DNA meets PAF

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(This fireside was presented with a powerpoint presentation. The speaker refers many times to images in the powerpoint.)

Thank you for inviting me to be able to talk about some of the things that I'm extremely excited about. I've learned a couple of things as I've talked over the last few years concerning my work. The first one is if you put the word "mummy" or "Dead Sea Scrolls" in the title of your talk, you'd get about ten or twenty times as many people in the audience as what you thought you would get, and if you put the word "genealogy" in the title of your talk, it sometimes has the opposite effect. No, that's not true, as you can see tonight, we're talking with people who can really make a difference about something that is extremely important and that has been reinforced--and I want to emphasize reinforced--in my mind, especially over the last three years.

As a geneticist, geneticists have always been interested in genealogies. That's what we do. We rely on genealogies to be able to understand the things that we study in the laboratory, and what I'd like to do tonight is just talk to you a little bit about some of the successes that we've had in the last couple of years in our laboratory in trying to reconstruct genealogies.

We realized a number of years ago in attempting to reconstruct genealogies of ancient peoples, that one of the best resources that we had were living people, people that were living today, that we could extract DNA from and reconstruct genealogies based on their DNA. Having realized that, we understood that perhaps there's something we can do for people who are living today that we have been doing for people who have been gone for 2,000 years. That would be to help them fill in some of the holes that they might have in their genealogies by looking at their DNA, reconstructing that, and seeing what belongs there, or who belongs there, and attempting to reconstruct some of those pedigrees. So that's what we've been doing over the last three years, a combination of genealogy--traditional genealogy--and adding to that, some of the tools of molecular biology.

We have as our goal, at the Center for Molecular Genealogy, to establish the largest, most comprehensive genetic and genealogical database and to provide the tools that come along with that for reconstructing human genealogies in ways that currently have not been available. It's a dynamic field; it's moving very rapidly, and it's been exciting. To be able to establish links between families, people that are living today, links that currently are not available based on traditional genealogical methods, and then to enlarge and enhance the current genealogical tools that are in place.

Elder Holland in conference in April talked a little bit towards this idea of establishing links and why we might want to do that. I think when you go around and meet someone new in a small gathering or in a large gathering, some of the first questions that we ask

each other are, “Where are you from?” and “Do you know?” and “Are you related to?” or “Do you know this family?” As a geneticist, I look at those questions, and I think, “Now those are our genes speaking to your genes, wanting to know whether or not they should be friendly to each other, because the idea is that if I can find out all that I can about you, someplace back there I’m going to find a connection. I’m going to find some place where we connect, and if we find a place where we connect, that means that we probably share genes, and so my genes are saying, ‘I better be friendly to your genes because we came from the same place.’”

And I really think that there’s something to that as we reconnect individuals through genealogies and through families, that there’s something biological as well as all of the other things that we know about, that connect us together and reasons for that. It’s why I don’t find it strange at all that these words like genealogy and generosity and genetics have a common root, meaning of the same birth or kind, the same family or gender, and we will always find it easier to be generous when we remember that this person being favored is truly one of our own.

When people understand how they are connected to each other, they treat each other differently. That’s what we would like to be able to do: we would like to be able to take that to all of the peoples of the world, show them how they are connected together, show them what genes they share, tell them that there’s also a biological reason why you should treat each other differently--hopefully better. I know some of you probably have had the same experience. I grew up with three brothers--we’re pretty close genetically. And I think probably some of the worst fights that I’ve ever had has been with my brother.

There have been good things too because of those genes. President Faust spoke of some of those tools that are available for enlarging and complementing the existing resources that we have out there. He says, “I hasten to add that scientific knowledge, the marvels of communication, and the wonders of modern medicine have come from the Lord to enhance his work throughout the world.” As an example, the Church’s FamilySearch website has more than seven million hits a day, and it continues to be one of the most popular sites on the Internet. In the Doctrine and Covenants, in Section 121, it says, “That God shall give unto you knowledge by his Spirit, yea, by the unspeakable gift of the Holy Ghost.” And I think this is particularly applicable to our subject this evening, which our forefathers have awaited with anxious expectation to be revealed at the last times.

