mud, or to be correct clays show promise for treating and maybe curing some diseases. Listen in as co-host Marissa Henderson and Dr. Biology learn more about the amazing properties of some clays from microbiologist Shelley Haydel.

Transcript

Dr. Biology: Everybody ready to rock and roll?

Shelley Haydel: Let's go.

Dr. Biology: All right. This is "Ask-A Biologist", a program about the living world, and I'm Dr. Biology here with my co-host Marissa Henderson from Mesa Academy. Marissa, can you tell us just a little bit about yourself?

Marissa: Well, like you said, I go to Mesa Academy and I'm in seventh grade. I'm 12 years old and I have a little brother who is a normal little brother. [laughs] I love learning and I like science.

Dr. Biology: Oh what a perfect combination. Marissa have you heard anyone use the term "mad science" or "mad scientist"?

Marissa: Mm hmm.

Dr. Biology: You have, OK. Today we get to do something that's not really mad science, instead we're going to be talking about mud science. I don't know about you, but I've never thought about using mud to help cure disease or as a treatment, but I think we might learn a little bit in our story today about mud or what someone might call clay, a little bit later.

In fact, I've talked about soil in another show with Ferran Garcia-Pichel. He's a microbiologist in the School of Life Sciences and he actually had some really fun things to say, and in particular, he didn't like it when I said: "A cup of dirt."

He really said, "It's a cup of soil." The reason he says that is it's not something dirty, that's the way we usually think of dirt is something bad, and there are a lot of amazing things that are in soil and I think we're going to learn a lot of amazing things in mud.

To do this, we have Shelley Haydel. She's a professor in the School of Life Sciences and a researcher in the Center for Infectious Diseases and Vaccinology at the Biodesign Institute at Arizona State University.

Her laboratory studies infections caused by bacteria, such as tuberculosis, and also the unusual treatment for Buruli ulcers, that's where the mud comes in. Yes, you heard it correctly, mud. Today Marissa and I are going to learn more about the story behind mud and how it might be

healing some people.

Welcome to the "Ask-A-Biologist" show, Professor Haydel.

Shelley: Thank you. It's a pleasure to be here with you and Marissa.

Dr. Biology: Do you mind if we call you Shelley?

Shelley: Absolutely, it's required.

Dr. Biology: It's required.

Shelley: It's required.

Dr. Biology: OK, all right. Marissa, what do you think about when I say the word "mud"?

Marissa: Kind of dirty and pigs. [laughs]

Dr. Biology: Dirty and pigs, OK.

Shelley: Pigs, wow.

Dr. Biology: OK. I think we're going to be corrected here, and I'm going to be at least corrected because we're not really talking about mud, are we?

Shelley: Not really. We're talking about a component of mud. Now let me put out that I am a microbiologist, I am not a geologist, so I understand just the basics as well. And basically the way I understand it is soil is everything.

It might be called dirt as well, but it's the decaying matter from dead and dying plants and from animals. It's sand, it's clay minerals, it's very, very rich and so one component of soil and or dirt can be clay.

And so clays are actually minerals and a lot of people don't really understand that, but they are usually a silicate structure that have a number of different ions that are contained within it. It's a very important component of the soil and of dirt, but what we're talking about today is specifically clay minerals.

Marissa: How on Earth did you ever get started studying minerals?

Shelley: As a microbiologist I was just a shocked to find myself studying clay minerals at this point in my career, but obviously because I'm involved there's a microbiological component to it and so back in 2000 there was a French humanitarian who actually traveled to Central and Western Africa and began treating kids or children that were afflicted with the disease that's known as Buruli ulcer.

That's caused by a type of micro bacterial organism that is somewhat related to tuberculosis and leprosy. What this infection does is it starts attacking the skin and starts destroying it. So it makes a toxin that is involved in destroying it, but the big problem with Buruli ulcer is that it's

extraordinarily difficult to treat and extraordinarily difficult to cure.

You can imagine that if something is eating away at your skin and there's no way to stop it, it's just going to continue and continue and continue. Antibiotics don't work once it becomes a bad, bad infection and starts to destroy the skin.

And so she traveled down to Africa because she had been using two different clays to treat her kids. They would fall and scrape their knee and develop a sore and we would put Neosporin on it in this country, she put clay on her kids and they never had a problem.

