

# Obituary

## Tony Gardiner (17th May 1947 – 22nd January 2024)

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Anthony David Gardiner (or Tony as he was universally known) died suddenly at home on 22 January 2024, aged 76. Tony was a giant of the mathematical scene who enriched the lives of thousands of young people through the competitions which he instituted, the books that he wrote as well as summer schools and countless talks and lectures. Prior to retirement, he was a Reader in Mathematics and Mathematics Education at the University of Birmingham. (He was determined that the job title should contain both elements.)

Obituaries have appeared in various places, including *The Times* and *The Telegraph*. The purpose of the present Article is to provide a mixture of an obituary and an appreciation which has an MA slant to it.

### *Tony and competitions*

On being appointed to a lectureship at the University of Birmingham in the mid-1970s Tony set about disseminating his pedagogical philosophy. However, schoolteachers had more than enough on their plates to come to seminars, so that a change of tack was needed and Tony came up with the quaintly named BUMMPS (Birmingham University Midterm Maths Puzzles). Teachers could simply dish these out to pupils and encourage them to enter. Scripts were to be returned to the University of Birmingham and a phone number was supplied for queries.

The following story has appeared elsewhere but is worth repeating. One cheeky pupil decided to use the phone number to try and get some help with a problem. Little did he know that the number was Tony's office phone number. Tony's reply was to ask the pupil if his maths teacher (whom Tony knew by name) was aware he was phoning for help. The pupil was suitably chastened.

This little cameo illustrates the point that if you named a secondary school in England and Wales, you could be pretty certain that Tony would be able to tell you the name of the Head of Maths there. His knowledge of schools and teachers became encyclopaedic.

Tony wanted as many young people as possible to be exposed to interesting problems that would challenge them, going beyond the mundane exercises in their school textbooks. At the celebration of Tony's life at Weymouth Crematorium, the following quote appeared in the order of service:

*“Failure is far more important and far more creative than success.”*

The number of entries for BUMMPS grew rapidly and eventually this led to the birth of two national competitions: the Junior Mathematical Challenge and the Intermediate Mathematical Challenge for students aged 11-16. To run these Tony set up the United Kingdom Mathematics Foundation. Numbers of entries continued to grow apace. This led to a huge amount of marking. It was reported that on one occasion Tony marked 1000 scripts single-handedly. Whereas others might whizz through a pile of scripts at high speed, Tony was meticulous and took great care over every script. One cannot fail to be amazed by how many scripts he must have marked over the years.

### *Enrichment, not acceleration*

Tony showed great talent at an early age. He took his A-levels when he was 15, having therefore been accelerated quite considerably. (He also showed prowess in swimming and cricket and even played rugby against Gareth Edwards on one occasion.) There is often a discussion of *Enrichment versus Acceleration* in the context of highly talented students. Tony became a vociferous opponent of acceleration. Instead such students were to stay within their normal peer group and have their mathematical diet enriched by harder problems based on material they had already met. All Tony's work with aspiring young mathematicians, especially through the various competitions, was geared to enriching a huge pyramid of mathematical talent. One might wonder if his own experience sowed the seeds of his passionate opposition to acceleration.

### *Summer Schools*

The first summer schools were held at Queen's College, Birmingham in the early 1990s. The facilities there were fairly basic but the venue had two geographical advantages; it was close to Tony's home and was suitably far away from any licensed premises which minimised the risk of young people being led astray.

The organisation was carried out by Tony with help from his wife Gwyn. A group of 40 students from Y10 were selected on the basis of evidence such as performance in his two challenges. All the students were from different schools. On arrival they knew none of the other students and initially some were rather timid and shy. All stood out from the crowd at their schools as being "good at Maths" and some had had difficulties with classmates as a result. However, when they realised that they were now among kindred spirits, things changed dramatically and it wasn't long before the sparks began to fly mathematically.