How many of those ancestors are there out there that are waiting for this information to be revealed? There’s an experiment that you can do: how many parents do you have? You have two; everyone has two. How many grandparents do you have? Four. Great-grandparents, eight. And then it goes to 16, 32, 64, 128--let’s go back thirty generations. If you go back thirty generations, at about 25 years per generation, that puts us back 750 years. That’s about 1350 A.D. How many potential ancestors did you have thirty generations ago? The answer, I think, will surprise you: that’s one billion. That means I have one billion potential ancestors, and each of you have one billion potential ancestors back there. There’s a problem with this equation in that if you go back to 1350 A.D. and

ask how many people were on the earth in 1350 A.D., there were not a billion people, let alone a hundred billion people. So what does that mean? What does that mean for all of us? That in the near past, certainly before 1350 A.D., all of your ancestors married their cousins, all right. That's how it works; it coalesces back to common ancestors. All of us--all of us have common ancestors.

Some of us have more common ancestors than others, but the rule is and the law is that as we go back, the numbers increase, yet the number of potential ancestors--or actual ancestors decrease, and they coalesce. So we are connected, and that's part of our goal is to discover where those connections are, how deep are those connections, and how many of them are there.

The basis of molecular--or the molecular basis of genealogy is the way that we would like to do it, comes from the DNA that each of us carry within every one of our cells. You have three trillion cells in your body; each one of those cells has two molecules--well, more than that--but molecules of DNA that contain almost four billion bits of information in each one of those cells. Within each one of those--and all of that DNA came from your mother and your father, fifty percent from mom, fifty percent from dad. They received their DNA from grandma and grandpa, so you are carrying around in you 25 percent of your DNA came from your grandfather on your father's side, 25 percent came from your grandmother on your mother's side, and so on. And so you have within you a history of who you are and your genealogy. That's what we would like to be able to unlock is that genealogy that you are carrying around inside of you.

That DNA is so--there's an interesting paradox within the DNA. It is, there are so many bits of information in there that it's absolutely almost very easy to be able to identify you as a unique individual, different than any other individual that has ever lived on the earth or who will ever live on the earth. Each one of you are truly a unique creation. But also locked within that DNA are pieces of DNA that you share with your most immediate ancestors, with your brothers and your sisters and your parents and your grandparents.

There are other pieces of DNA that link you together with people who share a common origin 200 years ago or three or five or six hundred years ago, and the key is to identify each of those different regions that give us that information, pull that out, combine them with those of us that are alike and use that information to build the databases that will allow us to answer questions for individuals. In order to do that, we need genealogies, we need to be able to combine the genetic information that we have locked within ourselves with the genealogical information that each of you have built and compiled.

The source of our DNA comes, it could come from any cell of our body. Some of you, I hope, have participated in the studies so far, and if you have, we've actually taken your blood. We thank you for that. And those who have not, you're more than welcome to come. However, we are making it a little bit easier as we go along. Right now, one of our best methods, one of our most simple methods for collecting DNA, is a simple mouthwash, and we find that we can obtain enough DNA from that mouthwash that we can extract the genetic information we need to have in order to answer the questions.

To generate that genetic information, we first of all have to isolate the DNA. And then the second step is a piece of molecular biology that is still relatively new. This procedure was discovered in the middle 1980s. It's a type of a molecular Xerox machine that allows us to go in and to isolate a very small piece of DNA away from all of the other DNA that you have inside of your cell and amplify that up hundreds of thousands, even millions of times, so much that this little needle in a haystack, it now becomes a hundred million needles in that haystack, and we're able to then pull out one of those and identify some very specific differences between you and any other individual that's ever lived and also the similarities between you and your family members, and those are called polymorphisms that we see in the DNA.