Their skin would heal, they would go back and be no worse for it. So her husband was a diplomat and he actually, I'm not sure how, but got wind of some of these kids in Central and Western Africa that were afflicted with this horrifying disease.

She traveled to Africa in a humanitarian effort and starting treating them with hydrated clay minerals, which is basically purified clay that's mixed with water to create a gel solution. We have some clay here so you can feel what that feels like. What she did initially was that she traveled to Africa and she began treating them with clays from Africa, but she had used clays from France so a clay is clay is clay, it should all be the same.

It had no effect. So she said, "OK, I need to get the clays from my home country of France." and so she imported those clays and starting treating these children with two different clays from France and lo and behold they started healing.

I mean devastating infections. I got involved some years later because that was antidotal information. It wasn't controlled, there were no physicians there that were treating these patients, we were interested in how were these clay minerals actually affecting the organism that causes the disease.

Dr. Biology: Do people actually die from these ulcers?

Shelley: It takes a very long time to actually die from the ulcers. The infection can become systemic in a sub-group of population, meaning it gets into the blood and is spread throughout the body, but it takes a really long time and usually they die of something else, some other secondary infection or some other problem.

Dr. Biology: OK, all right. None the less, this is a really, really bad disease.

Shelley: It's a bad disease because it's devastating because you can see it. It's not something that's going on inside of the body and later you die, but these people have disfiguring wounds and it's much like we saw historically with leprosy.

You're kind of young so might not be totally familiar with leprosy, but there were leper colonies and they had these leprosy lesions and they were put away because they were lepers and they were dirty and nobody wanted to be around them.

And so they have the same connotation with Buruli ulcer and they're embarrassed because they do have these infections that are on their skin and they can't get rid of them.

Marissa: What is it about the mud or clay that it can be used to treat these particular ulcers?

Shelley: That's the one billion dollar question and when you become a scientist and figure it out you'd be rich.

Dr. Biology: [laughs]

Shelley: Well and actually we don't know yet and that is the whole basis of some of the studies that are going on in my lab.

One, do all clays kill all bacteria? The answer is no on both sides. Some clays kill some bacteria and there are very few of them out there that we've actually identified and so that's the golden question. How are these clays actually able to one, kill the bacteria and then maybe even heal the wounds that had developed? We don't know the answer to either one of them yet and we've only been studying this for about two and half years now so we still have a long way to go to understanding how the clays can actually kill bacteria.

Then number two, can they actually heal wounds.

Dr. Biology: So not all clays are created equal.

Shelley: Not all clays are created equal. They are extraordinarily different. I mean if you think about it on a chemical level all it takes is one chemical component to make a clay different.

Dr. Biology: Well you brought some samples in.

Shelley: Yes.

Dr. Biology: Which I love. They're actually dry.

Shelley: These are dry.

Dr. Biology: And when I think of clay, I'm always thinking maybe about class where I'd be modeling with clay or something. This looks like powder to me.

Shelley: What gets stuck under your tires.

Dr. Biology: Right.

Shelley: Or you slip and fall when you walk through it. Clays are actually defined as minerals that are less than two microns, which is .002 millimeters. You can see a millimeter on a ruler, very, very, very small. These are actually fine powder clay. You should feel them. These are just arbitrary names that we gave them that don't mean anything.

Dr. Biology: Alright.

Shelley: But one of these can kill bacteria and one of them can't.

Dr. Biology: It's powdery.

Shelley: Like Talc, like Talcum powder.

Dr. Biology: Yes.

Marissa: It's like flour.

Shelley: It's like flour right.

Dr. Biology: Yes, yes like flour only in this case it's green flour.

Shelley: That one's green and this one has a greenish tint to it as well, sort of grey green. So did you feel that one? Why don't you feel the one that Dr. Biology has.

Dr. Biology: Are they different?

Marissa: Yes, they are a little different. One of them is thicker and one of them is kind of thinner.

Shelley: Do you think that's important?

Dr. Biology: One's coarser and one's finer in the powder.

Shelley: And that might be just how they were milled because you can mill. Have you ever used a pepper mill?

Marissa: Yes.

Shelley: And you can change that little dial at the bottom so you get coarse pepper and then you get fine pepper. It's the same thing with the clays. I actually have a napkin somewhere.

