Thank you very much for coming to this lecture, we will discuss about ACL, the current paradigm, how we as surgeons you know try to reconstruct the ACL the best we can. In terms of this lecture we research – receive support from Smith & Nephew in our department and we receive support from Arthrocare, Synthes Styker, J&J, DePuy, DonJoy, Breg, Omeros, Biomet and Mitek.

Now the basis of all you know surgery is anatomy, so I think it is important for us to understand that we when we do ACL surgery we should reconstruct it as anatomical as possible. In other words, with ______ anatomy, we have to individualize the surgery, we have to look at not just short term success, returning to play in 1 or 2 years doesn’t mean a thing if your knee is going to be worn out in 5 to 10 years. And lastly, we have to also look at better outcome measurement to look at our results.

So I think that the anatomical reconstruction is based on nature, based on form and function. So if you want to put those three together then you should have a pretty good outcome. In Pittsburgh we like to define anatomical anterior cruciate reconstruction as a functional restoration of the ACL to its native dimensions, collagen orientation and insertion sites. So at this point I think as surgeons we probably can start an insertion site the best we can. The native dimensions and collagen orientation still have to be worked out.
In our hand we like to pick a graft that can reproduce the patient’s ACL to 80 to 90% of the native insertion sites. And the bottom line is we like to provide the patient with the best potential successful outcome.

Now this is the ACL, this is how the ACL look like, this is a 90 degree of flexion and you can see there is 2 bundles of ACLs, anteromedial bundle and the posterolateral bundle. Those two bundles work together to make the ACL function perfectly. And if you do not reproduce the whole ACL it may not you know get the full kinematics or function back.

And this are the so-called where the insertion sites of these bundles are, the anteromedial bundle is inserted in the anteromedial portion of the TBL and the posterolateral bundle is inserted in the posterolateral part, you know, of the TBL of the ACL. So this is a 3-D CT scan done in Pittsburgh to confirm the anatomical dissection with the CT scan you know insertion sites.

Now this CT scan done of the femur, the thigh bone, it is essential to show the insertion site at 90 degree of flexion, the AM and PL bundle and you can see on this CT scan on the right side AM and PL and you can also see this ridge here which we call Resin’s Ridge. Above the ridge there is no ACL and below the ridge there is all ACL, so in other words right now we have a technique with CT scan that can tell us exactly where we should place our ACL. And we are placing the ACL not in the right place for many, many years because we do not understand this kind of relationship.
Now ACL is to bundle, but the ACL is also changing the orientation from 0 degree to 90 degree. At 0 degrees the two bundles are parallel, whereby at 90 degrees they cross. This is how it works. AM and PL are parallel and as knee flex from 0 to 90 degree the AM remains the same whereby the PL crossover. And the reason why the PL crossover is it’s become loose, it becomes loose because it allows rotation. The AM provides the AP’s ability, right by the PL allow rotation, and those two bundles work together to make the knee work perfectly. And the amount of rotation is quite different in different people, and it depends on the bony anatomy. In other words, if this medial femoral condyle is bigger there will be potential more rotation.

Anatomy never changes, so why do we as surgeons want to change anatomy? Why? Because we have some theory in the past, for example in the ‘80s and ‘90s, early ‘90s we theorized that if do ACL reconstruction you had to put it in the isometric position. And after many studies people concluded the isometric position is right here, okay, and this position is actually more anatomical. The isometric is when you move the knee the ACL will move, which I have demonstrated to you it doesn’t exist. The AM and PM move differently, okay, so if you put the ACL in this isometric position it won’t be in the right position anatomically.

And this is why in the ‘90s we as surgeons devised drill guides to help us to do the surgery as quick and as efficient as possible, and this is one of those so-called over the top ______ that you put this, your guide right there and you can drill this isometric position. It is absolutely a non-anatomical position.
And also we invented machines, this particular one is called a KT1 ______ and it measures so called AP translation of the knee and this is really good, and it gives you a measurement of numbers in milliliters but with this kind of measurement – it doesn’t measure rotation. So in other words, this is the one dimensional measurement that doesn’t tell the whole story of the knee.