There are a number of different ways that we detect those polymorphisms in the laboratory. They make some nice pretty pictures. They, as we separate them and tag them with fluorescent dyes and then shine a laser on them, the laser excites the dyes and they fluoresce in different colors that are then captured on a CCD camera and are transmitted then to the computer, which is then analyzed and converted into letters that we can read. This is the sequence, the DNA sequence of about ten different, nine or ten different individuals, and if you looked at all of these individuals, you would find at least one place within that small DNA sequence that all of these individuals differ from each other. That identifies them as a unique individual, separate and different from any other person that's lived on the earth.

The other pictures--the blue and the red and the green ones, you see the bars up there--you'll see that those individuals represent, each one of those lanes represent a separate individual, and you'll see that some of those individuals share the same color bar at the same position on that gel, and that's because they share those particular genes and they are related. The more of those bars that they share with each other, the closer they're related. So we can take this at a number of different steps: individuals, families, subpopulation groups, larger population groups.

But it's not complete with just the genetic information. We also need genealogies, and for those people that have been involved so far in helping us to build our database, we've asked them to provide for us at least four generations of genealogy. We found out that that was too easy, that there's a lot of people out there with four generations of genealogy, and we can get a lot of valuable information from four generations, but we get a lot more information from six, and we get even more information from eight, and so what we've done now is we've increased our request for those individuals who would like to help us in building this database, that we get at least six generations of genealogical information.

We get the source of our genealogies in this database through written genealogies that people hand in. Sometimes we get them in the form of Gedcom files; that's very nice and makes it very slick and easy to go back into our database. And we also have professional and our student genealogist, which we regard very much as professional genealogist in the work that they do, who take the information that we have and extend those

genealogies using all of the resources that we can find that are available to us and extend those genealogies through public resources, private resources.

Extracting from that information primarily geographical information about places of birth and dates of birth and surnames of individuals, four generations, five, through fourteen. Those are the primary data points that we're looking at to build this database as we begin, so we have two components of the database. We have the pedigree charts, we have multiple generations of information that are collected and the information extracted, including locations, birth locations, and birth dates.

What we would like to be able to do is generate gene pools. Gene pools correspond to a location and a date. My genes that are walking around in, that are inside of me as I walk around, are here right now, and I am a part of the Provo, Utah 2002 gene pool. But my genes in 1956, when I was born--I was born in Virginia, and so I represent the 1956 Virginia gene pool, my genes, right? But my parents weren't born in Virginia; they were actually born in Utah, and so my genes also represent the 1930 gene pool in Rolapp, Utah. And they also represent the 1900, actually 1899 gene pool of Huntington, Utah, and at the same time, the 1900 gene pool of Lee, Lancashire, England, because my grandmother was born in England, so 25 percent of the genes that I'm carrying around right now came from Lee in Lancashire in England in 1900. And so I actually represent a number of different gene pools, different places and times in the past.

Likewise, each of you represent very specific gene pools, the genes, the collection that you have that you're walking around with now came from someplace else--it came from your parents and your grandparents and your great-grandparents. There are some of you in this room that share the same gene pool as me in 1900; some of you have genes that were in Lee in Lancashire--or at least in Lancashire--in England in 1900. Some of you have genes that were in every county in Utah in 1900. We share genes. And so we take that information from me, we take the information from you, and we combine that, and as we combine that information, pretty soon we have a pretty good picture of what kind of genes were present in Emery County in 1900, what kind of genes were present in Sanpete County in 1957.

You know, the gene pool of Provo, Utah, is much different today than the gene pool of Provo, Utah 1960, which is much different than the gene pool of Provo, Utah 1900, which is very much different than the gene pool of Provo, Utah 1945--I mean, sorry, 1845, right? It's changed a lot over the last 160 years. And that's part of bringing all of this information together in this database, combining the genealogical information and that very important place and time of birth with the genetic information, which are the genes that you're carrying around today. Those are the two major components of the database that come together to help us to answer the questions that we have.