Students arrived on Sunday afternoon and left the following Friday after lunch. The first sessions every morning took the form of a series of lectures or "Masterclasses" on a particular topic, delivered by Tony. After a coffee break, the students were divided into groups for team competitions, including mathematical relays. The afternoon consisted of various one-off

sessions led by guest tutors. After dinner there were cultural activities. These might take the form of a musical evening with performances by some of the students. On other occasions Tony would lead a crocodile along the banks of a canal to a play or concert in a venue in the city centre.

After a few years the event moved to Oxford with students resident in one of the colleges. Being in the busy centre of a city rather than a quiet suburb provided some fresh challenges for Tony. However, the format remained the same with the canal walks replaced by outdoor performances of plays in the grounds of colleges. These summer schools formed the basis from which the current summer schools have evolved.

Later, Tony developed a programme of 6-day summer schools for teachers, held in Robinson College, Cambridge. It seems that at one of these there was a heated argument over whether 1 is a prime number or not. Tony must have enjoyed that!

### *Tony and the IMO*

The United Kingdom entered the International Mathematical Olympiad for the first time in 1967. In the early years of UK involvement, training and selection was in the hands of a relatively small group of people, including Frank Budden (to whom reference is made again later), Robert Lyness and David Monk. By 1990 it was felt that a more robust system should be established and the British Mathematical Olympiad Committee (BMOC) was set up. Under the aegis of BMOC, Tony became Team Leader in the early 1990s. Residential training sessions took place in Tony's house, with his wife Gwyn doing the catering for the family of 7 plus the team (lemon meringue pie being a particular *spécialité de la maison*).

Ever since, he has followed closely the fortunes of former members of UK IMO teams as they have made their way in life. When the IMO was held in Bath in 2019, Tony organised a reunion which was well attended.

It is worth highlighting two things related to the composition of the teams of six students which Tony led. Firstly, in 1990, before he took over, five of the six students were from "private" schools and only one from a "state" school. In 1995 the numbers were reversed with only one from a "private" school. Secondly, prior to 1990 only one girl had been selected for a UK IMO team, but during Tony's tenure, there were one or two every year. This illustrates Tony's crusade to involve students from all sorts of different backgrounds who shared a common desire to engage in interesting and challenging mathematics.

At the 1992 IMO a crisis arose. The six problems for the competition had been agreed after a long selection process, marking schemes had been approved and the exam papers printed. It was then discovered, at a very late hour, that one of the six problems had been used in a competition somewhere in the world, which meant it had to be withdrawn. A substitute was therefore needed at very short notice. Tony rose to the occasion and produced a lovely problem based on a curious property of the number 169.

We can write it as

$$13^2, 5^2 + 12^2, 3^2 + 4^2 + 12^2, 2^2 + 4^2 + 7^2 + 10^2, \text{ and so on.}$$

Indeed we can write 169 as the sum of  $k$  squares for any  $k$  from 1 to 155 (by which time most of the squares are 1's). This is as far as we can go. Indeed for any square  $n^2$ , the largest number of squares we can use before we fail for the first time is *at most*  $n^2 - 14$ .

So 169 cleared as many hurdles as possible. Tony's problem asked the competitors to prove that there are infinitely many squares like 169 which clear the maximum number of hurdles. This was Tony at his brilliant best.

In 2019, Tony was one of the so-called Problem Captains. Each of the six problems chosen for the competition was assigned a team of twelve co-ordinators to assess the solutions of the contestants for that problem. Prior to this, the group of twelve had to come up with an agreed marking scheme. Tony was the leader of one of these teams. He was to perform the same role at the 2024 IMO, but sadly that was not to be.

Tony wrote over a dozen books and one that stands out is [1]

*The Mathematical Olympiad Handbook.*

Part of the selection process for the UK IMO team is the two-part British Mathematical Olympiad (BMO). In this book Tony presents all the BMO problems from 1975 to 1996 and follows them with detailed solutions in which the reader has to fill in gaps (with prompts). This is essential reading for those youngsters aspiring to a place on the IMO team. (Subsequently other authors have produced similar books for more recent competitions.)