And this is why we try to do the knee in this kind of position, a trans______ technique that is right in this isometric position and the true ACL anatomically is in this position, AM and PL and this is the front of our ___________ KBGS, so it’s not quite correct anatomical position. So if you put your ACL in this position and if you do a CT scan like we do today you can see this is completely in the wrong position, this is the correct position. And if you extend the knee to 0 degree you can see this has become a very vertical graft and this measures 30, 40 degrees on this AP  x-ray which is a very non-anatomical construction.

Now we need to recognize the relationship between the ACL and the bony morphology, and this is something that we as ACL surgeons have not done a good job. And that’s why we went to Dr. Owen Lovejoy and Dr. Chris Baer here, they are the paleontologists who understand the bones really well, but they do not understand the ________ as good because they don’t see them. And this is Lucy, which Dr. Lovejoy put together and luckily part of the knee of Lucy still exists. And this is Lucy ________, this is the ridge between the two bundles as you can see right here, and from the morphology of the Lucy bones they are upright, walking animals or human beings. This is 3 million years old, 3.2
millon years old. Lucy CT scan, this is the Resin’s Ridge of Lucy, this is a modern day human being, this is AM and PL and this is the ACL of Lucy, and the AM and PL too. So the bony morphology haven’t changed in 3.2 million years, and I don’t think it will change in our lifetime, Lucy _______, so I think that we should think of what we know and do the right thing to a patient, the right anatomy.

Well, this is a human knee on your left and gorilla. And you can see human knee rotates much less than gorilla. The reason why is gorilla’s knee needs the more rotation for the daily function, whereby human beings do not need this as much. So here is knee as you can see doesn’t rotate as much as a – you know as a – you know a gorilla knee because the gorilla knee is much you know more you now bigger on a medial size, and this is why there is 3 bundles of the ACL for the gorilla as compared to 2 bundles for human beings. And a human being, this is more equal, maybe a little bigger on the medial side, the natural side.

You only see what you know, but technology has improved to where MRI becomes very highly sophisticated, you can actually see the two bundles, AM and PL, and you do the MRI right and UPMC, where I work, okay, very high quality, this is the AM bundle and this is the PL bundle. You can see a tear, a substantive tear on the MRI right here, AM and PL bundle, and you can see the soft tissue attachment on both ends, and you can do surgery, you know look for this insertion site and try to reproduce it.
This is a partial hemorrhage into the PL bundle of somebody who fell on a treadmill. The patient was stable, no swelling, the knee — after leg extension because this is painful to extend the knee. But the patient recovered after about a month of therapy because the hemorrhage went away and the patient was able to extend the knee.

This is a complete tear of the PL bundle, whereby the end is intact. From a skier who was skiing at Seven Springs tore the PL bundle only. This is you know probably a partial rupture of AM bundle right here, the PL is intact. So we can see there all sort of permutations. This is a ACL that was supposed to be torn, but we found it to be stable, so we reexamined the MRI a month later and found it to be you know normal, this is probably hemorrhage around the knee that caused this distortion of the image. So I think again as a doctor you must examine the knee before you just conclude on an MRI image.

Now we have to eliminate anatomical reconstruction as a risk factor for osteoarthritis, this is very important, you know, interestingly when we do ACL surgery we thought we fixed the whole problem but right now we know that 5, 10 years later most of these people will develop osteoarthritis. There are many factors, like there may be meniscal tear, there may be chondral injury to the - you know accident but also if you put the ACL in the wrong place, the wrong place is probably one of many factors that can produce for arthritis.
So there are many studies you know published over the years, so Dr. _______Van Eck, my fellow, looked at 4,000 papers in the last 10 years and finally only 88 papers in ACL you know have the real anatomical in it, and only 61 of those papers describe how they technically performed the surgery anatomically. And ______ this image, you can see here that _______ you know convince us this surgery done anatomically. In other words, we can publish papers in ACL surgery without any regard to the anatomy. And as surgeons, this is scary, okay, so if you are in neurosurgery the patient will die if you put it in the wrong place. If you are heart surgery, and you put the heart in the wrong place you die. But ACL surgery you don’t, patient just plays sports and they get arthritic later, and okay, maybe is okay, but I don’t think is okay.

So this is the exact position of the ACL that’s done in CT scans in a lab, this is published in ______, this is _____ AM and PL bundle on a tibia and a femur, and this are cases that are done you know, you know done ________. And we did CT scan on them and find out the ACL positioning is absolutely wrong. So this was done by transtibial technique, this is a PL area and a high AM, and this patient completely asymmetric. This is Dr. Tashman research patient, just come back for routine follow-up and the studies and the CT scan was done. After surgery it showed the position to be not entirely correct, but at the time they didn’t know was incorrect. And now we know this is not the correct position.

