Rough draft

January 29, 2018.

Physics lecture.

>>Speaker: Recording starting. Okay. Can you hear the audio? This is our first speaker for the semester, doctor Jancy McPhee, a neuroscience and former manager of domestic and international space research programs. One of the big things she will talk about is science communication which is the biggest thing I expect from you this semester. It's going to be an interesting talk. I'll hand it over to Jancy. You are going to hear a little reiteration of what he said. There's a couple of take home messages I hope will stick. It's lovely to be here and great to be first. So I'm looking toward to talking to you. So let me tell you a little about myself to give you context. I was that kid who was really not sure what she wanted to be when she grew up so I had great teachers and a lot of classes. I really loved science and I was good at it. But my Mom was the arty kind of person. All of my hobbies was music and theater. I was afraid by making a choice of either science and engineering or the arts that I would miss a lot

of cool things down a different pathway. So it was an out of it thing for me. I did decide, however, to become a neuroscientist. If you don't know what that is, that's a biologist the that studies the nerves in the mind and body. That was a compromise because it was the science of how we think, move and create. So it was just the blend of my interests and my research work got very specialized. I would study cells and single cell molecules and parts ever molecules. I started to miss the big picture. And I moved on to doing international space life research for NASA. It was essentially hurting (indiscernible) they came from different backgrounds as professionals but came from different countries, but the experience was fascinating and I learned a lot from both my years as a research laboratory scientist and my years of a research coordinator. I started the work I'm going to talk to you about today while I was still a scientist at NASA. It's under our non-profit "Sci-Art" exchange. It focuses on three principals that I decided really needed to be worked on in order to safeguard the advance of

space and science and technology. Those three principals are to engage and educate, to innovate and collaborate. We are going to talk about that we can relay science relevance and also the advance of science by doing the key activities. We are going to talk about how good science is not just facts, we also have to make people care about it. And also touch on some tips on how you can think about science in order to make yourself a better scientist and science communicator. I'll tell you one of the tools is to integrate the arts. In some way into your work. I will give you examples of how we are doing that as a nonprofit. And then opportunities that you have right now to practice the skills we are talking about. So the first thing I want to know, does everybody know what STEM stands for. Science technology engineering and math. Has anyone heard of STEAM? Steam is stem plus the arts. It's an educational movement but I just wanted to define those terms because they may come out of my mouth while we are talking. Who is interested in space? This is clearly Texas so the future of space exploration and development

has a lot of challenges associated with it. They range from the meeting to develop science and technology to how to write mission strategies. Money is always an issue. Timing is it going to happen five, 50 years from now. Do we have the political support. Are we doing what we can to develop the workforce that we are going to need in the future and our workforce as well because learning is never done. We are going to start with communication. I would like you to think about whether you think it's a good example or bad example. We will start with this first one. This comes from the clear lake newsletter. (Reading slide) how many people thought this was a good example of communication? The least you can do is touch its, the meteorite. Science is freaking out. This is from a museum in Chicago. It's the Adler planetarium. So is that an engaging way to draw people in? Thank you. I think we are agreeing about what the difference between good and bad science communication so we are off to a good start. When we talk to others we have to do a good job talking about science. You might not realize

by learning how to talk about science you are going to do better science so what happens there's a general improvement in your science quality when you learn and think about how you are thinking about your science and your ability to relay what you are doing to others. It can do things like help you to remember the big picture, give you insight into the next steps of your research. It can help you to communicate to collaborate torse and identify the collaborators. Be more innovate for. Tell a complete story and to get those better papers written and communicating grant proposals. That's the reality of how a lot of science gets done. So communication is not just done talking in public. So we can learn a lot of things about science communication by actually looking and learning from some of the classic communicators. Does anybody know the guy in the top left? He wrote 120 papers to communicate about his work. If you realize that was before we had word processors and computers that was amazing. Do you know who the next one is. Bill Nye. Do you know this woman? She is popular for a show called talk

