

TAKING RESEARCH TO THE NEXT LEVEL

*The National Research Centre:
A Vision for Australian Mathematical Sciences*

THE DECADAL PLAN

The Australian Academy of Sciences launched *The Mathematical Sciences in Australia: A vision for 2025* in March this year. A headline recommendation of this decadal plan concerned the formation of a national research centre:

"Australian universities should collaborate with the discipline to source seed funding for a new national research centre in the mathematical sciences, with the objective of enhancing connectivity with industry and strengthening the international collaboration and visibility of Australian research in mathematics and statistics."

The decadal plan subcommittee charged with examining this issue was unequivocal about the structure an Australian centre would have:

"The panel members were unanimously of the view that the relatively vast distances within major centres in Australia, combined with the relatively sparse population density, makes a distributed model the best of the options for initiating a research centre.

The distances between major population centres in Australia are not dissimilar to those on the west coast of Canada, and we note that the best known distributed research centre in the mathematical sciences, PIMS, is centred in this region."



A NATIONAL RESEARCH CENTER IN THE MATHEMATICAL SCIENCES REMAINS AT THE VERY TOP OF AMSI'S AGENDA & IS A KEY RECOMMENDATION OF THE NEW DECADAL PLAN FOR THE MATHEMATICAL SCIENCES

AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

DIRECTOR: **PROFESSOR GEOFF PRINCE**

AUSTRALIA'S NATIONAL RESEARCH CENTRE

AMSI's programs in school education, public outreach and research training are highly regarded at home and abroad. In turn, we envy the well-funded research programs of our sister institutes elsewhere. While we have sponsored more than 250 workshops, bringing around 60 international colleagues to Australia each year and put many eminent mathematical scientists on tour, we have not seen the sort of funding necessary to engage in the long term, collaborative projects which are the hallmark of famous institutes such as Oberwolfach (Germany), the Isaac Newton Institute (UK), the Pacific Institute for Mathematical Sciences (Canada & USA) and the Institute for Mathematical Sciences (Singapore). You can read about their programs in the following pages.

A COMPELLING CASE

The Australian mathematical sciences community wants a well-resourced national research centre which will:

- ↑ **Deliver significant growth of high quality research outputs;**
- ↑ **Build a stronger discipline in all of Australia's universities & research agencies;**
- ↑ **Establish Australia as an international research destination;**
- ↑ **Network existing centres of excellence;**
- ↑ **Be a platform for attracting funding, philanthropic, public & private;**
- ↑ **Be a hothouse for mathematical sciences start-up companies;**
- ↑ **Build sustaining & strategic research-industry collaborations;**
- ↑ **Build the future mathematical sciences workforce, public & private;**
- ↑ **Increase public awareness of the role of the mathematical sciences in 21st century science, technology, innovation, the social sciences & commerce.**

THE MODEL

A national research centre in the mathematical sciences remains at the very top of AMSI's agenda and is a key recommendation of the new decadal plan for the mathematical sciences. Planning for this centre is currently underway as a partnership comprising AMSI's membership, learned societies, agencies, centres of excellence and existing networks which currently run research and research training programs in the mathematical sciences.

During an initial three-year period the partners will co-badge their programs, including AMSI's own significant research and higher education initiatives, as national research centre programs. They will also co-operate on national programs like the successful Maths of Planet Earth led by AMSI in 2013. The new AMSI Trust will support the formation of the centre and a high profile group of champions will pursue philanthropic, public and private sector funding.

The new centre will build on AMSI's existing model of distributed delivery, wiring up the various hotspots in the mathematical sciences scene, simultaneously strengthening our ability to raise national funding and also strengthening the position of the partners. These programs will be designed to deliver on our aspirations, informed by international best practice and addressing the gaps in current research funding. For example, a small grant scheme for individual mathematicians to fund collaborations, a network scheme to fund long term, themed national collaborations on a smaller scale than the current Centres of Excellence, and themed industry collaboration programs.

As Australia seeks to implement a national research centre to strengthen its mathematical sciences leadership, we talk to leaders of some of the world's most successful mathematics institutes about their programs, the benefits of national leadership, and how they are influencing research policy and funding, as well as their impact on innovation, industry and research collaboration.