Dr. Biology: Well here I'll give you a Kleenex and we can wipe that off our fingers.

Marissa: OK.

Shelley: OK and so that was the dry clay. So then what I did was I took some of the dry clay and just hydrated it and made it a gel or what's known as a poultice like material. These aren't the French clays, these are other clays from the United States but basically how it was used in treatment was basically you just put it on your skin like a gel.

Dr. Biology: OK, I'm game.

Shelley: OK.

Dr. Biology: I'm going I'll try a little bit of it.

Marissa: Alright.

Dr. Biology: Oh, it's interesting. It seems almost I don't know mine seems a little oily feeling in a way or looking.

Marissa: It's kind of like lotion.

Shelley: It's like lotion.

Dr. Biology: Right, yes, yes, right OK that's...

Shelley: Do you want to feel this one Dr. Biology?

Dr. Biology: OK, oooh, yes. I'd like to do some painting.

Shelley: It feels cool and smoothing and people will pay a hundred dollars in Scottsdale to go get a clay facial.

Marissa: Ohhh, yes.

You're getting it at the Arizona State University, School of Life Sciences for free. One of these can kill bacteria, one of them can't.

Dr. Biology: OK and so you have a 50/50 chance of picking the right one. I'm going to pick the lighter colored green one that seemed to be a little smoother.

Shelley: So this one, OK.

Dr. Biology: What are you going to pick?

Marissa: I'll do the other one, the darker green.

Dr. Biology: OK.

Shelley: The winner is Marissa.

Marissa: Alright. [laughs]

Dr. Biology: So Marissa got it.

Shelley: We've actually shown that this particular clay in its hydrated state can actually kill bacteria.

Dr. Biology: Now how did you do that in a simple form?

Shelley: In a simple way, we followed clinical microbiological approaches where basically we just grow up the bacteria and we have it in a hydrated suspension at a certain number of bacteria. Then we add the powdered clay minerals directly to that bacteria and we're rotating it in a suspension at 37 degrees Celsius, which is body temperature, for 24 hours. Then we perform dissolutions and put the remaining solution onto Petri dishes to see what grows.

Dr. Biology: And I see some Petri dishes here.

Shelley: We've got Petri dishes and this isn't actually from some of the clay studies but I wanted to bring sort of what bacteria look like on a plate.

Dr. Biology: Yes.

Shelley: So this would be Escheria coli or Salmonella type vermerium.

Dr. Biology: You'll hear it on the news they'll say E. Coli.

Shelley: E. Coli, right. Salmonella type vermerium and this is a laboratory strains so it won't hurt you but on this particular plate...

Marissa: That's bacteria?

Shelley: It's good that... but then it's also sealed with parafilm and it's not going to jump off the plate so you'll be OK. It's sort of yellow. What I wanted to also bring is E. Coli would look just like this on the plate as well.

Another thing that we can do related more to our other studies is that we can make bacteria turn colors. In this one, this is E. Coli where we put in a plasmid which is another piece of DNA, on a circularized piece of DNA that will allow the bacteria to turn red. We can put different colored DNA molecules to make the bacteria turn different colors and so we can use that as sort of a tool.

One of the organisms that we use in our studies is MRSA, which means Methicillin-resistant Staphylococcus aureus, which you hear a lot about on the news; it's out in the community. It can kill you relatively quickly. This is not MRSA but this is Staphylococcus aureus, or staph aureus, and on this particular plate it will turn a yellow color.

This bacteria over here this is Norma Flora so this is, can you see the bacteria on there?

Marissa: Just barely.

Shelley: Look at it real, real, real close.

Marissa: It's like in kind of strands almost sometimes.

Shelley: What I did was I struck it out on there with a little Q-Tip. I took that from my own body.

Marissa: Eww.

Shelley: And most people would go oh, that's gross.

Marissa: Yes.

Shelley: But it's on my body, it's on Dr. Biology's body and it's on Marissa's body. This was from behind my ear. I swabbed it and then swabbed it on this plate. That's telling you that the bacteria are supposed to be there and they help to keep us safe as part of the normal flora. The normal bacteria that are supposed to be in your body.

If you ever want to find some bacteria from the body, behind the ear is a good place.