(indiscernible) to me. Do you know the last guy. Do you know who his mentor was? Excellent. Thank you. And he was one of the best examples as a science communicator. He is not alive any more. We have lots of good communicators who we can take examples. I'll give you three basic science communication tips because we don't have a ton of time the first is know your audience. Are they your peers or the public. Are they potential funders or politicians. What age are they. Sometimes it's hard because they are a diverse group but you have to do an assessment. What are their interests, what do they have in common with you. It's all important. Even venue can be important. And depending on how you answer the question who is your audience it may change what you say and the flow of what you say. In general we talked to clients and give context and background. If we find we (indiscernible). So we want to give all the background in doing what we are doing before we get to what we did and why it was cool. But when you speak to the public their attention span can be shorter and it's classic the way

journal articles are written that you give the most important message in the first sentence. And then you start to pile on the content and the background. So the you can make a big difference. The second tip is tell them why they should care about what you are doing. How does it influence them and how is it connected to them. If they don't care they will tune out. So you really need to relay that point. You need to tell them the why, not just the how. And in the words of (indiscernible) has anybody read that book? Did says if you want to build a ship don't drum up people to collect wood, teacher them to long for the sea. Tell them why they should care. And tell it simply. Because according to Einstein if you can't say it simply you probably don't understand it yourself and it's a dead give away to your audience if can be difficult to what you want to tell your audience. There's devices and techniques and tips and tricks. That will take a couple of hours of lecture so we won't go through all of them. But there's one basic one that will help you identify your bottom-line message you need to communicate and structure

it. It's the and, but and therefore principal. So you say what we know and this and that and that. What is new. And that's the but. Then we found this. And why it matters, therefore we can conclude. So this is just one example. Sea level is relatively stable for 8,000 years and... (reading slide) so that's one of many tools to help you identify your message that you wish to communicate and structure third pick is to tell a story. And we have been telling stories since we became modern humans and there's lots of evidence for that. Stories are very important to humans and effective for communication. Another reason they are important is because they are hormones behind storytelling. There's hormones released during a story and they help to you remember and connect emotions to what the story is about. So it's a very effective tool. It can be quite difficult to find your science story. And again that's another thing that takes some time and we can talk about that maybe some other day. But let me just give you a little advice that the story could be the science itself or the story of your process of discovery. Both

of those angles can give a framework for an engaging communication about your work. But be careful, when you become a really good science communicator you need to keep your eye on the ethics. Because sometimes really effective science communication can lead to problems. So just bare in mind when you get good at what you do, you need to pay attention to what you are saying. So there's lots of ways to make your story interesting you can use analogies and metaphors and tell mini stories and personal antidotes. Humor. I love this because there's a traditional value of grandma in little red riding hood. All of these devices can be helpful. Multi-media can be helpful. It's very humbling and you need to be caution about the words you use to communicate. So that's what I want to talk about, communication. Now I would like to touch on the second principal which is creativity. Science is always evolving. One way, that's one way in which it stays relevant and addresses the so what, it's evolving to the needs of the local and broader community. In order to evolve and advance, you have to underlie those innovations with

creativity which is a skill. In order to learn creativity we can look at people and identify and see what they have to say and think about their personality. This is Robert Heinlein. Specialization is for insects, not for creative humans. So we will expand on that in a minute looking at neuroscience and psychology, in a grossly simplified way creativity is a way to connect to thoughts or two experiences or a thought and an experience in a novel way. It's how you connect. So one of the important things to do is to not just have this specialization, which honestly we all need that to be practicing scientist. But to make sure you expose yourself to broad experiences because you will be creative in the way you connect everything that's in your brain. Please use your whole brain, not one half of it. I think that would be a waste. Another thing that's important to remember is the creative process has multiple phases of thinking. The first is that preparation phase she. That phase where you get your skills, knowledge, do your background research. But then there are two phases in the middle

incubation and illumination which are a little different. This is where those connections, those novel connections between what you know and what you are thinking about in your experiences will occur. For many people they need to do things to get into the right mental space to actually make a connection. I'll use myself as an example. Most of the best research I did as a scientist was in Seattle, Washington and in the winter in Seattle there's sun for exactly 30 minutes. From 1:00 to 1:30 P.M. at that time the entire laboratory empties out and everybody goes outside. We used to have a running club and we would run a 5K and then return to the lab all sweaty and red to go. There was this amazing thing, whatever the research challenge I had over that day or the several days, I almost always had an idea what to do next after that run, because my brain was busy thinking about it, but I was distracted enough I was not focusing on thinking about it in exactly the same way and beating my head against the wall. I allowed myself to get into a different mental state. A lot of people have their creative moments when they are asleep or

