Briana Dorrough – Presentation to Surfers Sunrise Rotary Club 03 February 2021

Good morning everyone!! As you have already heard, my name is Briana. I've met some of you already, but to those who I haven't, I hope you had a lovely and restful Christmas season.

Throughout January this year, I was invited to participate in the National Youth Science Forum; a program that aims to teach young Australians the value of STEM subjects through understanding their importance in our communities. It was because of your support, through the Rotary Club of Surfers Sunrise, that I was able to take this amazing opportunity, and for that I am very grateful. Despite the program's shift from in-person to online, I found NYSF to be insightful, engaging and a great help in my career-making-decisions as I move towards graduation.

I found NYSF's most valuable resource to be their range of STEM experts, all of which spoke individually about an incredible array of faculties. Among these, the guests I personally found the most interesting were Professor Barry Marshall, Dr Carola Vinuesa and Professor Brian P Schmidt. Both Professor Marshall and Schmidt are Nobel Prize Laureates, of 2005 and 2011 respectively, Dr. Vinuesa is the co-director of personalised medicine at ANU, and oversees cutting edge research.

So, to give you all a better understanding of what NYSF taught me, and how it has influenced my career decisions, I'll be spending the remainder of this presentation outlining the most interesting parts, the highlights if you will, of my experience.

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The presentation by Professor Barry Marshall was the first talk of NYSF, and took place on the 6th of January. Over the period of an hour, he gave an incredibly captivating presentation explaining his accidental discovery of Heliobacter Pylori; the bacteria that is now known to cause stomach ulcers, which in turn causes stomach cancer. Professor Marshall cleverly summarised his scientific discovery into three parts; *Discovery*, *innovation*, and t*ranslation*. To explain, you make a discovery, figure out what problem your discovery solves, then you translate this solution into a viable product.

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Professor Marshall's discovery was that he had found a living, growing bacteria in the stomachs of ulcerated patients, which contradicted a major medical belief of the time; that nothing could grow in the stomach because the acid was too strong. However, after many years of research, Professor Marshall found that the bacteria (later named Heliobacter Pylori) could neutralise the stomach acid and thrive in this otherwise sterile environment. Thus, causing an international shift in medical belief.

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Next, he moved to innovation; how did his discovery of a bacteria fix a problem. Well, in the early 1980's, when Professor Marshall first made his discovery, one in twenty people used to have a stomach ulcer; meaning he had the potential to save millions of people from a

lifelong struggle. At the time, the sheer volume of people with these ulcers allowed the multi-million-dollar-industry of antacids to flourish. Though intimidated, Professor Marshall saw this as no reason to abandon his inquiry. And, after much investigation, he found that, as Heliobacter Pylori was a bacteria, he could completely eradicate stomach ulcers using antibiotics.

Now, finally, Barry Marshall faced the problem of translation; how could he create diagnosis and treatment accessible to members of both developing and developed countries? Biopsies were expensive, so he formulated a simple way of testing called the 'string test', where the patient is asked to swallow a string with a small ball on the end, wait for twenty minutes, then pull the string from their throat.

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These samples could then be transferred to a petri dish and shipped away in mass numbers for testing. Though uncomfortable, this method of diagnosis allowed Professor Marshall's solution to reach even the most distanced and/or disadvantaged members of society. Antibiotics could then be prescribed accordingly.

So, through his discovery, innovation and translation, Professor Barry Marshall discovered the cure for duodenal ulcers and was awarded the Nobel Prize for Medicine in 2005. The fact that he essentially stumbled upon a discovery that led to a form of cancer prevention is incredible, but, more than that, his perseverance is astounding. There were over 20 years between his original discovery and his receiving of a Nobel Prize.

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The self-assurance he had in his understanding that this research could change lives is not only applicable to research, but all aspects of life. As Professor Marshall put it, "**If you have the facts, you don't have to worry if nobody believes you."**

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The next presentation I found very interesting was that of Dr. Carola Vinuesa, who specialises in personalised medicine. At first, I had no concept of what personalised medicine was, or how it applied to modern society. Only a few minutes into her talk, I understood that personalised medicine is the study of human genome sequences to understand how to best treat genetic disorders, mutations and diseases in both individuals and wider populations.

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In the world today, there are over 8,000 gene variants known to cause disease, and over 80 different autoimmune disorders. Currently, there is no cure for autoimmune disorders, only unspecific treatments with damaging side-effects; this presents one of the greatest opportunities for personalised medicine.

One particularly interesting case study Dr Vinuesa presented was that of convicted murderer Kathleen Folbigg, who is currently serving time for the alleged 'murder' of her four children. As there was only ever indirect, circumstantial evidence, an investigative team at ANU pursued an inquirey into the genetic history of Kathleen, her partner, and her four children. This led them to discover that all four children had the necessary genomic sequences for various life-threatening conditions.