Dr. Biology: And it's actually really important point that we have a tendency to say "bacteria" and we give the "eww, bacteria" as in all bacteria's bad and that is not true. There are a lot of things that are very important and actually help keep us healthy. We want to be a little careful about thinking that all bacteria are bad.

Shelley: And there's a lot of bacteria in mud and dirt and the soil and its there for a reason. It's there to help degrade different things and help break down plant material and whatnot. As Dr. Biologist said, not all bacteria are bad.

Marissa: So if clay minerals become a popular treatment, how would they be administered to patients?

Shelley: Well right now this is strictly being approached as an alternative therapeutic treatment and a lot of people in this country as well as many other countries are looking towards alternative, non tradition medical treatments. And so the approach that I have is, as a topical treatment much like it was used to treat Buruli ulcer patients. We are not advocating to go and to drink this or eat this clay.

A lot of people in this country and many other countries do eat and drink clay daily.

Dr. Biology: Really!

Shelley: Yes.

Dr. Biology: Marissa, have you been eating clay lately?

Marissa: You know, last week. No... [laughs]

Shelley: And I don't judge these people, they believe that it really helps their health and it might because we know that clay is a great physical absorption agents and so that the clay that you rubbed on your skin just now, is probably very dry. And basically what it does, is this particular type of clay absorbs oils and toxins and waters, and so if you wipe that clay off of your skin, you are going to be removing probably some of the bacteria that were in some oil, some water, anything on the skin.

So it's a physical absorptive agent. And that's known. And we've been known about that for years.

So if you think about drinking the clay or eating the clay, will it be doing the same thing in the gut or in the intestinal track?

And there are some studies out there that show it can be beneficial. At the same time clays can have a lot of toxic metals and toxic minerals that are part of their composition, and drinking or eating too high concentration of some of these toxic metals can hurt you.

So, we are not trying to advocate internalization of these clays, just topical use.

Dr. Biology: You said not all the clays are the same and for example, some of them aren't the type that will actually kill bacteria. So, they may not have any effect. But are there any, that actually encourage bacteria to grow?

Shelley: There are, and we have identified a number of them in our studies. And so whenever we actually look at clays because we are interested in clays that can kill bacteria. So anti-bacterial clays, but we have to screen a number of different clays in order to find these.

And people will send us clays from around the world, saying, "Oh this is a wonderful clay. It heals, blah, blah, blah." But does it kill bacteria? So we have to do a lot of screens and we actually have identified a number of different clay minerals that actually promote bacterial growth.

Dr. Biology: So, you want to be careful, you don't want to go out digging your backyard Marissa for clay, and start using it as your home remedy.

Marissa: So, could we have run in to the same problem as antibiotics. Well that is the problem of the bacteria becoming immune to that treatment with clay minerals. And if so, how can we prevent it?

Shelley: Well, the first thing that we have to do is, find out how they are killing bacteria.

And at this point of time, we don't know yet. So we are doing some studies right now. And we have a bit of information that's telling us that it's somehow attacking the membrane of the bacterial cell.

And so it's going to be dependent on how it's attacking the membrane.

Are we attacking proteins or genes that are important in maintaining the membrane? And if so, then we could develop a resistance or do we have a multifaceted approaches, destroying the membrane, destroying DNA, destroying proteins and we have got an army of clays that are killing the bacteria in an assortment of ways.

And that would be almost like treating the bacteria with three or four different antibiotics. And once you have a multifaceted approach to destroy something, then it's usually not going to become resistant. But we need to be able to determine how are the bacteria actually dying before we can really get a good feel on it, whether or not we are going to see resistance.

Dr. Biology: It's a really good question.

Shelley: It's a very good question.

Dr. Biology: Something to watch out for. So, do you think these clays could be used for treating other diseases?

Shelley: I do. Are we ever going to get in to mainstream medicine with clays? I can see it both ways. We use leeches and maggots in the hospital and I can imagine the hurdles that people had to jump over in order to use leeches and maggots in the hospital. So, if we determine that clay

mineral treatment, at least topically is beneficial and the treatment of some people that have different infectious diseases or, different problems like eczema or psoriasis, would it be advantageous? And I think it absolutely is, if we see a great benefit that is not found in traditional medicine.

