Annual Ruth Bishop Address 2022

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Mr Robin Davies 00:02

Welcome to Contain This. I'm Robin Davies, Head of the Indo-Pacific Centre for Health Security. It's my great pleasure to share with you the Centre's 2022 Address in honour of Professor Ruth Bishop AC who sadly passed away earlier this year.

Firstly, I'd like to acknowledge the Traditional Owners and Custodians of Country throughout Australia and the Indo Pacific region. We recognise the continuing connection to land, waters, and community and pay our respects to Elders past and present. We also extend our condolences to the victims of the earthquake which took place in West Java, Indonesia, the day preceding this address, which has claimed a significant number of lives.

When the Indo Pacific Centre for Health Security established this annual lecture in 2019, we wanted to name it in honour of somebody who had made a great contribution to reducing death and suffering in developing countries, particularly in our region. And Ruth very gracefully agreed that we could name this lecture in her honour. (pause) This year we featured Ruth's own life and achievements and is delivered by two of her close friends and associates: Professor Graeme Barnes and Professor Julie Bines.

Professor Graeme Barnes graduated from the University of Otago in New Zealand, and following his paediatric training, he undertook an MD programme in gastroenteritis with Ruth, preceding the discovery of rotavirus. In 1975, Graeme became the Director of Gastroenterology at the Royal Children's Hospital in Melbourne and continued his rotavirus research programme. He then directed the Royal Children's Hospital Research Institute from 1996 until its merger in 2000 with the Murdoch Institute to form what is today the Murdoch Children's Research Institute. In 2020, Graeme was awarded an Order of Australia in the Queen's Birthday Honours. Since his retirement in 2021 he holds honorary appointments at the MCRI, the Royal Children's Hospital and the University of Melbourne.

Professor Julie Bines is Professor of Paediatrics at the University of Melbourne. Julie is a paediatric gastroenterologist at The Royal Children's Hospital in Melbourne, and leads the enteric disease group at Murdoch Children's Research Institute. Julie has focused on the development of the human neonatal rotavirus vaccine. Julie is director of the WHO collaborative Centre for Child Health and the WHO rotavirus regional reference laboratory for the Western Pacific region. Julia is the inaugural Chair of the Australian chapter of women in global health.

This year's address was delivered in person, and online with many of Ruth's family and colleagues in attendance, including some of her collaborators in Indonesia.

And I’m now delighted to bring to the Contain This audience the full lecture, commencing with an address by Ruth’s brother, Mr David Langford, followed by Professor Graeme Barnes and Professor Julie Bines.

Mr David Langford 14:29

Good afternoon, on behalf of the Bishop and the Langford families. I'd like to thank the organisers of this function who invited us to be here today. Ruth Francis Langford was born in Dandenong Victoria in 1933. Our mother was a junior teacher at Dandenong High School where our father was the headmaster. In 1937, our family moved to Frankston Victoria, Ruth and her two brothers, John and I all attended Frankston state primary school. And then Frankston High School where dad was the headmaster, Ruth's matriculation results were brilliant, but she was too young by six weeks to enrol at university.

Mum and Dad persuaded Ruth to apply for a teacher Scholarship, which of course she got. For her compulsory Gap Year, she worked as a teacher's aide at Frankston state primary school. At the end of that year, she realised she did not want to be a teacher. Ruth enrolled in a Bachelor of Science degree course at Melbourne University in 1951.

Early that year, the Langford family entered the team in a very popular weekly quiz on a Melbourne radio station called Patterson's family quiz. The Langford team of four consisted of dad Ruth, an uncle and an aunt. After beating the other teams in their heat, Langford competed for and won the jackpot, which had risen to more than 1000 pounds. I understand that in today's currency that was equivalent to around $50,000. Ruth used her share of the winnings to repay the education department for cancelling her teaching scholarship and to assist her to be more financially independent in pursuing her studies. Without this good luck, she might have struggled to further her academic studies, and may have never become a medical researcher. If that was the case, all that talent could have been lost to science.

For my first year at Melbourne University in an electrical engineering degree. I often travelled with Ruth by train from Frankston to Melbourne, which took an hour. It was Ruth's third year in her science degree. Ruth took a keen interest in my studies, and often displayed a better knowledge of electrical theory than me. Ruth met her future husband, Jeff Bishop at Melbourne University. They found out later that Jeff's father had been the headmaster of Frankston high school immediately before our father became the headmaster. Ruth and Jeff married in 1956. In 1959 I shared an apartment in Kew, a Melbourne suburb with Ruth and Jeff Ruth at age 26. had started work at the Medical Research Centre at the Children's Hospital. I had an very, very enjoyable year with them that I did have one problem.