in the shower and some people it's meditation or after meditation. So you need to do a little self knowledge to figure out what helps me to consider my problems. And I mean your intellectual problems. Or maybe it would work with the other problems too. Try and let me know. How do I get myself in that state. It will take self knowledge. Another thing to be aware. There's more than one way to approach a problem. Most of us have been thinking about the scientific method. There's another classic design process that involves an early process that iterates until a best solution is found. It's closer to the way an artist might approach a new work of art. There's a nebulous idea. Part of what is going on gets evolved in the process of doing. So it's important to respect and be aware there are different ways of approaching problems and try others when you are stuck. So to summarize here, what is creativity. It's this diagram that's three different things. You need to have your selective specialized knowledge, but you also need to have a broad experience base. Then you also need to be open and imaginative. And the

last thing is you need to be motivated. It's not just your audience that needs to care, you need to care about what you do in order to be really creative in science. So there are a lot of different ways you can help do your own communication science skills and own creative personal skills. I'll talk about one way which is the one we happen to be using and that's an arts integration approach. There are some shared aspects of the process of creating art and science. But they are not the same. There are things to be learned dabbling in both or integrating either or in what you do. There are different ways of thinking and problem solving. So science and technology often inspires art and that art engages and communicates about science and generates interest. We have lots of examples of that. All of these movies and television shows. These wonderful quotes from the space era, we choose to go to the moon. The boot print. We know that, we have seen lots of examples of art relating the Y of science. It can be inspiring us to do and make life choices. This is the chief communication officer from the original

Star Trek, and this was me at a party. So, I was inspired by Star Trek. Not specifically about space, but about the wonderers of exploring beyond what we know at this point. So anybody else, you don't have to admit it, but if anyone else remember from art that they have inspired them at SH sounds point in their lives? I think if you give it a little thought there's a couple of things that influenced you and you may not have paid attention. But art can influence science and technology. So this is just one example underlying our modern computers and cell phones. A lot of aspects that actually work stimulated by contributions from artist. We are not going through all that technology. Don't have me what frequency hopping is. This is definitely not my field. But the point is it's a two-way street. Art influences science, science influences art. And it's important to do things to train our skills so that we can be better scientist and science communicators and what art allows us to do is work on our mental training, allows us to think about different ways of approaching problems. It is really good at big picture,

and identification the underlying most important points about something. And it also allows us to do that early (indiscernible). So mixing the art in your own science can be very helpful. Incidentally a lot of inventions were made by people who are practicing artist. A couple of examples. The telephone, steam engine. Telegraph. Turns out if you look, almost all nobel laurate engaged in arts as an adult. So that's an interesting thing. It remind me that we need to try out for another community theater gig to keep my own creativity alive. So I'm going to tell you a little bit about our humans in space art program and use it to furniture a couple of examples of art about science. Basically the human in as far as the art program I started as a scientist as NASA and it had NASA support through the last nine years in a different levels for different kind of activities. We have three projects underlying the program. The first targets children, second college and early career and third is professional artist. All of those projects, the underlying all of those projects are two simple phases. The first is whoever is

the participating artist group, we invite them to learn about space and the underlying science and technology and we feed them some of that information, and then we encourage them to address a question about the future, but in order to relay their vision they have to write us a symphony or a short film or paint a picture or create a poem. So it's forcing them or encouraging them rather, to think about the science and the engineering, to put a creative twist on it. That's phase one. The second is to then leave all of that artwork into multi-media live performances and display on line locally around the world and in space when possible so the artwork now engages the listeners and viewers. So it creates a snowball of communication and creative thinking about this topic that we are interested in. So I'm going to start showing a couple of videos and actually we are doing okay so I might be able to show you several videos. This is a trailer from a youth art competition. And the footage you are about to see was taking from coal loan Germany because we worked with them to be the opening ser moan any for an