Are we there yet? No, will we ever get there? Possibly. It's hard to know at this point of time. But, I can visualize, when Staphylococcus aureus or MRSA, we always think about it and we hear about it in the news that when it actually gets bad. But usually, if you read about it, you hear, football players at the high school, or the professional football players have a cut on their skin and then they develop MRSA infection and then they are in the hospital for several days.

Some of them actually die as a result. But those infections start topically. And so if you have an infection that starts topically, you can rid the body of infection before it gets in to the blood. Then you have just inhibited the trip to the hospital.

Dr. Biology: And saved the patient!

Shelley: And saved the patient.

Marissa: So which clay seems to be the most promising that you have found so far?

Shelley: Well, it can almost be a needle in the haystack search. Because the clays from France, that we use to treat Buruli ulcer patients. We actually had those two clays - 2000 and 2001. And the one that actually killed bacteria, of course, that's the one we are all excited about.

So what we did was, we traveled back to France, went to the processing plant, we got pounds and pounds and pounds of clay and brought it back to United States.

The fact that clays are natural, in the environment the earth provides it for us. Means, that it can change. So, we brought all those clays back from France and none of them killed bacteria.

So, that's why we are not working with the clays from France anymore. And so what we did actually, we have had different people that have contacted us, said, "We use this clay to this, we use this clay to do that." So we just started screening some of those clays. And so we have found two additional clays that are in the United States that actually can kill bacteria.

So one kills a little bit better than the other, but they are both very, very effective, at killing a wide variety of bacteria. And you know, we haven't done any experiments beyond looking in a test tube to see if the clays can bacteria. We haven't done anything in humans. We are just now starting to try to figure out how that bacteria are dying. And then the more we understand, the more likely we might be able to use this in practice.

Dr. Biology: Now, are we going to be able to manufacture these clay? Should we actually find the holy grail of clays, or is this something that only Mother Nature can do?

Shelley: Well, with some of the studies that we have actually done, we might be able to synthesize something that's natural, but also synthetic. Because it's a mixture of chemicals, and can we get it right, to synthesize it? And so, are the clays important?

And so, I think the clays are important in providing the environment and the chemistry. And the clays might also be important for topical treatment. Because, as you said, it feels like a lotion or gel. So, basically the application is putting a thick gel on the wound, and then everyday removing it, cleaning it, putting it on again, putting a band-aid.

So, in that regard, the clays or the hydrated clays are almost like a band-aid, that are antibacterial as well.

Dr. Biology: Alright so now comes the fun part or at least the part a lot of listeners like. That is where we ask three questions. When I have my co-host, Marissa, here on the show I like them to ask some of the questions. We talked about this a little before and Marissa is going to start us out.

Marissa: Alright. So when did you first know that you wanted to be a scientist or biologist?

Shelley: Actually I was a sophomore in college. I knew I was interested in biology and medicine, but I floundered quite a bit. I changed my major in college five times before I found microbiology. So when you go to college and your parents go, Marissa, are you going to change your major every semester, every quarter? Tell her yes, until I find what I really, really want to do, but you don't want to change it all the way through your senior year or else you will never graduate.

I actually took a pathogenic microbiology course. Which are the organisms that can cause disease in humans. I was premed so I was going to be a physician and treat patients that had a number of different diseases. But I took this course and a big light went off in my head because I was always interested in how those little organisms could kill us, and kill humans. We must be vastly smarter than these little single-celled organisms. We have got to be much smarter than these little viruses that are tinier than the bacteria, but they can kill us.

The ones that could kill us faster were the ones I was most interested in. I was almost rooting for the organisms, and rooting for the diseases, and so I took that course and went wow I can study these creatures, these little bugs that can kill us without going to medical school. So that is the track that I took as a sophomore in college, and here I am some years later.

Marissa: So, if you weren't a scientist then what would you want to be?

Shelley: That is a good question.

Dr. Biology: Yeah. No science, none at all, taking it out.

Shelley: No science, so no medicine because physicians are scientists. I am very analytical in nature and so it would probably be like a detective of some sort because they still get to analyze a lot of different things.

Dr. Biology: Right.

Shelley: Maybe even forensics, but that’s science.

Dr. Biology: Yeah, it is back to science. It kind of gets back to the fact that you really can't remove science from just about any occupation, but it is fun to try.