Now this paper published in Australia is a very good study, 56 patients, they listed 10 factors, one, you know one will cause osteoarthritis at the ___________. They talk about _________ chondral
injury but they did not mention anatomy. And I think this is a problem. Even looking at the x-ray they show you, this is the x-ray in that paper.

This is only as mentioned 30 to 40 degrees, as we discussed 40 degrees is an absolutely non-anatomical position. So we can see what happened to this patient. So in other words, these people are writing papers, they may not even understand. They were putting ACL in the wrong place and non-anatomical place, I won’t say the wrong place, and then years later they would develop osteoarthritis. So the question we must eliminate two things in the knee, the non-anatomical position and cause osteoarthritis. In other words so is evidence based medicine really evidence based? So evidence based medicine is really well defined studies like this one. But ________ is non-anatomical.

So in other words, and we’ll look at what you know people provide for us.

So how much do we need the ACL to restore? We cannot really know, but we know this is a big variation in size of the ACL. This paper just published this month to show there is a variation in size of the ACL tremendous. Most ACLs are between 14 to 18 millimeters, but some of the are as big as 35, and some of them are smaller than 9 millimeters, so a big range. So we can’t do a one size fits all surgery.

For example, this lady who is smaller than this gentleman has a much bigger ACL. You know it’s 20 and he’s only 12 millimeters. And we can use a ruler now as well as an MRI to measure the size so this is 12 millimeters, 16 millimeters, 24 millimeters size of ACL and you can measure the you know
also the cross-sectional area of the ACL too, which is anything from 8 to 10 millimeters. Also can measure the _______ size, which is more than the tibial size by 2 to 3 millimeters. Also we can measure this on the MRI. These are being done you know in Pittsburgh by Ken Ellsworth to look at the size, so we can you know have some idea. For example a 24 millimeter size of ACL you probably can do a so-called double bundle whereby 14 or less you may consider a single bundle to restore it 80 to 90% of you know insertion site size.

So we can measure in the OR with a ruler, and this is 10, 12 millimeters insertion site size. So given another 10 millimeters tunnel of ACL size probably give you about 80% of the ACL surgery, 80%. Now this is the CT scan for this patient, pretty good, single bundle. Now this is 18 millimeter insertion site size, bigger than the last one. So a single bundle will provide you probably half the ACL. And this is what you need, you don’t know how much you need so this is a single bundle you know BTP, that was done, you can see the size of this reconstruction. The patient decided single bundle BTP, we did offer the patient a double bundle too. And this is 18 millimeters, that was from a double bundle, 2 tunnel reconstruction. You can see AM and PL will give you 80 or 90% so I think single or double bundle is how much we restore the insertion site size. So if you have a small insertion site size, I don’t think you need a double bundle, a single bundle probably can do the job; whereby if you have a big size, you may think of doing a double bundle.

This is a good examination of preop, so the patient on your left has a 12.9 millimeters insertion site size and the patient on your right has a 20.8. So in preoperative we discuss, the patient on the left
side I say it was hard for me to do a double bundle, probably a single bundle whereby the patient on the right side you have to offer a double bundle.

So we confirm the measurement during surgery, it’s exactly quite right, and we do it in Pittsburgh, we measure the MRI in Pittsburgh the measurement look right, correct. And we did a single bundle on the left side, and 90 millimeters you know tunnel, single bundle on the CT scan and double bundle on the right side, AM and PL, you can see the CT scan and you look at the MRI image, the one on the right side, a double bundle looks smaller than right on the left side because the double bundle have a larger insertion site size. So relatively it looks smaller than the single bundle.

So what is the approach? The approach not that difficult. I have been an ACL surgeon for 29 years now, so I think that you know I’m a quite simple surgeon so it won’t be very complex. So it’s just a matter of measurement, paying particular attention, nothing more than your carpenter would do in your house, okay? This is what we do as surgeons, like a carpenter with some thinking about the knee. So this is a measurement, put the tunnel in the right place and put it in the graft. So this is a double bundle, you know reconstruction. You can see the CT scan on the right side that confirms the tunnel placement. Also we just think of bundle about 40% of the cases patient with small insertion site size, small notch and one bundle tear, so this is a small insertion site size 12 millimeters, small notch, 12 millimeter notch, small is really difficult to do the surgery in a female except if you want to use an outside technique or a ________ and this is a one bundle tear. Those are the cases when we do
single bundle reconstruction. Also multi-ligament injuries of the arthritic cases, partially rupture with good ________, also do single bundle cases.