If we look at the representation of the database now, we currently have about 35,000 individuals who have contributed both the DNA sample and a pedigree, genealogical information. This chart represents the first 17,000, about half of those. And you can see that most of the people that we have in the database at the 17,000 step, 81 percent in fact

were born in the United States. So that doesn't really give us a whole lot of information about countries of origin or places of origins of my family genes and where I came from, but if we add to that information the genealogical information that came with those DNAs, a different picture starts to emerge, and if we look at the great-grandparents, the birthplace of the great-grandparents of those individuals--instead of 81 percent of them being in the United States, now only 53 percent of them are in the United States. That means thirty percent of those have now, we've gone back to another place of origin, and most of these, for those that have come from Utah, have been United Kingdom and continental Europe, western Europe.

And so you can see that those proportions of those countries then have increased. Since this time, in the last 17,000 samples that we've collected on top of this, we have gone to some of those places directly: we've gone to the United Kingdom, we've collected DNAs there, we've spent some time in other places in both western and eastern Europe. We've spent a lot of time this last summer in South America, and so our database is enlarging and moving outside of the United States.

There are three types or modes of inheritance that we're going to talk about just briefly tonight. The first one is Y-chromosome inheritance. If we look at a traditional pedigree chart and look at the numbers of individuals, or how that chart is laid out, you'll see that you as the proband, or as the beginning individual, sticks out there on the left, and then that red line going across the top represents your father, your father's father, your father's father's father. But it also represents a very specific type of genetic inheritance, and it's followed by a piece of DNA that we know as the Y-chromosome.

The Y-chromosome comes down from father to son, essentially unaltered, with some minor exceptions, but it's a contribution solely from the father to his sons. Women do not receive the Y-chromosome; it's the piece of DNA that makes a man a male. I used to say "that makes them a man," but my wife informed me that it takes a lot more than a piece of DNA to make someone a man.

On the other side of the pedigree chart, we see another line that's called the mitochondrial line, or the maternal inheritance. On the line following the blue lines, we have our mother, our mother's mother, our mother's mother's mother, and so on, and this also represents a very specific type of inheritance of mitochondrial DNA that comes down only from our mothers--our fathers don't give us any of that DNA. My wife was in big trouble again, because our first four children were all sons, which means that her mitochondrial was at a dead-end because none of her sons will pass their mitochondrial DNA on to the next generation, and so she said we have to try one more time, and it worked, and so we have a daughter, so her mitochondrial line still has a chance.

But if you look at this, and look at the pedigree that we have represented here, now we can say something about that one line across the top and that line across the bottom. But if you look at the end of that pedigree, we can only say something about two out of sixteen of those individuals. We can't really say anything genetically about any of the

other individuals, and that's troublesome, because that's where a lot of our problems are, that's where we have to figure out who we are and how we're connected.

But all is not lost. There's another set of DNA--in fact, the majority of the DNA that we inherit, comes in our nuclear genes, or our autosomal genes, and these are the ones that are inherited fifty percent from mom and fifty percent from dad. But it's a much more difficult process to unravel the inheritance, because they get mixed up at each generation, and so it takes a lot of parts to be able to reconstruct the genealogy of a common ancestor.

So let's back up, first look at this Y-chromosome type of inheritance. Again, males only, so it doesn't do any good for any of the females here tonight, because you don't have a Y-chromosome, so we can't test your DNA for Y-chromosomal DNA, at least I hope we can't. We don't want to see any Y-chromosome in you. But if you have a brother, or your father, or maybe an uncle on your father's side, we may be able to say something about that line. But it's a very, very small representation of all of our genetics.

On the other part, we have the mitochondrial DNA--again a very, very small part of our total genetics, and again follows only our maternal line, although all of us have it. Both males and females carry mitochondrial DNA; only the females transmit it to the next generation. But by far the most interesting groups of DNA are those that are found on the autosomes, or the nuclear chromosomes. Both males and females have them; they're inherited equally from both parents. And it contains greater than 99, well, yeah, about 99 percent of all of our genetic information.

So look at this pedigree. I think all of you will probably recognize this as--but it's missing, it's missing a lot of people on this pedigree. All this is a very selected paternal inheritance pedigree. There are a number of individuals at the terminal ends of this pedigree marked by those arrows that are living today, all of whom we were able to obtain a DNA sample from.

