INNOVATING AUSTRALIA'S FUTURE

Renaissance Man to Chief Scientist, Dr Alan Finkel AO

A RESPECTED NEUROSCIENTIST, ENGINEER, ENTREPRENEUR AND EDUCATOR, AUSTRALIA'S EIGHTH CHIEF SCIENTIST, DR ALAN FINKEL, SHARES HIS VISION FOR THE NATION'S TOP SCIENCE JOB AND THE FUTURE DIRECTION OF AUSTRALIAN RESEARCH, INNOVATION AND THE MATHEMATICAL SCIENCES.

WHAT ARE YOUR KEY PRIORITIES DURING YOUR FIRST YEAR AS CHIEF SCIENTIST?

Year one is already well spoken for with three major advisory roles: leading the research infrastructure roadmap, co-chairing the R&D tax incentive review and sharing the development of a draft national strategic plan for science, research and innovation with Bill Ferris and others on the Board of Innovation and Science Australia.

The first is probably the least discussed, but for the mathematics community it really should be front of mind. We are talking about the nationally accessible supercomputers and research facilities that will underpin Australian research for more than a decade to come. It will be critical to sustaining excellence in our fields of strength and building new capability in areas of strategic potential. Our supercomputers, for example, will support mathematicians in the huge variety of modelling and analysis tasks we need, ranging from materials analysis to climate projections. I'm delighted to be leading a highly consultative process across a broad range of capability requirements.

I'll also be busy telling the success stories of Australian and global science, and pointing to the ways that science, technology and mathematics continue to contribute to all aspects of our national wellbeing.

WHY IS THERE SUCH A DISCONNECT BETWEEN HOW WE VALUE MATHEMATICAL LITERACY AND OUR UNDERSTANDING OF ITS CRITICAL ROLE IN OUR TECHNICAL WORLD?

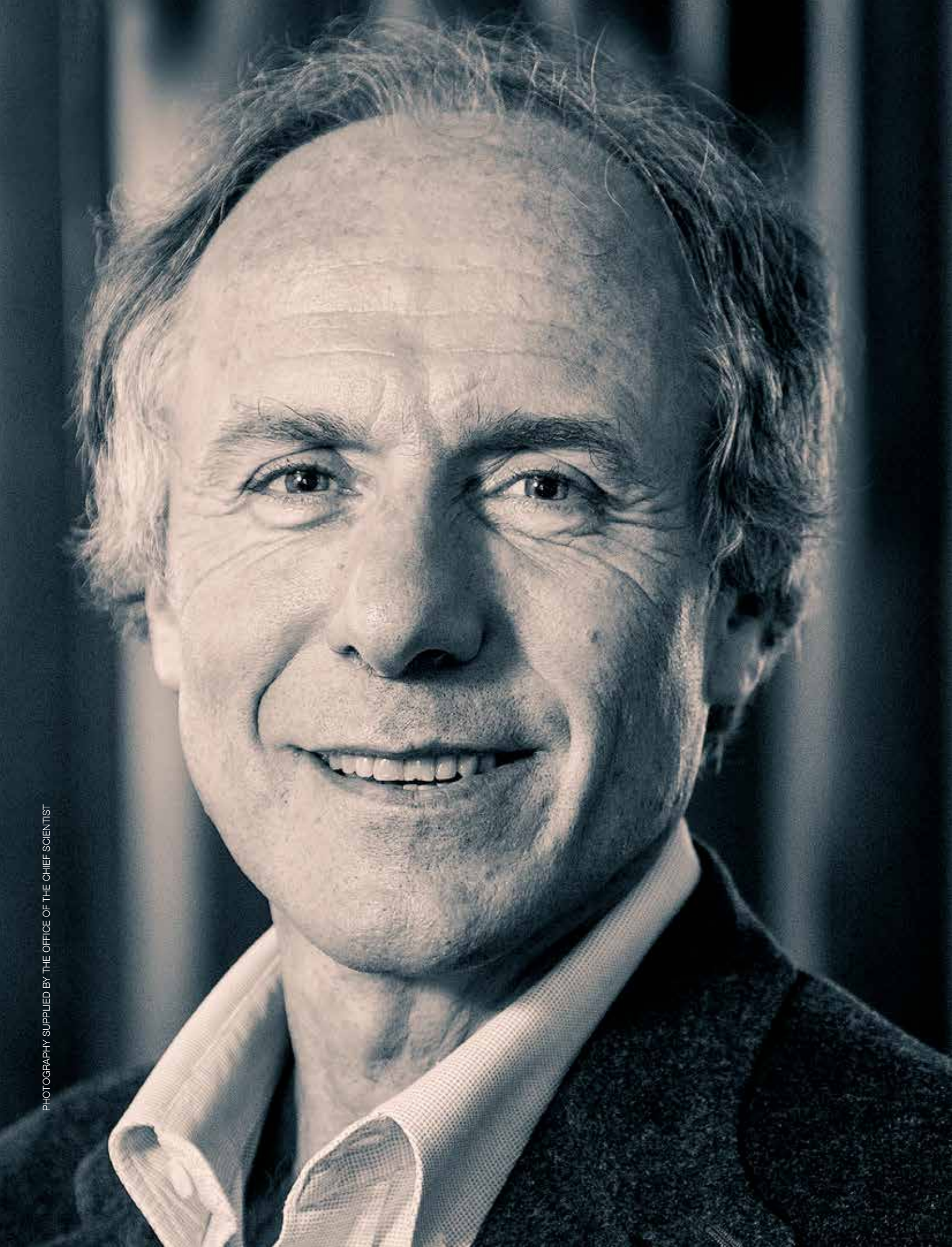
It's part of a broader problem at least as old as the desktop calculator. We see that machines can do a particular task, and we assume that we've got an easy substitute for human beings with deep knowledge and skills. So we lessen our expectations of mathematics education. That is a deeply mistaken viewpoint. To be a technologically sophisticated economy, of course we need to be numerically literate people! Software engineers, for example, cannot write algorithms without using mathematics, and they cannot write creative algorithms if they have to consult websites all the time. Human brains process information in parallel, but they cannot do that unless the information is already pre-loaded. Sequentially accessing information one website at a time is the antithesis of parallel processing and the dampener on creative design.