international space meeting. We had a can test the year before and we had the top winning artwork loaded it into this display and live performance and in the one minute video you will see a lot of young people. They are the top winners from around the world that the German space agency paid to come to this event and lead the astronauts and scientist who were carrying out our space program to talk to them about their views and also to meet each other because one of the important aspects of this activity was to prosper the future space relationships. So we will show this for a minute and hopefully the audio will work. (Video playing). One of the things I'm going to say is whenever possible it's a good idea to include multi-media, because not every person responds to the same kind of communication tool. So I personally am touched by music and I think that the visual art we get is spectacular. But when it's woven in with music as well, I know that we have seen the audience crying because of just the emotional impact that the combined artwork gets. So we have been lucky enough to receive thousands of art

works from around the world up until this point and to display and exhibit this artwork in more than 100 places around the world. They have been hundreds of thousands of listeners and viewers of the been on the International Space Station twice and bounced radio wave off the moon. So I'm going to give you a couple of examples of the artwork and while I'm doing that I thought it might be interesting, the audience is very broad, multiple ages and countries, but maybe you can think about do you see evidence on the tele story. I'm going through this quickly so it's going to be a stream of consciousness going on in your head. But it will be the beginning chance to exercise the things we talked about. So the first examples are going to be from the youth art competition, visual and a couple of literary quotes mixed in there. So you talked about a lot of topics. SH sounds of those topics included the dreams and underlying human need to explore. So they had touch on the intellectual process. And just the ways human beings are asking questions. They have talked very much about the different steps and

designations that we will visit going forward with the space program, so they have touched on what they think are the view of the important strategy. There's been a lot of discussion whether rot bot tick or in-person exploration is important. What are the tools, habitats and colonies versus what we will be using. A lot of discussion and value of the research and also of commercialization going forward. On the topic of creativity and collaboration. One of the driving is looking for life elsewhere. Many of our young people are concerned about the state of the earth at this time. And whether or not making those humans survive means we have to go somewhere else. So very interesting topics expressed. These are all children. All the artwork you are seeing so far. There were a couple of quotes there, but just in all fairness this is a longer excerpt of a poem written by a young girl from Macedonia. You can see the progression of the story. A young girl asleep in her bed. Moves on to her imagination and her dream. And then she goes through her discovery and learning and preparing. And it ends with she can hear the

engine now as it roars beneath her feet and she knows infinity is in here reach. It's a lovely text of an important thing and there's a lot of the so what. So this is a children's example also and it's an except from a symphony space written by a 14-year-old boy. The inspiration for this piece was this Hubble space telescope. This is the pillars of creation. It's believed to be a capture of gas and dust forming new stars. What we have done is overlaid an audio with this imagery. So you can get this multi-media feeling of some things we know about the universe. (Video playing) very powerful. Fourteen years old. The second project targets college and early career. I'm going to show one example, the top winner for this particular IS program is actually an and mated film from a teen in Australia. It's beautiful I will show it to you later. I want to show this one because it's more suitable it's a team of students from Georgia tech and their theme is we need space.(Video playing). This particular group followed up on their video using a hashtag we need space. So they amplified the value of their artwork. I hope

you got a sense so far we are not done with the examples, but of some of the attempts to bring in a storyline to these formats to hit the so what, to use multi-media and different literary vices, different types of even given media and different styles. Remember the call to action, because your chance is coming soon. So the last project that I mentioned is engagement in our cafe program where we take it upon ourselves to introduce a professional artist to science and engineering. We take them to talk to the scientist and allow that to inspire their artwork. Then we stand back and let them do what they do well, which is to communicate about the science. And I'm going to take a couple of minutes to show you a piece that we did working with a professional Japanese pop star. It's extremely cultural. So it may or may not be your personal taste. This is about communicating and respecting different forms of communication and creativity. Hopefully you will notice that as a powerful storyteller she is using role models as symbols throughout this piece to actually tell her tale.(Video playing) so, obviously that was a call to young women