### *Tony and UKMT*

By the early 1990s, entries for the challenges had soared, follow-up competitions had been introduced for high achievers and the summer schools were going strong. It was decided to set up a body to oversee all these activities. This body was the United Kingdom Mathematics Trust (UKMT) which was founded in 1996 with Tony as one of the original trustees. UKMT took over the running of Tony's two challenges, as well as the National Mathematics Contest (which had been run by the MA since 1961), the latter becoming the Senior Mathematical Challenge. Summer schools and IMO training were also incorporated. UKMT has grown enormously during its first 25 years, with over 700,000 entries to the Junior, Intermediate and Senior Challenges. However, we should not forget that had it not been for Tony's amazing pioneer work, UKMT might never have existed in the form it does now. Tony had rejoined the Board of Trustees in 2022.

### *Tony and the MA*

Tony had a long association with the MA and served on its Council for several years. He was elected President for the session 1997-8.

The version of his Presidential Address which appears in *The Mathematical Gazette* [2] bears the title *The art of knowing* and is prefaced by quotations from, among others, Plato, Francis Bacon and Sir Isaac Newton. So the prospective reader knows in advance that they are in for almost 20 pages of serious stuff. In typical style Tony leaves you in no doubt as to where he stands.

Tony's first article in the *Gazette* appeared in 1981 [3] with the fascinating title *Stamps, coins and beer*. It examined some problems whose solution involves linear diophantine equations. Further articles followed but these were interspersed with a number of Matters for Debate, of which the following one is typical.

*Wrong Way. Go Back!* [4]

The title is immediately arresting, borrowed from signs on American highways telling drivers that they are about to go in the wrong direction down a one-way road. The piece was published in 1995.

A few quotations will give the flavour of Tony's views.

*This article looks back at the last 15 years or so and illustrates the extent to which the current arrangements are failing our more able students.*

*There is a remarkable consensus among those in universities who teach such students that something has gone dramatically wrong, especially over the short timescale of the last six or seven years.*

*School maths in England and Wales is at a crossroads. Our syllabuses now look as though they cover more than they used to. But they cover it far less thoroughly.*

*It is time to admit that recent changes in school mathematics have been implemented before they had been sufficiently well thought through. Hence the title of this Article.*

One can't help feeling that many of Tony's observations are just as valid 30 years later, and not just South of the Border.

Perhaps his most unusual article in the *Gazette* appeared in 2018 [5] and is another example of how he kept in touch with former participants in the various competitions and summer schools. He managed to make contact with all the students who had attended a particular summer school in the mid-1990's (except for one who had sadly passed away). Those participants were by then in their 40s. He listed (anonymously) what had become of each of them in the intervening years. His conclusion was that, *with a suitable programme and follow-up, it is possible effectively to encourage and to support the long-term mathematical development of promising adolescents.*

### *Obituaries*

It is rather poignant that the final two items by Tony in the *Gazette* have been obituaries. The first was for Geoffrey Howson [6]. Geoffrey had

agreed that Tony should write his obituary. The two of them enjoyed a warm professional relationship based on mutual trust and respect. Their respective connections with Southampton may well have been a factor.

The second arose from more unusual circumstances. It has been an MA tradition that Past Presidents are accorded an obituary in the *Gazette*. For some reason, this had failed to happen in the case of Frank Budden who was President in 1982-3. Tony was determined to right this wrong and embarked on in-depth research, in which he was assisted by Chris Tew, a former pupil of Frank. The resulting article appeared as a *Matter for Debate* [7] under the heading *What makes a good maths teacher?* . It makes fascinating reading and shows that Frank was a truly remarkable man, both as a mathematician and as a musician. As noted above, Frank was heavily involved in the IMO in the early days.

Both obituaries represent works of great scholarship and show clearly the esteem in which Tony held both gentlemen.