Often on a Friday evening, she brought one or two rats home in a cage, which was parked in the hallway between our bedrooms and I've sometimes heard a rat shuffling around. Ruth insisted she had to bring the rats home, because if a rat died, she had to dissect it straight away and not leave it till Monday. Ruth and Jeff had three children Tom, Anne and Michael. Anne and Michael are here today. Tom is overseas at the moment, but he is planning to watch the address on Zoom. My wife Margaret and our three daughters Sue, Sally and Kate. All have wonderful memories of Ruth and her family during get togethers, especially at Christmas time.

Ruth was incredibly modest. Our families often found out more about her achievements in the media than from Ruth herself. Eventually, we came to realise that she has made enormous contributions to medical science and to making the world a much better place. We are all proud of for her, but so many people not only in the medical science community, but others, including those involved in implementing

public health programmes have recognised her achievements. I appreciate being given the opportunity to speak to you all today. On behalf of the Bishop and Langford families, thank you.

Mr Robin Davies 19:46

Thanks very much, David. I'm sure we'd love to see more people going into teaching but in this case it was okay. I'd like to introduce Graeme Barnes so over to you Graeme.

Professor Graeme Barnes 20:03

Thank you, Robin Davies for the welcome and the introduction. And it's lovely to see the Ruth's family here with us today too. And staff and guests of DFAT. Julie Bines and I have been colleagues of Ruth Bishop for many years. We are honoured to be invited to give this address named for her. She was a remarkable woman of science and made a real difference to the lives of children.

Ruth died in May this year on her 89th birthday, as David has mentioned. So it is fitting that this year's Address honours the scientist for whom it is named, but also outlines the discovery for which she and her colleagues are known around the world, and importantly, her legacy of improving the health of the world's children. I'll begin with a sort of potted version of her CV, acknowledging some of the people on whose shoulders she would say she stood. Next, we'll look at the events leading to the discovery of rotavirus by her team. And then Julie Bines, who now leads the team, will tell you about the impact oral rotavirus vaccines have had on global health in children, and describe some continuing work testing a local candidate vaccine to be given from birth. Because after all, it is the outcomes of the discovery which are Ruth's true legacy.

Ruth Bishop's name will forever be linked with the discovery of rotavirus in 1973. One of the most common causes of death from gastroenteritis in infants worldwide, the virus was estimated to kill more than 600,000 children each year prior to vaccination.

What set Ruth apart is that she and her colleagues not only discovered this lethal virus, but Ruth contributed enormously to development of vaccines to prevent infection by this serious pathogen. Since 2007, every Australian child has received an oral rotavirus vaccine, reducing the 10,000 childhood rotavirus gastroenteritis admissions to Australian hospitals each year by 80%. Rotavirus vaccination is now recommended by the World Health Organisation for all children. By the time Ruth died, rotavirus vaccination was included in the childhood vaccine schedule in more than 110 countries.

You've heard that Ruth was brought up in an academic environment. Her Father, whom I understand was a Gallipoli veteran, was Headmaster of Frankston High. Her mother had an MA in French. Ruth was known for giving everything a go, perhaps a precursor to her tenacity as a scientist. She was good at sports and interested in music.

She graduated BSc in 1954, Master of Science in 1958, PhD in 1961, and then Doctorate of Science in 1978. Ruth was an awarded an Honorary Doctorate of Medical Science in 2010, all from the University of Melbourne.

Her first job was in the Department of Surgery at the Royal Melbourne Hospital, working with Professor Maurice Ewing on gut bacteria. She was then a bacteriologist, not a virologist. She went to the United Kingdom with her obstetrician husband, Geoff, and their young children In 1962, but she still found time to be a research fellow in the Department of Surgery at the hospital where Geoff was working.

In 1968, Ruth was recruited by Professor Charlotte Anderson as a Research Assistant, and so began her lifetime association with the Royal Children's Hospital in Melbourne. Professor Anderson was the first paediatric gastroenterologist in Australia, and one of the first in the world. Ruth assisted Charlo as she was known, with her pioneering studies on chronic diarrhoea in children, including cystic fibrosis and coeliac disease, at a time when the difference between those two conditions was not clear.