Shelley: Yeah, yeah, because I also thought of, OK, I like to play golf. I'm not good, and I just started playing about three years ago. Then I thought, well, run a golf course, but you still need science because you got to make the grass grow. And when you have the dead greens that are brown nobody is going to come to your golf course. So you have to understand how do I make it green, how do I make the grass grow, how do I aerate, and that is science.

Dr. Biology: We will let you off the hook with detective.

Shelley: OK.

Dr. Biology: Because I think that sounds like a especially kind of a cool job. Doesn't it?

Marissa: Yea.

Shelley: And my brother is a detective so I have learned a little bit about it through him. And there is danger.

Dr. Biology: Yeah.

Shelley: I like the danger.

Dr. Biology: You like the danger.

Shelley: Well this is dangerous. I mean.

Dr. Biology: Yeah, well.

Shelley: I am working with MRSA that could kill me. It might take a little. Well, no, it could kill me pretty quickly.

Dr. Biology: Alright, Well let's not kill you off yet.

Shelley: OK, thank you Dr. Biology.

Dr. Biology: In fact, what I would like you to do is give us some tip. I don't want a long story, but what little bit of wisdom you might want to give someone say, like Marissa, who might want to become a biologist.

Shelley: I can even broaden that to scientist just in general. Don't ever stop asking questions. Always be critical about what you are reading and what you're understanding, because for everything that we know scientifically someone had a question, or someone made an observation and subsequently asked a question and developed the answer.

So here, with the clay minerals, the French humanitarian said could the clays that I use to treat my children be useful to treat Buruli ulcer patients that have an infectious disease? Yes or no? So she did the experiment. Yes. My question is do the clays really kill bacteria? Yes. How do they kill bacteria? We don't know. Can we use these clays or the substrates of the clays to treat

people? We don't know, but they are all questions, and so a question is the most important thing to develop because you're going to be seeking an answer, and that is what science is all about, questions and answers - much like this interview.

Dr. Biology: I guess I have one more question to add to our three questions and that is did you play with mud when you were young?

Shelley: Absolutely. My sisters and neighborhood friends we actually made mud pies, and you make a mud pie, you have to taste it and you have to eat it. So we would actually taste it. We were doing real science.

Dr. Biology: Early on.

Shelley: I didn't taste very good. It was gritty as you would expect, but yes, played with mud, got dirty, made mud pies, and ate it.

Dr. Biology: Well, Professor Haydel, thank you for visiting with us.

Shelley: Thank you, Dr. Biology, and thank you, Marissa.

Marissa: You are welcome.

Dr. Biology: Marissa, I hope you enjoyed being a co-host.

Marissa: Yeah.

Dr. Biology: You would do it again?

Marissa: Of course.

Dr. Biology: You would recommend it to others?

Marissa: Yes.

Dr. Biology: OK. What was the best part about today?

Marissa: Probably getting to talk to Dr. Haydel, she's cool.

Dr. Biology and Shelly: She's cool.

Shelley: Cool. Alright. Not many young kids say that about us older people.

Dr. Biology: Yeah, well, you are not nearly as old as I am, and I agree, she is cool. Alright, you have been listening to ask a biologist whom my guest has been Professor Shelley Haydel from the ASU School of Life Sciences, and a researcher in the Center for Infectious Diseases and Vaccinology at the Biodesign Institute at Arizona State University.

My co-host has been Marissa Henderson from the Mesa Academy in Mesa, Arizona. The "Ask-a-Biologist" podcast is produced on the campus of the Arizona State University, and is recorded in the Grass Roots Studio housed in the School of Life Sciences, which is a division of

College of Liberal of Arts and Sciences. Both the School of Life Sciences and the College of Liberal Arts and Sciences provided funding for our co-host contest. So we have to send a "thank you" out to them, don't we?

Marissa: Yeah.

Dr. Biology: An also remember even though our program is not broadcast live you can still send us your questions about biology using our companion website. The address is askabiologist.asu.edu or you can just Google the words "ask a biologist." I am Dr. Biology.

Marissa: And I am Marissa Henderson.

Dr. Biology: And teachers, podcasting is also a great project to do in your classroom or in school. We have all the information about podcasting and the contest and how you can create a contest in your own school. We have details about the equipment, the software used to create podcasts, and much of the equipment by the way, and software is inexpensive and in some cases free.