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The youngest child had undiagnosed laryngomalacia, which causes weak windpipe tissues to partially block the airway, causing breathing problems and, at worst, suffocation, in young children. The next child had severe epilepsy, the next a susceptibility for respiratory tract infections, and the third, myocarthitis, a inflammation of the heart that causes it to beat abonormally, and often result in cardiac arrest. This study of the children's genetics revealed there is a high chance all four of Kathleen Folbig's children died of genetic defects, thus questioning the validity of her incarceration. Though morbid and specific, Dr Vinuesa's presentation of this case allowed me to fully grasp how a study into induvidual genetic sequences can unveil essential medical understanding that would not have been discovered any other way. The potential of personalised medicine to completely transform disease prevention, diagnosis and treatment is astounding, and is something I was completely unaware of until Dr Vinuesa's talk. Diagnosis will not be purely based on physical symptoms and signs, but rather your induvidual genomic sequences, as well as your genetic likilihood for disease contraction, which will decrease the likelihood for misdiagnosis expontentially. In terms of treatment, an understanding of a single patient's genetics would allow for doctors to pinpoint the molecular pathway of disease and subsequently provide the best treatment, without any side effects.

I found the greatest take-away from this presentation was the power of futurist thinking; how a once-crazy idea (that we could use the study and alteration of our DNA to save lives) is now being realised across the world.

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The third presentation I will be outlining this morning is that of Professor Brian P Schmidt, who discovered and confirmed the acceleration of universe expansion.

He recreated the orginal experiment of Edward Hubble to understand that the universe was expanding. Before this talk, I understood the big bang happened but figured the explanation would be far beyond my understanding when, in reality, the explanation is quite simple. Data collected from the brightness of various stars across periods of time within our galaxy allowed for scientists to calculate Redshift, or the distance between us and the star. They then used this data to determine that the stars in our universe were getting further away, meaning the universe was expanding. So, if you believe the universe is expanding, you can think back in time, where everything gets closer and closer until, you get to the point in time

when the expansion begun; when everything was on top of each other. This moment in time is what we know as the Big Bang. This graph shows the data from Hubble's experiment:

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By extrapolating this line backwards, it can be calculated that the universe is apporximately 14 billions years old. After graduation from university, Professor Schmidt wanted to pursue a PhD in astrophysics, where he proposed an experiment to ANU where he would aim to prove whether this line, over billions of years, was curved to accelerate of decelerate; essentially, he wanted to zoom out this picture. It would look one of two ways;

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If the line was found was curve below the straight line, it would mean the universe has a lot of gravity and its expansion will slow down until it stops completely; it would prove that the universe is finite. Similarly, if the line curves upwards, or continues straight, it is accelerating and is, therefore, infinite.

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Professor Schmidt was hired at ANU to conduct this experiment, and in 1994, he developed a Team to study exploding stars, which are very rare, only occuring every three centuries in galaxies such as the milky way. This required huge telescopes, some of the first digital cameras and groundbreaking photo-merging software. After studying thousands of exploding stars across hundreds of galaxies, Professor Schmidt and his team had come to the conclusion that the expansion of the universe was indeed accelerating; and that space was, therefore, infitinte.

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At around the same time, a team at Berkeley University came to the same conclusion. Professor Schmidt was awarded a Nobel Prize for astrophysics and space discovery in 2011.

When asked what advice he would give to the students of NYSF, Professor Schmidt highlighted how important he believes life-career balance is, and that "wisdom comes from knowing when things are hard and when things are impossible." He explained how it can be smarter to know what you're doing is futile than to just persevere through an impossible task. But, at the same time, how understanding the rewards of well-judged perseverance can lead to great success.

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Thus, despite all the incredibly interesting and informative information presented to me and my peers by these three speakers I have discussed today, they each possesed great advice that not only applies to success in science, but success in life, advice that I consider the greatest reward from the NYSF program.

In terms of how the program has helped me to decide what I want to study after school, it has definitely provided some much-needed clarification on the ins-and-outs of many areas of science. Before NYSF, I was interested in computer science and biomedical engineering; having known very little about either. Now, after talks from experts in both fields, I have decided to pursue entrance into medicine and aim to sit the undergraduate medical admissions test this coming June. I've made this decision because medicine is an academically challenging, intellectually and socially stimulating field that requires real-life problem solving. It allows you to make a tangible difference to human life, and constantly requires you to learn and stay engaged in your area of expertise. I've always found the human body incredibly fascinating in its complexity and potential, and am, at the moment, hoping to be a doctor one day. Of course, there is still room for me to change my mind, but NYSF certainty helped to clarify my hopes for the future, which will then allow me to better focus my energy to pursuing a career I'm passionate about.

Overall, I found NYSF to be insightful and inspiring, and am so grateful for the opportunity to take part in it. I just wanted to thank all of you again for your generosity, and I hope you understand you've made a real difference in my future.

Now, I believe, it's time for questions…?