Ruth became familiar with the clinical investigation of small bowel biopsy, which the next director of gastroenterology Dr. Rudge Townley developed to a fine art for use in small children. This test later proved to be pivotal in the discovery of rotavirus.

Some of her many appointments and awards included: Senior Principal Research Fellow in the Hospital and later in its associated Murdoch Children's Research Institute. She was a National Health and Medical Research Council Principal Research Fellow, and Honorary Professorial Fellow in the Department of Paediatrics, University of Melbourne. You heard that she was appointed Companion of the Order of Australia AC. She smiled when her staff called her Lady Bishop. Other awards included the 1994 Royal Children's Hospital Gold Medal, the 1978 Selwyn Smith prize for clinical research, and the Clunies Ross National Science and Technology Award.

She was made an Honorary Fellow of the Royal Australasian College of Physicians, an uncommon honour for a non-medical doctor. She was the first woman to be awarded the prestigious Florey Award in 2013. And of course this DFAT address is named in her honour.

Ruth was much better known overseas than in Australia. Dr. Roger Glass from the Centre for Disease Control in Atlanta, labelled her the icon of rotavirus.

There were many roles with WHO, including Chair of the steering committee on viral diarrheal diseases, and a special adviser to the WHO vaccine development programme. More recently, she was a member of the rotavirus working group for the Bill and Melinda Gates Children's Vaccine Programme. Bill Gates has published a statement that Ruth Bishop's work was a catalyst for he, and his wife Melinda, to set up their foundation.

International awards included the Children's Vaccine Initiative Pasteur Award, presented in Geneva by Sir Gus Nossal wearing his WHO hat. This honour was shared with colleagues from the National Institutes of Health in Washington, and the Centre for Diseases Control in Atlanta. In Bangkok, she was presented with the Prince Mahidol Award for “outstanding achievements in medicine and public health worldwide”. Ruth had large numbers of publications in prestigious journals. She was also in great demand as a speaker in the international arena in the USA, Europe, Indonesia, Africa and at the Country Women's Association in Bunyip, Victoria.

So now to her science. How did the discovery of rotavirus come about?

Charlotte Anderson who had recruited her, left for the Chair of Paediatrics in Birmingham, UK in 1968. Dr. Rudge Townley who had returned from Boston, took over as Director of Gastroenterology. He had a particular concern about sudden onset, acute diarrhoea, often causing dehydration. Gastroenteritis required a special ward at the Children's Hospital in those days. And numbers were such that overflow to the old infectious diseases hospital at Fairfield, was often needed during winter epidemics. Dr. Townley wanted the new technology as used in chronic diarrhoea, to be applied in acute diarrhoea. Ruth agreed to apply her bacteriology skills to try to find the elusive cause.

I joined the department in 1971 for research training, with Rudge Townley and Ruth as my supervisors. We explored possible causes of gastroenteritis. A huge amount of work by Ruth using her meticulous

bacteriology skills, virtually excluded bacteria. However, the site of pathology was shown to be the small bowel. The degree of inflammation in the duodenum was severe, comparable to that seen in Coeliac disease. So the site of damage was clearly identified.

This was a big step forward. But the primary aim had not been completed: ie to define the cause. Ruth Bishop was not satisfied with the outcome of two years detailed microbiological work. She was impressed with the severity of the damage and felt deeply that was where the search should be focused. RCH did not have an electron microscope at the time, but she pursued her idea that there might be a virus causing the damage.

Here is the first page of her notes written in April 1973. She outlines her hypothesis and her strategy to decide whether the idea is correct. She discussed her idea with Dr Ian Holmes, at the department of Microbiology in the University of Melbourne then persuaded Dr Townley to ask Dr Geoff Davidson, who was the next clinical research fellow, to do some more gastroenteritis tests before he started his own planned research programme. Geoff sent nine specimens to Dr. Ian Holmes.

This was the bingo moment. Ian found a new virus in six of the nine specimens. This was a virologist's dream. This is an electron microscope picture from one of the six. The little black dots that you see in the centre of the screen are rotavirus particles, initially called duovirus, because it came from the duodenum. And here is the discovery group, with Ruth prominently at the front in the centre. And here you see Ruth, Rudge and Geoff with a baby, and a photo of the duovirus taken with the electron microscope.

I came back through Melbourne in 1973 from the UK, on my way back to New Zealand.
" We think we've found it", she told me.