All of these men are connected back to a common ancestor--you can see that Douglas and Jesse and Silas have a common ancestor just two generations ago in the form of Joseph F. Smith. Then there's another cousin over there, Eldredge G., who ties in at a common ancestor at Hyrum Smith with the other three. Can you see how that fits back together again as we reconstruct this genealogy going up? Then we take one more individual over there, a man named Terry Smith, who traces his paternal line back through Samuel Smith, and if we tie all five of these individuals back together, the common ancestor back there is who? Joseph Smith, Sr. Now what do all of these men share? What piece of genetics do all of these men share? They all share a common Y-chromosome, because it was all derived from Joseph Smith, Sr.

So this is what we can do with that. If we extract DNA from those living descendants of Joseph Smith, Sr., and type them at a number of different markers on the Y-chromosome, we can see that they have a very specific pattern, and you don't have to memorize those numbers--you don't have to even know what they represent, except that they're the same.

If you look across at each one of those numbers, that they all share the same. With one little exception down there--there's a little red ten there. That's something that we call a mutation. It's not bad--mutations are not bad. We know how they happen, and we know about how frequently they happen. And then you'll see at the bottom line another individual.

This is another person--this happens to be a random Smith. This is a Smith whose walking around on BYU campus, the name Smith, but of no known relationship to the Joseph Smith line, and if you look at his Y-chromosome, you can see that there are a lot of differences between his Y-chromosome and the Smith Y-chromosome that belongs to the Joseph Smith family chromosome. So if we look down at the bottom line, we can now say something about Joseph Smith, Sr.'s Y-chromosome because all of these living men had their, received their Y-chromosome in a line. If we tie it back to the last common ancestor that they all had, that was the source of their Y-chromosome.

We didn't have to dig Joseph Smith, Sr. up, we didn't have to test him at all in any way, but we've been able to now infer what the chromosome type--what the hapla type, we call it--of Joseph Smith, Sr. was, and you can see that on the line at the bottom. Now what can you do with that? Is it just a curiosity? Well, maybe for some people, but we think that it becomes a very valuable tool now, because this is the genealogical question that we have concerning the Joseph Smith family: Joseph Smith, Sr.'s father's name was Asel, whose father's name was Samuel, whose father's name was Samuel, whose father's name was Robert.

At this point, something happens--it happens in almost all of our families. There are a number of different potential Roberts that could have been the correct father, and we don't know which one it is. So what do we do about that? Well, we have this hapla type, we call it, and in this case we've called it hapla type 227, that belong to Joseph Smith, Sr., that we have inferred.

So now what we do is we go to a place where we may think that that Robert may have originated--in this case, it was England. And there are two or three possible sites, locations in England that we think that this Robert may have come from. And so we go over to England and we start walking down the street, and we say, "Is your name Smith? Is your name Smith? And would you give me a DNA sample?" Actually we try not to do it quite that way, but we do, we have contacted some Smiths that we've identified in these different places in England, and we've asked for DNA samples, and we're in the process of testing those DNA samples, looking for what? We're looking for hapla type number 227.

Eventually we will find a hapla type 227--we haven't found him yet--and what's that going to tell us? That's going to tell us that that person who is walking around in England today with hapla type 227 shares that piece of genetic information with people who are walking around in Utah who have hapla type 227 because they have a common ancestor, because they share a common paternal lineage. So then we start working back probably with the traditional genealogical tools and saying, "Who was your father? Who was your

grandfather? When was he born? Where was he born?" And reconstruct those genealogies back until we link these two families back together again who are currently walking around not knowing that they belong to each other. Haven't done it yet, but that's where we think we can go, and I'll show you in a minute places where we have been able to make that work.

So we have a Y-chromosome database where we take all of our individuals in the database, type them a Y-chromosome, because Y-chromosome information goes along with some very interesting genealogical information, and that's a surname. In Western societies, we should be able to associate specific Y-chromosomal types with specific surnames, so we extract that information from the genealogical database, including the dates and places of the birth of these individuals, add the surnames of individuals who are born prior to 1900, and that's primarily for confidentiality purposes in maintaining the confidentiality of the individuals who have participated in the database. You may think that that's a paradox: how do you do a genealogical database and maintain the confidentiality of the people in the database? I think it is possible, and that's how we've been working, but we're not going to talk about that tonight. But this location, or this then allows us to locate a specific surname with a date and a place and a hapla type that then gives the traditional genealogist a tool that says, "This is where you ought to be looking for the ancestor of this individual. And don't worry about all of these other possibilities."