So when we do single bundle we do something called match anatomical single bundle. Match, you want to match AM to AM, PL to PL. These are hard to have, midway to midway. In other words, you don’t want to put PL to AM, you do that, it’s a mismatched ACL. So you must use a ruler, you must understand the anatomy. So even if you do a single bundle ACL you must understand the anatomical double bundle you now anatomy to match the AM to AM, PL to PL and midway to midway.

So this is how I used to do ACL, wrong position, transtibial quick technique. This is what many people would do, AM to AM, Dr. Clancy, Dr. Charlie Brown and others, and this is what I propose you to do is do some AM and some PL maybe 60/40, 50/50 we don’t know the answer, but essentially we have to explore that this is probably a good position to think about. And this is a CT scan of this patient as I show on your right side.

This is a single bundle reconstruction on a patient with a small insertion site size, you can see just follow step by step. This is the stump, this is the stump right here, this is the drill holes for the femur, drill holes for the tibia, this is the graft right here. And this is the MRI on the left side, the CT scan on the right side to demonstrate the postop position. So I will challenge all of you to do some of those
studies postop, MRI and CT scan, this is the only way you can find out whether you put your ACL in the correct positions.

So this is a one bundle tear case. This is a PL bundle tear. As you can see the AM is intact, so essentially the AM is intact right here. The PL is torn, so we did a single bundle reconstruction in this situation. And as you can see on the CT scan too.

In terms of graft choice you can – we offer 4 graft choice for every patient. We give patella tendon, quad tendon, hamstring, autograft and allograft. So just the allograft, there are many choice of allograft too. The allograft takes longer to heal so if you use the allograft you make sure the patient is compliant and don’t want to return too early. But the allograft is probably you know better healing process.

Now if you do ACL anatomically they will move the knee very fast, this is one week postop only, one week, very good quad you know function too. So if you put the ACL right place basically you know this – you can see the quad construction right here, this is about actually 5 days postop. Right? Now the problem is if you are going to do this surgery people think they can come back very fast. This guy showed me this tape in 4 months, he said Dr. Fu, why you want to wait 9 months, I’m doing fine, I have no problem, look at that, I’m doing everything. Although I disapprove of this you know kind of move he is doing right now, but he just wanted to show me I’m wrong. But Dr. Fu is absolutely
wrong, I’m right, look at that, okay? So he can do this like a cheerleader, okay, but unfortunately a month later he tore his ACL.

Now on your right – on your left side you can see his graft is not mature at 6 months, they are still kind of white, not dark. On your right side is a graft that is healed, at 4 years it’s dark, so it takes time to mature. So it’s like fine wines or just like anything else, it takes time. And I think right now in this country we are driven by market, driven by patient wanting to come back early, and also doctors go along too because it’s okay. If you thought a view of his ACL is okay, you know, but not all of them will tear, but my goal is to get 90% of people back you know without re-tearing. And you have to wait longer than 6 months. So this is a re-rupture of the patient you can see, a re-rupture. You can see he came back much too soon.

So we can see the two bundles do not heal, and this is why it takes time. And this is why you need to put something called fibrin clot in there sometimes to heal this, okay. So this is a stage of healing. Times 0 is dark, 6 months is white, and then 4 years is dark again. So and then now we are using clot. We take 50 cc of blood and in about 38 minutes this blood will clot like you can see, and we have put this clot in the graft, so in the graft between the bundle it’s like this, you know you can see inside the knee and we have some early results to show that some of this, you know 6 months all becomes darker and I try to help people heal faster, but don’t encourage them to go back too soon.
So why is our outcome so good? So you may challenge me and say doctor, I like your talk, I think your theory is very good but my results are fantastic, why is that? Now there is an EKG. EKG was invented in 1903. So it’s our objective measure of our heart, objective, there’s no – I don’t put my hand on it and say okay your heart is doing good.