This is the Lancet paper which caused great excitement globally. Geoff Davidson never started his own project! Ruth and Ian Holmes quickly developed methods to identify rotavirus in faeces samples using electron microscopy now that they knew what to look for. This meant that studying large numbers of children, ie epidemiology, became feasible. Geoff Davidson embarked on a prospective 15-month survey of all children admitted to the Children's Hospital with gastroenteritis. Meantime, the Children's Hospital had acquired an electron microscope.

And here is Ruth driving it, working her way through hundreds of faecal extracts. They found that rotavirus caused gastroenteritis in more than 50% of the 378 children admitted. Cases where the cause of gastroenteritis was identified, went up from only 12% in 1972, to 73% in 1974. So, clearly rotavirus was the main culprit. This finding was then rapidly confirmed in Birmingham, Washington and Toronto, because everyone knew what they were looking for.

Soon afterwards, Ruth met Dr. Yati Soenarto at Gadjah Mada University in Yogyakarta, Indonesia. Dr. Yati has collaborated with us ever since. Her study in Yogyakarta, reported in 1981, showed that rotavirus was also the most common cause of gastroenteritis in Indonesian children. Here is Dr. Yati with Ruth and the Indonesian Minister of Health, at the launch of a vaccine trial.

It soon became clear that rotavirus infection was the most common cause of severe dehydrating diarrhoea in children worldwide. It was a virus. Perhaps a vaccine could be developed.

After the discovery, Ruth worked with research fellow Dr. Don Cameron, and found that many healthy full-term newborns in Melbourne obstetric hospitals, were excreting a unique strain of rotavirus, yet appeared to not have significant symptoms. I returned to Melbourne in 1975, and the group conducted a three year follow up of infected newborns and compared them with those who were known to be not

infected during the first two weeks of life. Those infected in the first two weeks were protected against the severe effects of community outbreaks. So it might be an ideal vaccine.

This study published in the New England Journal of Medicine and another from South America, became the basis for vaccine development for all candidate rotavirus vaccines. Locally, this unique Australian strain has been developed and tested as an oral vaccine.

Professor Julie Bines is about to take over the story to give an assessment of the outcomes so far of Ruth Bishop's work. Just before that, a brief mention of her team. Throughout several decades, Ruth trained a large number of scientists, national and international. They enjoyed a terrific relationship with their boss, and they regarded her as a real friend. Ruth was a team player, always giving credit to her staff. It was intriguing to see many of her international colleagues lining up at a rotavirus world congress in Melbourne in 2016, all desperate to get their photo taken with 'the icon of rotavirus'.

Now I'll ask Julie to tell you about what we know so far, about Ruth Bishop's real legacy, and about the unique strain from newborn babies at the Royal Women's Hospital, which has entered the long pipeline towards being used routinely as a vaccine in some parts of the world.

As a postscript, the Royal Children's Hospital no longer needs a special ward for children with gastroenteritis. Thank you.

Professor Julie Bines 41:20

Thank you, Graeme. What a wonderful story of achievement, perseverance, dedication, and collaboration. And beautifully told Graeme. It's a great honour for me to acknowledge and share Ruth's legacy with you today. I would like to acknowledge Ruth's family who are joining today, and also the many colleagues, including colleagues from Indonesia who have joined online.

The discovery of rotavirus in 1973, gave an opportunity to target a protective vaccine. In 2009, WHO made a global recommendation that all children should receive a rotavirus vaccine, and today 122 countries have introduced a rotavirus vaccine into their regional or national immunisation programmes. Many of these in the poorest countries of the world including in Africa supported by GAVI. Rotavirus vaccines have had a major impact on hospitalisations and have been cost effective in countries where this has been studied.

Fiji, is a great example from our region of the impact of rotavirus vaccines following introduction into the national programme in 2012. Five years following introduction, there has been an 80% reduction in all cause diarrhoea mortality in children less than five years old. And then 87% reduction in rotavirus diarrhoea related hospitalizations, a huge impact of a vaccine on child health in our region. However, the work has not yet done.

Over 58 million children, or 40% of the world's children, still lack access to a rotavirus vaccine. And this is particularly an issue for the Indo Pacific region, which is lagging behind, with about 30 million children still remaining unvaccinated. There are also some challenges to the current rotavirus vaccines. Rotavirus vaccines have generally had a lower immunisation coverage compared to other routine EPI vaccines. Oral rotavirus vaccines have been less effective in high child mortality regions in Asia and Africa. And there is has been a reduced duration of protection that these vaccines provide in high child mortality regions. So as Ruth would say, the work has not yet been done.