If we return, and we search this database, we can sometimes find some very interesting information. In this case, we have searched that database, and it came back and found three individuals that share exactly the same Y-chromosome hapla type and thought this was pretty interesting until we looked at it a little bit more in-depth and found out this actually is one of the students--I hesitated calling him a student; he's one of the main principal investigators of our study--who participated in the database in New Zealand, along with his brother and his father. And guess what? They're all related. They came out of the database. That was nice, wasn't it? But it worked that way. But we can identify their matches--18 out of 18 in this case--we can identify the hapla type, that long string of numbers that all go together. We can identify the surname of those individuals in that family who were born prior to 1900. You can see this is in 1839, and we also have the locations of where that surname was located in 1874, that this is a Scottish surname in 1874.

Now that's fine on the Y-chromosome; we can do the same thing on the mitochondrial DNA and look at the mother's line. But the real interesting part is going to be when we can take the autosomes, the nuclear DNA, and so I'm going to show you a small example of how we do that using another pedigree that most of you should recognize.

This is a short abbreviated pedigree of Lorenzo Snow. Lorenzo Snow had another very valuable genetic situation in his life in that he was a polygamist, and so he had a number of different families. That means that we can look at his genes coming down through a number of different branches through different wives. And it turns out that as we look at these genes in the general population, we find that we can put them together in

combinations so that the genes that you have are relatively rare in the general population compared to other people. So if we see the combination of genes in you, and we see the same combination of genes in another individual, the most likely reason that you share that combination of genes is because you share a common ancestor, rather than it's just frequent in the population.

And so that's what we're going to do now, is we're going to look at two different branches of Lorenzo Snow's family. The first one--let me see--individuals in group number one, we visited the Snow family reunion a year ago about this time and brought our needles, and they were very gracious to give us their arms, and we took from them some blood and brought it back to the laboratory, extracted their DNA, and then started to reconstruct some of the genotypes with the purpose of trying to reconstruct Lorenzo Snow's genotype.

So if we look at group number one, it turns out that that's a daughter, a mother, and a father, and the father in pink there is the one that connects back to Lorenzo Snow. And if we look then at the genes and the combination of genes that we extracted from them, we'll see some very interesting patterns. You see that green set in the daughter--211-175-285--if you'll look in the parents, you also see that set, 211-175-282. And so we know where that set of genes in the daughter came from; it came from the mother. So if that set came from the mother, then the other set had to come from the father, right, because you get half of your genes from mom and half from dad. And so if we look now at the 213-175-306, which is blue, we know that that has to go to father. But now that tells us something more about father: that if father has the 213-175-306, then the other set of genes the father has is the 209-172-298--that's going to become important in just a minute.

So now we take group number two on this end from wife number…you know, I actually don't know which wife that is, one of his wives. And then again you have a two-generation cluster. We have a daughter, a mother, and a father, and in this case it's the mother who is connected back into the Lorenzo Snow line, and again if you look at this individual, you can see that 207-175-266, which is different than anything that the other cousin had, and we can see where that came from: it came from the father. That means that the 209-172-298 had to come from mom. Now we're starting, we're going to see something happened here, because if we combine the information from group one and group two and look to see what the common ancestor is between those two groups, we'll see that it belongs to Alphonzo Snow, actually Alphonzo Young Pond, who is a descendant of Lorenzo Snow.

So if we take that information and fill it all in, you start to see something interesting about that pink 209-172-298 in that it's present in the two cousins, and it's rare in the rest of the general population. So what that tells us is, that those two cousins received that 209-172-298 from a common ancestor, and they're common ancestor is Alphonzo Young Pond, and so that allows us to take that set of genes and assign it to Alphonzo Young Pond; we infer that with a certain degree, a certain probability--in this case, quite high.