Pacific Institute *for the*
Mathematical Sciences

ONE OF THREE CANADIAN DISTRIBUTED INSTITUTES, THE PACIFIC INSTITUTE FOR THE MATHEMATICAL SCIENCES (PIMS) is working to promote mathematical sciences generated across Western Canada and Western USA. Based at the University of British Columbia, the institute's membership includes all major Western Canadian universities, as well as the University of Washington. Working at all stages of the mathematics pipeline, the institute supports initiatives through its high school education, industrial innovation and fundamental research programs.

INTERIM DIRECTOR: **PROFESSOR MARTIN BARLOW**

COUNTRY: **CANADA**

TOGETHER WITH THE OTHER MATHEMATICS INSTITUTES IN CANADA WE HAVE RECENTLY BEGUN AN INNOVATION PROGRAM. THIS INITIATIVE AIMS TO DEVELOP CONTACTS BETWEEN RESEARCHERS IN THE MATHEMATICAL SCIENCES & INDUSTRY

COLLABORATION

Collaboration is a strong focus for PIMS. Our flagship program is our Collaborative Research Groups (CRGs). These support a group of researchers across PIMS sites to run a three to four-year themed research program. As well as providing support to postdocs, workshops and graduate summer schools, CRGs are frequently the basis for ongoing research collaboration between different PIMS sites.

INNOVATION & INDUSTRY

Together with the other mathematics institutes in Canada, we have recently begun an Innovation Program. This initiative aims to develop contacts between researchers in the mathematical sciences and industry.

INFLUENCING PUBLIC POLICY

Primarily PIMS funding comes from the Natural Sciences and Engineering Research Council of Canada (NSERC). This funds postdocs, workshops, graduate summer schools and collaborative research groups. While contacts between scientists and government are not as extensive or as broadly based in Canada as other countries, this is something we would like to improve and that the leaders of the institutes are well placed to address.

Currently Canada has several research institutes in the Mathematical Sciences – the Fields Institute (Toronto), the Centre Recherché Mathématique (Montreal) and three distributed institutes: PIMS, AARMS (Eastern Canada) and the Canadian Statistical Sciences Institute. As a collective, these institutes provide a powerful voice for the mathematical sciences in Canada, promoting mathematics and securing additional funding from the Provincial Governments.



ESTABLISHED IN 2000, THE INSTITUTE FOR MATHEMATICS IS A UNIVERSITY-LEVEL RESEARCH INSTITUTE BASED AT THE NATIONAL UNIVERSITY OF SINGAPORE (NUS). With the aim of fostering both fundamental and multidisciplinary mathematical research, the Institute provides funding and facilities to the global mathematical sciences community for research and collaboration. It aims to nurture mathematical research expertise, train new research talent and provide a platform for research interaction between the Singapore and global science communities. Over the past 15 years it has held more than 90 programs and perhaps an equal number of workshops.

DIRECTOR: **PROFESSOR CHI TAT CHONG**

COUNTRY: **SINGAPORE**

THE PROGRAMS & ACTIVITIES ORGANISED AT THE IMS ARE ALL ABOUT INNOVATION & A LARGE NUMBER OF THEM CONCERN APPLICATIONS OF MATHEMATICS TO TECHNOLOGY

COLLABORATION

Many research collaborations and discoveries have arisen from work done at IMS. The Institute cooperates with many departments and institutes in the country to organise programs in multiple areas within the mathematical sciences, from pure to interdisciplinary, serving both the Singapore and international scientific communities.

We host a range of thematic one to three-month programs and specialised one-week workshops. With the aim of nurturing young women and men interested in mathematical science careers, the institute organises summer and winter schools on advanced topics for graduate students, and provides opportunities for mathematical scientists beginning their research careers for short-term attachments at the institute. The IMS periodically organises public lectures to fulfil its other mission of raising the interest and awareness of the public in the role of mathematics in modern society. Finally IMS also works closely with other mathematical institutes to organise joint scientific activities.

INNOVATION & INDUSTRY

In many respects, the programs and activities organised at the IMS are all about innovation and a large number of them concern applications of mathematics to technology (e.g. computer security, high performance computing and materials science, finance and drug delivery).