This is a heart. The heart surgeons agree there are 4 chambers of the heart. Arthritis surgeons agree there is 2 bundles of the ACL _________. There’s really two bundles like four chambers of the heart, okay. You must understand there is four chambers for the heart to work. So for the knee there is two bundles of the ACL for the ACL to work. So they know everything about a heart, they know – they may not agree about exact treatment, but as arthritis surgeons we are 100 years behind, we don’t even agree on basic things about objective evaluation and the anatomy.

We agree that this is a __________, KT1000 which measures two dimensions of the knee, which is nice. It gives you some idea but there’s only a very small part of the story. So we said _____, now this is a gold standard, this is being put as a gold standard, which is sad because it puts us in the wrong place. Never work. Any ACL done in the knee will give you a good KT1000, doesn’t matter where it is, doesn’t matter right place. Put any hinge in a door, the door will hold up. Don’t have to be correct position.

Now you look at all these articles that were written in the last few years by very good authors. They review the literature and they do systemic review of you know different things like single, double
bundle, allograft, autograft, technique, hamstring, patella tendons and basically the conclusion they didn’t find any difference in outcome. So in other words, you know very good people have done studies and they could not find any difference, and this is why as a profession we are very complacent. We say that I see no difference, we can do anything we want. Which is okay, you know, since everything is the same. Why is that?

So essentially you look at this New England Journal article, which is a very high level article, interestingly they, they conclude there is no difference between surgery, no surgery in the ACL, you can – no surgery is okay. But the only thing is their minimum objective outcome measurement, there are no MRI, x-ray, they have no good examination on this particular study. So then more meniscal injury in this study in a year follow-up, there’s more you know examination is not as stable, both _______ when they are shifting, and essentially the KT1000 is loose. So essentially objectively we can find difference on the paper but they didn’t report it.

So finding no difference does not mean no differences, okay, so this is the key. So essentially the current assessment of clinical outcome including patient reported outcome and anterior laxity outcomes goal is not very valid, it’s very subjective. In other words, I can write a paper and I can bias my success easily. In the ‘90s when I would write a paper I would say __________, now they are like there is 89%, my God, what happened? I go backward? No, because I looked at my patients come back to see my more, 90% follow-up, instead of 50% and I’ll use much better technique for follow-up. So I didn’t go backwards, in fact I’m more honest with my results.
Now this is a study, not published study, but done in Japan. Five famous doctors in a meeting, you know, I was there myself, and they asked these five doctors did you do examination on the patient? This shifting, as you can see right here, in AP Lachman test. None of these five surgeons, who by the way have at least 25 years of ACL surgery experience, some of them were 40 years, None of them did the examination, zero. The Lachman is from 8 to 15 in a shifting you do it the same way, in other words, nobody in the world do the same examination on your knee.

Now this is why and the reason why we cannot find any differences. This paper came out very nice, in fact it won Paper of the Year from AGSM, which is a good you know good journal, and they said there is no difference between the single or double bundle, very simple, because they include normal, near normal as one group. So if you include normal and near normal as one group, everything is 90% successful. Just like I would say that all Japanese, Chinese, Koreans are the same, then it’s the same, you know they are the same race and they are not. I’m sure the Japanese ________, the Korean too, okay. All right but this is what we are doing right now.

Now if you test at normal and near normal, you can see a difference, you can see the double bundle. But they report this one, they didn’t report this one in the paper. And this is what we find. We wrote them a letter, to the editor, and they agreed. I mean but this is how we report our results. Essentially we want to inflate our ego, they are really quick surgeons, oh, we are 90% successful. Ladies and
gentlemen, I’m telling you we are not 90% successful, we have a way to go. And I’m getting better after about 5, 6,000 ACLs, I’m not there. I’m getting there, okay.

Now this is a vertical graft done in the wrong position, I would say by myself 20 years ago, 15, 20 years ago. The patient is a housewife, she do some skiing and tennis, and basically she feels okay and she thinks I’m good, but when you look at her outcome her examination is always normal in the office, I took her in the operating room it was unstable, look unstable, not really that unstable but this is how she looks like 15 years later. The knee is worn out. And the CT to show the position to be not quite right, okay. So this is what we do, we put the ACL not in the right place, let the people do things, worn out. Okay, so when I go back to the office 6 months later I felt she was quite stable, so the office examination is not objective, it’s very subjective.