We believe that the rotavirus the RV3- BB rotavirus vaccine has the potential to play a role in the future, to improve the level of protection offered by a rotavirus vaccine. The RV3- BB vaccine is based on the

asymptomatic human neonatal rotavirus strain RV3, that Graeme referred to in his presentation, identified from newborns in Melbourne back in the 1980s

The vaccine has been named RV3-BB to acknowledge the huge role that Ruth Bishop and Graeme Barnes have made to the development of this vaccine. The RV3-BB vaccine is a novel vaccine. It's novel because it's based on this unique neonatal strain, RV3, which was identified in newborn infants. These were healthy children, they didn't have symptoms associated with rotavirus infection. And when followed, the infection appeared to offer protection up to three years of age against rotavirus disease . So a great opportunity for a vaccine protect from birth.

This vaccine has been developed at MCRI in high titer in WHO pre-qualified vero cell lines suitable for vaccines for children. It's been developed as an oral one mil 3- dose course and can be co administered with the other childhood vaccines. It's also been developed with a novel administration schedule in mind. The current rotavirus vaccines are delivered with the first dose at six to eight weeks of age. We aim that the RV3-BB rotavirus vaccine is delivered at birth. There are a number of advantages that this might provide particularly for children in low and middle income countries. This would address the gap in protection from birth to the first dose of vaccine the current vaccine at six to eight weeks of age. It may improve coverage where birth dose immunisation schedules are thought to be the best opportunity for best coverage for immunisation. It's a successful immunisation time point for existing vaccines such as hepatitis B, BCG and oral polio in low and middle income countries when mums and babies are more likely to be in association with a healthcare attendant. It may be that delivering an oral vaccine to a very newborn baby reduces the barriers to potential uptake of a vaccine from complex gut environment as the newborn gut is immature. It doesn't have a complex bacterial environment, given before a lot of breast milk comes in, and the gastric pH is neutral in newborn babies. There is some early evidence to suggest that providing a birth dose might increase the duration of protection offered by rotavirus vaccine. And in a recent modelling article by the London school it has been suggested that providing a birth dose immunisation schedule for rotavirus might improve the benefit risk ratio for rotavirus vaccine with the reduction in the risk of intussception when providing this vaccine very early.

We have approached this development also with a relevant relatively novel approach. We've been actively collaborating with emerging country manufacturers with the aim to have a low-cost affordable vaccine for children in low and middle income countries.

For the last 15 to 20 years, we've been collaborating with partners at University of Gadjah Mada, our colleagues, Professor Yati Soenarto, Professor At Thobari and BioFarma Indonesia. So why Indonesia? And why does Indonesia need a rotavirus vaccine? Rotavirus vaccines are not currently available on the national immunisation programme in Indonesia, however, there's a high rotavirus disease burden. There's over four and a half million children born each year in Indonesia. Indonesia i still considered a high child mortality region, with an infant mortality of around 20 per 1,000 live births and diarrhoea is a common important cause of death in children less than 12 months of age. Most of the hospitalizations due to diarrhoea in Indonesia, in young children is due to rotavirus.

Indonesia has also have has an active and effective vaccine manufacturing capability. BioFarma Indonesia is a state-owned vaccine manufacturer. It supplies all the normal infant vaccines for the Indonesian immunisation programme. In addition it supplies UNICEF been over 100 other countries. BioFarma have partnered with MCRI for over 15 years in the development of the RV3-BB rotavirus vaccine. And some of the advantages of the BioFarma's RV3 development programme is the aim to provide a low cost, affordable vaccine for Indonesia and the global market, to provide self-sufficiency for vaccine production and security and also to develop a porcine free manufacturing process to meet halal requirements..

To provide proof of principle that the RV3-BB rotavirus vaccine would protect in Indonesian infants from rotavirus, we conducted a safety immunogenicity and efficacy trial of MCI manufactured RV3-BB in Central Java and Yogyakarta. In collaboration with our colleagues at UGM and BioFarma. This was double blind randomised clinical trial in Jogjakarta and Central Java recruited over 1600 infants and a vast army of researchers including primary health centre staff and midwives. The results were impressive. 94% of infants who received the vaccine in the neonatal schedule are protected from severe rotavirus gastroenteritis at 12 months and 75% at 18 months. This is highly comparable to the current WHO pre-qualified rotavirus vaccines. These results were published in the New England Journal of Medicine.