Tony was also a regular contributor to *Mathematics in School* (MiS). For instance he wrote a four-part series on *Recurring Themes in School Mathematics*. Another article had the eye-catching title *Maths View: Fishy Chips* in which he discussed the effect of the use of calculators and made his views abundantly clear!

As well as writing books, Tony also reviewed many books in both the *Gazette* and *MiS*.

### PSJ

Another connection with the MA is provided by the PSJ or, to give its full title, *Problem Solving Journal for Secondary Students*. This was launched in November 2003 with early editions published by the MA. Tony's name appears as Editor but this is probably an understatement. Contributions from others, apart from Gwyn, were probably very small. PSJ appeared once per term and contained problems

- in two flavours: Easy (E) and Hard (H)
- on three age levels: Junior, Intermediate and Senior.

In a typical issue first came the new E problems, followed by detailed solutions to those in the previous issue, with successful students credited by name. This was followed by one or more Interludes, often of quite a philosophical nature, when Tony addressed such matters as *What is a mathematical problem?*. Then came the H problems and solutions. A typical issue ran to 12 densely packed pages, all typed up by Tony.

It is interesting to note that one of the successful students in the first year of PSJ won a Fields Medal in 2022 ! So PSJ succeeded in identifying exceptional talent.

*Tony the research mathematician*

Having graduated from Southampton, Tony gained an MSc at Warwick and then embarked on a PhD nominally based there. However, as was often the case with Tony, the period of study was unusual in that research was conducted in a variety of different countries. He worked in the areas of group theory and graph theory. Despite the many other things he was doing, throughout his life he tried to get away for a month each summer to do some research, leaving Gwyn to look after the family. The story has been told of the time when he headed off to Canada for a conference only to return a couple of days later. The conference was not until the following year! As my Latin teacher taught us,

*aliquando bonus dormitat Homerus* (sometimes the good Homer nods).

*Tony the family man*

It is likely that many *Gazette* readers who interacted with Tony only did so in a professional context. He held strong views which he expounded with passion, often leading to heated arguments. He could say things that lacked tact and political correctness and he could be difficult to work with. However, although the glass often seemed to be half empty, his aim was always to try to make things better. This was never more so than in his battles over curricula in England and Wales, and related matters.

However, there was another gentler side to him which came across very clearly at the celebration of his life. Tony and Gwyn had five children, all of whom have flourished in their chosen careers. When they were young, Tony would read them bedtime stories, some of which were quite ambitious. All 6 of them would pile into the “big” bed. The idea was to send the children to sleep, but often the opposite happened. Tony fell asleep and the children crept away and put themselves to bed. Now there are 10 grandchildren and Tony was never happier than when he was playing with them (and noticing some of their traits inherited from himself).

Among his other great loves were classical music and gardening. For him there was an optimal way of mowing the lawn, while he lavished great care on the orchard which helped to feed the family of seven. An afternoon at Edgbaston watching cricket was another form of relaxation.

Throughout their married life, Gwyn was a tower of strength to Tony. Apart from looking after their children she has, among other things, acted as hostess to house parties of mathematicians, ranging from team members training for the IMO to groups of markers, stuffed countless envelopes and done lots of proof-reading, for all of which Tony was enormously grateful.

*Conclusion*

Tony had an international reputation for all his achievements. In 1996, by which time Tony was well-known through his role as IMO Team Leader, the World Federation of National Mathematics Competitions presented him

with its prestigious Paul Erdős Award. In 2016 Texas A&M University presented him with its Excellence in Mathematics Education award.

St. Matthew's gospel tells us that

*a prophet is not without honour except in his own country.*

More than a few people feel that Tony was worthy of a Professorship and also that his name should have appeared in a list of Birthday Honours or New Year Honours in recognition of all he had done. He probably rattled too many cages. What cannot be denied is that he has bequeathed a wonderful legacy that will live on for many years to come. Hundreds, if not thousands, of people have had their mathematical lives enriched by him. Tony was one of a kind.

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