Now we take a third group from a different wife of Lorenzo Snow, and in this case, we only had two children. These happen to be grandchildren of Lorenzo Snow. And if we look at their genotypes, we see something very interesting: what shows up again? That same 209-172-298. It shows up in the two sisters,so that means that although we don't have any of the parents' DNA, we know that mom or dad had to have that 209-172-298. We don't know which one of them had it, but we know that each of them had it with a probability of at least fifty percent. So we can assign that with the little dotted lines around that with a certain probability and then use this information to combine groups one and two with group number three, and we see this 209-172-298 popping out again, and remember that this is very rare in the general population, so the probability is, if a person has it, they have it because they've received it from a common ancestor.

And so now if we take groups one and two, link them together with group number three and find out who the common ancestor is--it's Lorenzo Snow--which then allows us to assign with a certain degree of probability that specific genotype to Lorenzo Snow. Now we've just reconstructed one bit of genetic information about Lorenzo--we're actually combined three bits into one. In the process of building the database, we'll take all of our genealogical information, we'll find all of the common ancestors, and we'll assign all of those common ancestors genetic parts, probably about one hundred or maybe 200 of these types of genetic information to each one of those common ancestors. That will allow us to test other individuals to see whether or not they belong or share a common ancestor with those that are in our database.

Now I'd like to show you now a success story. This is one that we did in, that started in our laboratory, and we've done that in collaboration with actually a company in Salt Lake.

I was born an Auton. I was an Auton at age one and at age two, and then there was a divorce, and with that divorce my mother remarried, and I was raised by a Nielson father. He'd been my dad since I was very little. But I had not known anything about these Autons, this Dutch family. One day I simply wanted to know who these Autons were. We went in to Sorenson Research and with our genealogies in hand--you know, my side was a little bit longer than John Auton's--both of us, you know, we're looking at several hundred people were watching us just to see what was going to happen. They did not know there was a connection.

And it came back, and according to the research and everything that we had done, there were fifteen to eighteen generations that would separate him and I. I go back up to this and he would come down here, but you add those all up, and there's fifteen to eighteen generations, and there's DNA markers as they line out, there was not one difference. And this was all in a family I knew nothing about, absolutely nothing about.

Two years ago, I thought so little of family history, and now it's become one of the biggest hobbies that I'm involved in. I found out that there were several boxes at the family farm in Michigan, and that the family farm had been sold--it actually had been inherited by my direct father, and he sold it--but the boxes that contained everything in it,

they had the wills, the histories, the newspaper clippings, the formal photographs, the family sittings. All of these were in these boxes. In this box, I found this wallet. And this wallet just melted me because here is a woman--this is my grandmother's wallet; it's handmade--and I'm looking through this wallet, it is identical as to, she passed away in '69, I believe, 1969, and in this wallet I found my picture, and I barely remember ever seeing here. I'm not sure that I'd remember her. She remembered me, and I found this wallet with my picture in it. I about melted; I melted because it's somebody I never knew, and somebody who had my picture. I begged for that wallet, I think, because it told me that this Ruth Auton loved me even though I didn't know who she was.

I have tried to explain what's happened to my life because of relative genetics, because of this study that was done that connected these families, I have family all over the United States, and I've got lists of people that I have now called them. So I called aunts who had not heard, knew nothing about me, hadn't seen me since I was a little boy, and I have said, "I am Tommy Auton. Where have you been?" It's fascinating to know where I actually fit in, who my blood father is. I love the man who raised me--I don't want to know the man who didn't--but I've been able to know his family, and it's connected me to huge family that I did not have before. I have been a Nielson, but I don't look like them, I don't act like them, I don't think like them. I love them, they've adopted me, they took me in, and my heart's with them, but I look like the Autons, I talk like the Autons, I am an Auton.