It's not just high-technology workers and industries where mathematical literacy counts. It's the foundation of all commercial exchange. Just as the quality of social discourse is diminished if your dinner companions are too busy digging up answers and facts on their smartphones to respond to your witticisms, so too is the quality of business interactions diminished if the participants don't have useful knowledge at their fingertips and the ability to process information themselves. It annoys me when investors cannot work out the rough area of a block of land from the length and the breadth. Or when my dinner companions take up half the meal trying to do the sums on splitting the bill. But my personal annoyance aside, the problem is that the progress of the transaction is slowed down while they whip out their smartphones, find the calculator app and deal with their typing errors.

Scale that up across an economy trying to transform itself for the Data Age, and you don't have to be a mathematician to see the imperative for mathematics education.

I would also like to commend AMSI for its recommendations to establish a mathematical sciences committee that will advise my office on key policy measures. I look forward to more dynamic interaction with the Institute. ⇨

IT'S NOT JUST HIGH-TECHNOLOGY WORKERS & INDUSTRIES WHERE MATHEMATICAL LITERACY COUNTS. IT IS THE FOUNDATION OF ALL COMMERCIAL EXCHANGE



PHOTOGRAPHY SUPPLIED BY THE OFFICE OF THE CHIEF SCIENTIST

HOW DO YOU RATE THE HEALTH OF AUSTRALIAN MATHEMATICS EDUCATION IN SCHOOLS? WHAT ARE THE BIGGEST CHALLENGES?

From the declining number of Year 12 students choosing advanced or intermediate mathematics, the health of Australian school mathematics would clearly benefit from some strong medicine. That's not to suggest the cure is painful! On the contrary, mathematics can and should be a subject students enjoy, and choose because it equips them well for life. If that message has been lost, we need to intervene to reinforce it.

I would start by restoring mathematics prerequisites for university courses. Apart from a few brave Vice-Chancellors and Deans, most universities have sacrificed their prerequisites to make it easier to enrol students. It has nothing to with the goals of education, and everything to do with the incentives built into the funding and school-leaver assessment systems. If we corrected that market failure, schools would respond by improving their mathematics teaching all the way back to early primary years.