Building on this work, we've developed further evidence in collaboration with our partners in Indonesia toprovide to support for the development and decision making regarding the introduction of rotavirus vaccines in Indonesia. We've conducted in collaboration, a cost effectiveness study of introduction of a rotavirus vaccine into the national immunisation programme, important for the ATAGI to make decisions, which showed that RV3-BB would be highly cost effective and an effective commitment from the health budget. We've modelled the impact of the RV3-BB vaccine on rotavirus infection and transmission and disease, suggesting that there is a potential for a 95% reduction of infection and disease in vaccine coverage with RV3-BB vaccine and about 85% percent reduction even if immmunisation coverage is 55% in Indonesia.

We've also studied the immunogenicity of the vaccine and shown that it's not impacted by co-administration with oral polio vaccine, which is the case with some of the other current rotavirus vaccines. Genetic differences in histo blood group antigens which also appear to be a challenge to current vaccines does not appear to be the case for the RV3-BB vaccine because of its new unique structure. Breast milk antibodies and maternal antibodies do not appear to influence vaccine take. Based on these findings, Indonesia has now planned to introduce the BioFarma manufactured RV3 vaccine into the national immunisation programme from 2023.

Ruth has had enormous contribution to the understanding of rotavirus and the development of rotavirus vaccines but her legacy of innovation and collaboration has extended beyond. The Enteric Diseases group at MCRI hosts the WHO Collaborating Centre for Child Health and the WHO Rotavirus Regional Reference Laboratory for the WPRO region. We have expanded research across a broad range of enteric disease research, including inmicrobiome and virome and changes in genetic diversity of rotavirus, in particular to make sure that our current vaccines are fit for purpose and there is no risk of vaccine escape. The group collaborates in the Global Paediatric Diarrhoea Surveillance Programme and also in the development of a multi enteric pathogen diagnostic platform currently being tested.

And we're not done yet. We're still think that there's work to do on enteric vaccines. Wouldn't it be great if we had a gastroenteritis vaccine taking including other causes of gastroenteritis. How can we how can we build on our knowledge. Also looking at novel vaccine schedules. We're currently involved in a trial in South Africa using what we call, a prime boost therapy, a first birth dose of RV3-BB followed by a parenteral vaccine. Looking at new ways for vaccine trials, to look at optimising the potential protection of oral rotavirus vaccines and also looking at the potential for vaccines to address the emerging problem of antimicrobial resistance.

This work has also leveraged on current issues presented by the pandemic. Developing a wastewater surveillance system in Indonesia, again with our collaborators from UGM in Yogyakarta for COVID-19. And now also typhoid to look at whether introduction of typhoid vaccines may have a benefit in the region, looking at COVID in the gut and the long-term impact of COVID in Indonesian, an emerging problem. There have been a number of PhD and Master's students as a result of collaboration within

the region, students coming to study in Melbourne, and, and also Australian students studying within the region. There's been laboratory training to develop capacity in the region, including basic research to support surveillance activities in the region, and the work of commercial partners. And teaching and training Global Health and Vaccinology are a real need in the region.

I'm also really pleased that a great outcome of this Ruth's legacy has been the support and mentoring of future leaders within our region. And I just like to call out the work of Women in Global Health to address gender inequities in the region. So we owe Ruth a great deal for her enormous life's work in science, the collegiality, her support and mentorship of the next generation of researchers and her impact on child's health, not only here in Australia, in the Indo Pacific region and globally. And I know her work is not done yet. The next generation will continue to work on until we have many of these problems solved. Thank you.

Mr Robin Davies 44:13

You have been listening to Professor Graeme Barnes and Professor Julie Bines presenting the 2022 address for the Indo-Pacific Centre for Health Security in honour of Professor Ruth Bishop AC. Ruth's brother David, Professor Barnes and Professor Bines spoke of Ruth's life, her incredible career and contributions to science, and the legacy she's left behind with the huge impact oral rotavirus vaccines have had on global health in children. Ruth Bishop's name will forever be linked with the discovery of rotavirus in 1973, and by the time she died earlier this year, the rotavirus vaccination was included in the childhood vaccine schedule in more than 110 countries. A wonderful person, and a dedicated scientist. She will be missed.

Thanks for your company. I'm Robin Davies. Contain This aims to bring you fresh insights analyses and updates on what is shaping the future of global health in our region. We look forward to having your company on the next episode.

Contain This is produced by the Indo-Pacific Centre for Health Security. You can follow us on Twitter and Facebook @CentreHealthSec.