INFLUENCING PUBLIC POLICY & FUNDING

As Director of the IMS, I serve on various committees outside the university, including those at the Ministry of Education and other statutory boards. Mathematics and its applications are often on the agenda. ⇨



Mathematisches
Forschungsinstitut
Oberwolfach



LOCATED IN THE GERMAN BLACK FOREST, the Mathematisches Forschungsinstitut Oberwolfach (MFO) attracts over 3000 researchers annually. Covering the full spectrum of mathematics research and its applications within science and technology, the institute's programs provide ideal conditions for researchers to drive discovery and influence and stimulate field development.

DIRECTOR: PROFESSOR GERHARD HUISKEN

COUNTRY: GERMANY

SEVERAL SENIOR GERMAN INDUSTRY LEADERS OFFER ADVICE ON RELEVANT MATHEMATICAL DEVELOPMENTS & HIGHLIGHT THE IMPORTANCE OF MATHEMATICAL RESEARCH WITHIN THEIR INDUSTRIES TO POLITICIANS

COLLABORATION

The MFO's research program includes weekly and mini one-week workshops, as well as six annual Oberwolfach seminars where PhD students engage with field leaders to explore hot research topics. The Oberwolfach Arbeitsgemeinschaft lecturers provide a 'learn by doing' experience through presentation of recent results and research activities. Individual engagement through initiatives such as Research in Pairs and Simons Visiting Professors also supports discovery advancement. The high degree of abstraction and specialisation in mathematics makes distraction-free direct communication between mathematicians critical to inspire new ideas and technology development. MFO plays a crucial role at the beginning of concrete projects (inspiration, discussion of new resolution methods) and with the presentation of new results at the end, leading to new inspirations and applications to other problems.

INNOVATION & INDUSTRY

Several senior German industry leaders support the MFO as board members of the Oberwolfach-Foundation. They both offer advice on industry relevant mathematical developments and help highlight the importance of mathematical research within their industries to politicians and public office holders. While industry leaders provide financial and political support to the MFO in driving and applying basic mathematics research, they do not influence its excellence based scientific selection process.

INFLUENCING PUBLIC POLICY & FUNDING

A member of the Leibniz Association, the MFO receives German federal and state government funding. Represented on the administrative council, government funding agencies and external foundations also assist to legally oversee the institute.

Despite having no direct capacity to influence national policy, the institute's directors, MFO scientific committee members and program organisers and participants serve on relevant committees of many important German science institutions. Oberwolfach meetings and discussions also play an important role in policy debate and consensus building amongst German mathematicians.



INI Isaac Newton Institute
for Mathematical Sciences

BASED IN CAMBRIDGE, UK, The Isaac Newton Institute (INI) is a national and international visitor research institute. Attracting leading UK and international mathematicians, the institute runs science programs with applications across a wide range of science and technology. INI has a vital role, building on the existing strengths of UK universities to generate a new vitality through stimulating and nurturing research throughout the country.

DIRECTOR: **PROFESSOR JOHN TOLAND**

COUNTRY: **UNITED KINGDOM**

**THE ROLE OF RESEARCH
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COLLABORATION

Collaboration can have a transformational effect not only on the field itself but also on individuals, especially early-career individuals who are involved. The role of research institutes is to nurture collaborative research on a scale, breadth and depth that could not realistically be achieved by any single department. Inviting internationally leading experts nurtures and supports research in areas where your country may not yet have a significant presence. During each INI scientific program new collaborations are made and ideas and expertise are exchanged and catalysed through lectures, seminars and information interaction, which the INI building has been designed specifically to encourage.

INNOVATION & INDUSTRY

Established in 2013, the Turing Gateway to Mathematics (TGM) (turing-gateway.cam.ac.uk) acts a channel for knowledge flow and ideas between the mathematical sciences and mathematics users. It does this by facilitating interactions and activities such as programmes of work, events, projects, and education and training in areas where maths skills are needed. Acting as a gateway between academic mathematics, industry and government and other disciplines, it helps widen the access to mathematics generally and shorten pathways to impacts.

INFLUENCING PUBLIC POLICY & FUNDING

INI has made several written submissions to parliamentary enquiries on the science/industry/business interface. From time to time it attends lobbying meetings, for example at the House of Commons earlier this year and it answers questionnaires. □