with their (indiscernible). So now it's your turn. I'm thinking a little shorter term. We are funded by NASA right know to host a film and graphic arts condition test about going to Mars. And the target audience is career and college students professionals. It's a fantastic opportunity for you as an individual or team to learn something about how we are going to get to Mars and to create something that communicates your vision that have future. And you can -- one of the target audiences for this is the actual practicing artist of the most of what we do and it's not the emphasis of today's talk, we are trying to create these activity to reach not just to those who self identify as scientist and engineers, but also reach the artist and encourage them to learn about space and science and technology. This is one of those projects. There's a target towards the artist community. If you want to put together a team it's an opportunity for you to watch people not like you who don't have your skills but some of the other skills to work collaboratively to create a communication piece about space. And if training yourself

and doing some good for the world is not sufficient, the artwork also has high payoff. The top film and posters will get a directer of the star wars rouge one and top creative famous graphic arts organization called McCann and other personalities including mohawk guy. And in addition, there's lots of cash prices. So you can choice your motivation but I encourage you to apply some of your skills to actually generate a communication piece that would broadly appeal to the public. So we talked a lot about the so what. Science so what. I hope we have answered a little of that and how to understand how we can maintain and relay science relevance. And some of those underlying keys include communication and thinking creatively about science, that it continues to evolve and be of use. And also so that we can foster public understanding and engagement. Art integration is a tool to help with yourself training and for you to use with your communication and there's a lot of stuff out there about how you make your scientific figures and graph that involve some art integration techniques. There's a lot of stuff

we have not talked about today. And I have made a request to all of you to do your part and train your communication and your imagination skills and be creative in how we think about science and how we shape the future because after all the future depends on us. So that's all. And I finish almost exactly at 8:00 even though we started late. So I hope you felt you got something out of that. We have a few minutes for questions or comments.

(APPLAUSE).

>>Dr. Garrison: Any questions?

>> (inaudible).

>>Dr. McPhee: Nicole and I work together. She is one of our board of directer members. So we cross a lot in what we do. That project was started by a gentleman at MD Anderson and he brought the idea, what he was doing was having children create cancer victims create, children, create artwork as a therapy and he would put them in sculptures that lined MD Anderson. So he had this idea of having people

create art and then we made the space suit. So he brought that idea to NASA's and Nicole helped to make that happen. Because one of the interesting challenges, I'm using art integration as a tool because I care about the future of science and technology. I do also care about really fostering an understanding between very different kinds of people. So the scientist and engineers, not all, but occasionally they look down on people who think different from them. The artist I hear sometimes are flighty. I have done enough research to know there's some in the community that think engineers look down on us. So my general view, if we can figure out how to get the scientist and: Engineers and the artists to work together to solve a problem or do some good together as a team, then we can handle all the different people in between that broad continuum of different kind of people. And the space suit project crosses some of the same lines. But that's not actually a product of our program. But we have coexhibitted a lot. So the any other thoughts? Yes, please.

>>Speaker: Has a project ever been made

(inaudible) to come up with it.

>>Dr. McPhee: A piece of art that the scientist, yes, there are -- first of all the generalization I gave you was a generalization. There's plenty of science and engineers who have great respect for arts and practice themselves and vice versa. Lots of artists and I've been fortunate to meet a lot, who are (indiscernible) about space. So, yes, there are examples of that. You maybe aware we have done things to send art into space, not just with our program, but there's something called the golden record. Sent on the voyager spacecraft. A chronicle of different forms of communication basically recorded on record and sent on the voyager. There are a lot of examples on there and just recently there's a little controversy about this, but there was a satellite sent up that -- I didn't read a lot about it -- has reflective surfaces, and they shot it up recently. And it's supposed to be cool because it will reflect the light and we can see it from the earth really well and it's supposed to be a wonderful piece to help people think about space and the connection to us here

on earth. It's really fascinating because it's a technological achievement as well as a work of art. But the reason I know about this is because some of the at electron percent were mad because it's reflecting light and their earth based tell scopes are going to have interferences in their camera images. It's a challenge to find the balance that make everybody happy, but I think that's a fascinating thing to do. So I hope that answered your question somehow. Any other thoughts or questions? Anybody going to be in the contest. We need stuff from UH.

(end of lecture)