



Math matters

Peter Taylor

The Mysterious Process between Theory and Applications

I would like to start by congratulating the editors, Jan de Gier and Ole Warnaar, for encouraging debate about the state of our discipline via the “Math matters” and “Brain drain” columns. The previous contributions to these columns, plus some letters to the editor in response, have been both interesting and thought-provoking. I know that some people have found the blunt nature of some comments off-putting. However, it is healthier for the discipline to get these things out in the open. The mathematical community should, in the words of Jan and Ole “*be strong and mature enough to allow a free and open debate*” [2].

The Math matters series started off with Peter Hall’s statement “*There is little dispute that the mathematical sciences in Australia are in decline*” [5]. Peter then went on to detail a bleak picture of the way that the mathematical sciences have evolved in Australia over the last few years. Garth Gaudry [4] started in a similar vein, but then pointed out that there might be recent signs of a reversal of fortunes in the funding of the Australian Mathematical Sciences Institute (AMSI), the International Centre of Excellence for Education in Mathematics (ICE-EM) and the ARC Centre of Excellence in the Mathematics and Statistics of Complex Systems (MASCOS).

Possibly because I am a natural optimist or possibly because, like Kevin, I personally have been funded relatively well, I find myself agreeing with Kevin Burrage’s sentiments that we should “*have more emphasis on the positive and on our collective achievements*” [1]. That a great deal needs to be done is undeniable. However, I have

faith that our community is capable of responding to the challenges that currently lie in front of it.

Cheryl Praeger [6] and Tony Dooley [3] took a slightly different approach to the Math matters column than Peter and Garth. Rather than surveying the current situation, they put forward ideas that they believe would be of considerable benefit to our community. Cheryl emphasized that mathematics should see itself as a profession and made a number of concrete suggestions as to how this might be brought about. Tony, in his reflection on how research in the mathematical sciences might look in fifty years’ time, offered a number of perceptive observations and strongly advocated the opening of communication channels between the mathematical sciences community and those outside it.

On page 78 of [3], Tony wrote

“What I am arguing here is that the profession must try to take greater control of that mysterious process between theory and applications. If this is better done and understood, our work will be seen as more relevant, the benefits of a centralised profession of mathematical researchers will be manifest, and mathematicians will also be seen as the natural people for teaching of mathematics to other areas”.

In these few lines, Tony has set an agenda that, if followed, would solve most of the major problems facing the mathematical sciences today. I can not think of a better way to express the case than Tony did, so what I plan to do in this column is expand on his statement a little and offer some

thoughts on how the mathematical science community might implement his agenda.

My first observation is that it is implicit in Tony's statement that our destiny is in our own hands. This sets a tone different from that of many other contributions to the debate. We all need to appreciate that the health of the mathematical sciences lies with the mathematical community. If the mathematical sciences do not flourish in Australia, then it will be due to our failure, rather than the shortsightedness of "ignorant" politicians and administrators. Also, observe that implementing Tony's agenda is necessarily a task in which the great majority of the mathematical community must partake, and for which we should all take collective responsibility.

Very few of us would contest the truth of, for example, the statements by Phillippe Tondeur and General W.E. Odom quoted by Peter Hall in [5]. However the leap to the conclusion that all the research mathematicians in our publically-funded institutions should be given resources to do what they like is one that would not survive the refereeing process in any of our journals. The argument needs to be deeper than that, and we should be prepared to address the proposition that the people making funding decisions adverse to the mathematical sciences might not be as misguided as we think they are.

Let us ask the question of what the Australian community gets when it funds a mathematician to do research? To focus ideas, I think it is instructive to reduce this question to a personal level. Roughly-speaking, it costs the community around \$200,000 per annum to pay my salary and house me in an office with appropriate facilities. This money could fund quite a few hospital beds or pay for a couple of musicians in a symphony orchestra, so why should the community choose to fund me rather than the hospital beds or the musicians? I would like to think that there are good arguments why it should. However, I make it a point

to bear these arguments in mind and continuously check whether they are still valid. Each of us individually and, indeed, the profession as a whole, is in a similar situation. There are good arguments that the mathematical sciences should be supported by the community, but with support comes the responsibility to ensure that funds are spent well.

A decision-maker faced with the option of putting resources into mathematical sciences research or some other worthy cause would not be doing his/her duty if they did not weigh up the benefits of either decision. We would argue that the benefits to society produced by mathematical sciences research are often long-term. We might also say that they are highly uncertain, but that we need a critical mass engaged in activity to uncover the rare jewel that will make a difference. So let us assume that our decision maker is a wise person prepared to accept the case on these terms. Would the decision-maker come down in favour of the mathematical sciences?

If I were that decision-maker, I would ask one more question. I would want to know what the profession is doing to ensure that results of mathematical research have the best chance of providing some benefit to the community. In Tony Dooley's words, I would want to know what we are doing to control "*the mysterious process between theory and applications*".

The way that I interpret this statement is that, wherever we sit on the mathematical spectrum, we should be aware of how the work that we do links to the work that other people do and, indeed, how it could eventually be implemented to provide some benefit for the community. For example, a statistician might design a randomised trial for a pharmaceutical company, an applied mathematician might solve a problem posed by an engineer, or a pure mathematician might locate the work of an applied mathematician in a more general abstract framework,

which enables further insight and a better appreciation of the work's applicability.

Benefit to the community might accrue via a long path with many steps. However, it is the role of a responsible mathematical researcher to ensure that there exists such a path. I think it would be fair to say that many, if not most, research mathematicians in Australia currently do not think of their work in these terms. They are content to work within their own, usually fairly narrow, speciality and produce results that are

appreciated by an often very small community. It is this attitude that it is essential that the profession work to break down.

As a first practical step to achieving this, I would like to finish with the suggestion that all of you who are research mathematicians should make a new year's resolution that from 2005 onwards you will work on at least one substantial problem per year introduced by someone outside of your speciality. I believe that if we all did this, we would be taking a large step towards taking control of the "mysterious process".

References

- [1] K. Burrage, *Letter to the editor*, AustMS Gazette **31** (2004), 216.
- [2] J. De Gier and O. Warnaar, *Response to Kevin Burrage's letter to the editor*, AustMS Gazette **31** (2004), 216.
- [3] T. Dooley, *Math matters*, AustMS Gazette **31** (2004), 76–78.
- [4] G. Gaudry, *Math matters*, AustMS Gazette **31** (2004), 145–146.
- [5] P. Hall, *Math matters; The sum and the product of our difficulties: Challenges facing the mathematical sciences in Australian universities*, AustMS Gazette **31** (2004), 6–11.
- [6] C. Praeger, *Math matters; The profession of mathematics*, AustMS Gazette **31** (2004), 217–221.

Department of Mathematics and Statistics, University of Melbourne, VIC 3010

E-mail: p.taylor@ms.unimelb.edu.au