It's also been fun to realize as we go along that whatever this is, I think we know whatever it is that's inside of us is not something that's a local phenomenon, but it's something that has gone throughout all of the world. I had the opportunity now a couple of years ago to visit the country of Oman at the bottom of the Arabian Peninsula to give a seminar concerning some of our work that we are doing, and at that particular time, it had specifically to do with the reconstruction of genealogies of Bedouin tribes. And we had collected a number of samples in the country of Oman, and I was giving a seminar at Sultan Kabush University in Moscat.

After the seminar, a man came up to me, Humdi Al-Barwhani, who said, "I'm a mathematician here at the university. I usually don't come to biology seminars, but something when I saw the announcement, something told me inside of me that I should come, and so I came. And I would like you--I would like to know if you would accept a gift from me." And he went back to his office and came back, and when he came back, he had a large poster about this tall and about that wide of which this is a picture of the lower right-hand corner.

On that--and I hope that you can see that that's actually a tree. It's a tree trunk going up through the middle of that, and each one of those leaves have a name in it. And each one of the connections is the connection from the father to the son to the son to the son to the son for twenty generations of a man named Abdullah Al-Barwhani. He said, "This is my genealogy. This is my family; this is who I am." He says, "I want you to have it. You'll know what to do with it." I asked him, I said, "Well, you know, I can't take this." He said, I said, "Is this a copy of your genealogy?" He says, "No, this is my only copy." He

says, “But you’ll know what to do with it.” It just taught me a very valuable lesson, that the spirit of Elijah is alive and that it’s well, it’s dwelling throughout the world and that it’s all the way to the lower corners of the Arabian Peninsula, and it’s touched this person, that he knows that there’s something extremely valuable in being able to link those, his ancestors back together again.

Just a little aside to this story: there was another man at the same university who happens to be a cousin of Humdi Al-Barwhani. Not a very close cousin--he’s probably separated by fifteen generations--but he’s also represented on this tree. We took DNA samples from both of them. Now this is a Y-chromosome tree, right, from father to son to son to son to son, so Humdi and his cousin, who are separated by fifteen generations, should share something in their genetics, and what they should share is their Y-chromosome hapla type. When we tested these two individuals, that’s exactly what we saw, that the genetics and the genealogy, as represented by this tree that has been kept in their family for twenty generations was accurate, that is was right. Most of the time that this genealogy has been kept in their family, it’s been kept orally. It’s only been within about the last forty years that they placed this down in writing, so the last two generations have only been around while this has been in writing, but it’s still been maintained and been passed down from generation to generation within this family.

“Behold, I will reveal unto you the priesthood by the hand of Elijah the prophet before the coming of the great and dreadful day of the Lord. And he shall plant in the hearts of the children the promises made to the fathers, and the hearts of the children shall turn to their fathers; if it were not so, the whole earth would be utterly wasted at his coming.” A scripture that’s repeated in the Bible, in the Book of Mormon, in the Doctrine and Covenants, and also in the Pearl of Great Price.

And also speaking on this same visit and the mission of Elijah, in the 128th Section of the Doctrine and Covenants: “It is sufficient to know in this case [speaking of the promise of Elijah] that the earth will be smitten with a curse unless there is a welding link of some kind or other between the fathers and their children, for we without them cannot be made perfect, for it is necessary in the ushering in of the dispensation of the fullness of times, which dispensation is now beginning to usher in, that the whole and complete and perfect union and welding together of dispensations and keys and powers and glories should take place and be revealed from the days of Adam even till the present time. And not only this, but those things which have never been revealed from the foundation of the world but have been kept hid from the wise and prudent shall be revealed unto babes and sucklings in this, the dispensation of the fullness of times.”

President Kimball said in April Conference in 1974, “When we are ready, when we have done all in our power, the Lord will find a way to open doors, and I believe that the Lord is to put in our hands inventions of which we laymen have hardly had a glimpse.”

I’m thankful for the opportunity that I’ve had to be able to share some of my feelings about genealogy with you tonight. I feel that we’re doing something that is extremely important, and we need your help, everyone, we can help each other. I’m thankful for the

opportunity that I've had over the--especially over the last three years--to be able to feel of that spirit and to learn those things that are important for us to understand. I say those things in the name of Jesus Christ, amen.

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