The merits-based case for mathematics prerequisites is, of course, very strong. When asked, "why mathematics", I answer indirectly that there should be prerequisites for two subjects. English (in Australia) because our language is how we engage in discussions ranging from philosophy to economics. Mathematics, because it is the language of science, engineering and non-science disciplines such as commerce. With a firm basis in english and mathematics our students can aspire to any university course and career that takes their fancy.

YOU ARE AN ENTREPRENEUR, ENGINEER, NEUROSCIENTIST AND EDUCATOR, WHAT DO YOU SEE AS YOUR BIGGEST ACHIEVEMENT TO DATE?

While I am proud of most things that I have done in my various careers, I would have to point to the development of a series of products at Axon Instruments as collectively my biggest achievement. We made the best in the world scientific instruments for measuring the electrical activity of brain cells, for fluorescent imaging to monitor the response of living cells to medicinal compounds, and for scanning DNA microarrays to measure gene expression. I'm proud of what we achieved, as well as the progress we enabled other scientists and clinicians to make.

HOW CRITICAL ARE PROGRAMS SUCH AS AMSIINTERN, AS WE BUILD INDUSTRY RESEARCH EXPERIENCE INTO THE AUSTRALIAN STEM PHD TRAINING?

We owe it to our STEM PhD graduates to prepare them for industry careers, not just because the opportunities in academia are limited but because the paths in industry can be extremely rewarding. Here I am interpreting the term 'industry' very broadly, to include all non-academic activities. We know from the recently released *STEM Workforce Report* from the Office of Australia's Chief Scientist, as well as surveys by associations such as the American Institute of Physics, that PhD graduates are employed very successfully in a wide range of non-academic roles. Portfolio management, financial planning, urban planning, wine making, company management – these and many more are attractive industry paths to which a PhD can bring valuable transferrable skills.

In addition to the AMSI program, there is the IMNIS mentoring program run by ATSE. Both of these are national programs, delivered on the initiative of non-university organisations. These are critically important. Some of our best universities are modernising their PhD programs to add training for a variety of work-relevant attributes, and these efforts are complemented by the industry training provided by AMSI and ATSE's programs.

AN AMSI PRIORITY, HOW WILL YOU AND YOUR OFFICE IMPROVE GENDER EQUITY IN STEM?

Our *STEM Workforce Report* indicates about a 60:40 male to female split in the cohort of working age Australians with bachelor qualifications and above in mathematics. At the doctorate level, the gap widens to 80:20. There is also the question of pay. In the 30 to 59 year age bracket, for example, the percentage of men with bachelor qualifications reaching the highest income bracket is more than double that of women qualified at the same level. Mathematics is significantly better than other disciplines, such as ICT and physics to name two, but it's still got a way to go.

WE OWE IT TO STEM PHD GRADUATES TO PREPARE THEM FOR INDUSTRY...PATHS TO WHICH A PHD CAN BRING VALUABLE TRANSFERABLE SKILLS

Highlighting these issues is just a first step. Through my previous role as President of ATSE and through my current role as Chief Scientist I am a strong supporter of the Athena Swan program introduced by AAS and ATSE. It is built on a proven UK model that accredits universities and other research institutions taking action to improve gender equity. The universities themselves are enthusiastic and a large number of them have volunteered to sign up for the pilot program.

WHAT ADVICE WOULD YOU GIVE SOMEONE CONSIDERING A MATHEMATICS OR SCIENCE CAREER?

I speak to students often and always encourage them to choose a science, engineering or mathematics degree if they enjoy these disciplines. Career opportunities are evolving at a rapid rate. Analytical thinking, problem solving and deep discipline knowledge are applicable to all jobs, even if the disciplines are not necessarily the ones in which the students train.

Good fortune comes to the prepared mind. Students considering a career in science or mathematics should prepare themselves well. The better they can think without reaching for their smartphones, the more good fortune they will enjoy – and the more dinner invitations they are likely to get!

Professor Ian Chubb elevated Australia's innovation capacity to a critical policy issue. As he builds on this legacy, AMSI welcomes Dr Finkel's vocal support for initiatives to grow Australia's mathematical sciences at all stages of the pipeline, from the classroom to higher education, research and industry. □