So we need to strive for better outcome evaluation. I think this is what UPMC Pitt is doing good. They support myself and my lab with fantastic personnel to make it happen. This is Dr. Tashman, I was provided with millions of dollars to get him from Detroit. He was very happy in Detroit, but 5 years ago I provided a very good endowment to get him here, the only guy in America now, few people don’t have an EKG, this machine is a dynamic measurement of the knee how it functions with high speed x-ray. You can see how the knee moves and this x-ray goes 1,000 frames per second, and with a CT scan you can actually do the EKG of the knee. So there is no argument, by the way his study shows that any ACL done in the wrong position you can tell. Very simple, because you did it wrong anatomically this machine will tell you are wrong. Now you may not feel you are wrong, you
can say you feel you are great, you have no problem, it’s like you may have heart attack tomorrow, but you already know it’s going to happen because you have an ST elevation already, but you don’t see anything about it.

So these are some of the studies done in Detroit. Now in Detroit Dr. Tashman did not know that this ACL was done in a non-anatomical position. None of the ACL done in Detroit in right position, zero, because of how we taught ______ of the ACL, myself too, okay, for years. But if you see the blue, blue line is normal knee. The red line is the you know need the ACL was done. And these patients completely asymptomatic, 40 of them, they came back for the NIH study. And all patients had normal kinematics. They had 28 grafts, none of those grafts returned to normal, zero. In other words, if you put ACL in the wrong place your knee will never come back to normal, and what happens is you are putting abnormal contact on the surface of the knee. This is a silent killer. I didn’t balance your tire in your nice car, and your tire is kind of worn out. And this is exactly what happened to those patients.

Now if you do the ACL correctly, like we do now in the last few years, now this curve have to come together, the blue and the white come together. Okay, we do some more studies, and NIH just awarded us with a $3 million grant to study single, double bundle in 150 patients in the next 2 years, and we are going to work on that, okay. We are just kind of setting up.
So the ACL is complex, it depends on morphology of the bone, it depends on the muscle control, it depends on meniscus injury, chondral injury and also depends on what you do. If you are all sitting here today and playing sports it doesn’t matter if you have ACL surgery in the wrong place, your knee will be okay. If you are going to go and test it, do you know American football, like the Steelers are going to do this weekend, you know you may be in trouble, okay.

We need better outcome measurement, Dr. Connie Chu in a lab and others, Dr. Rocky Twon are looking at how to look at measurement of biological outcome and also introduce matrix you know, technology matrix to try to reconstruct you know cartilage. So biological kinematics and imaging all go hand in hand.

So the paradigm is changing. In our profession we have been allowed to place the ACL non-anatomically. We need to eliminate non-anatomically to cause osteoarthritis. We need to try to get better outcome measurements, we need to carefully follow our patient. I think that’s the key. If you don’t spend time with you patient, don’t talk to them, spend 5 minutes they’ll never come back to see you half the time. Only when they come back and say you have a problem, then you know there’s a problem.

So in the future when a patient comes to see you, you need to individualize every patient. Every ACL is different. Sadly in the last 20 years we make ACL the same, the industry, the surgeons, every ACL exactly the same equipment to do. So we make ACL individually and we can look at morphology of a
bone, the size and we can also do outcome measurement with a doctor like Tashman’s EKG so we know exactly what we have done wrong or right.

So in conclusion, ladies and gentlemen, ACL anatomy is the foundation of all basic signs and clinical studies. Surgery should be individualized to the patient. We need to understand the double bundle principle in order to perform anatomical single bundle reconstruction. And lastly, the ________ of anatomical ACL reconstruction needs to be discovered, it’s so new, it’s only a few years old. So there may be some negatives, we have to learn from that too. So we have to, for example, change our postop protocol because if you do the ACL in the wrong position it may tear easier in the wrong position. The wrong position may not see the force to tear for example. So you have to understand all these things so that we can inform the patient and they can make a you know good choice what exactly they want.

Lastly I want to tell you that our department is 100 years old, you know in 1999 when they started we had 5 chairs and I’m fortunate to be the 5th chair, and I’m still here. And Dr. Ferguson, the 4th chair was my mentor and Dr. Herndon before me put the department in the modern era. So this is a 100 year grand rounds celebration with Dr. Ferguson, 90 years old on the same day, so I want to thank all of you for listening to me and I think if there is any question I ask you to email me you know at ffu@upmc.edu, or you can go to our website, you know to look at our department activities too. Thank you very, very much for your attention.