



World Federation of National Mathematics Competitions

WFNMC 2006

**22-28 July 2006
Robinson College
Cambridge, UK**

Plenary talks

Saturday 22 July: 20.00

**Petar Kenderov (Bulgarian Academy of Sciences):
WFNMC Presidential Address**

followed by the 2006 Erdős Awards

Sunday 23 July: 16.45

**Robin Wilson (Open University and Gresham Professor of Geometry):
750 years of Cambridge mathematics**

Abstract: In this illustrated talk I shall cover the entire history of Cambridge University in one hour, in the context of the mathematical sciences. Among the people I shall mention are the sixteenth century textbook writer Robert Recorde, the two seventeenth-century Isaacs (Barrow and Newton), and the great mathematical physicists of the nineteenth century, ending with the current Lucasian professor, Stephen Hawking.

Monday 24 July: 16.45

**József Pelikan (Eötvös Loránd University Budapest)
Mathematical training, competitions, research**

Abstract: Training: goal or means? Competitions: a typology. Pros and cons: Erdős' view. The art of choosing competition problems. What should be in a journal? On early specialization. At the university level. The transition to mathematics research.

Tuesday 25 July: 16.45

**Maria Falk de Losada (Antonio Narino University, Colombia)
Creating an olympiad tradition in Colombia: What went right**

Abstract: I shall analyze the strategies and choices, the plans, projects and outcomes, that have enabled Colombia (and several of its neighbours) to create and sustain a tradition of enrichment and competitions that have influenced the educational and mathematical communities and the development of mathematics in Colombia and the region.

Tuesday 25 July: 20.00

**Colin Wright (Solypsis)
The mathematics of juggling**

Abstract: Sit back and enjoy the juggling, while helping to construct a mathematical analysis, or decription, of what it is that you are watching – with "negative" and "imaginary" balls emerging as part of that analysis in a natural way.

Wednesday 26 July: 16.00

Simon Singh:

The mathematics of luck, risk and gambling

Abstract: Are you lucky or just obeying the laws of chance? I will explore the mathematics behind various situations involving luck, risk and coincidence, from the casino to the hospital, from the courtroom to the supernatural. Indeed, our lives are dominated by the laws of chance ... an oxymoron if ever there was one. I will give some examples that illustrate how our intuition often misleads us, and will demonstrate how mathematics and critical thinking can help us live, thrive and survive.

Thursday 27 July: 16.45

Ben Green (University of Cambridge)

Long arithmetic progressions of primes

Friday 28 July: 11.15

Adam McBride (University of Strathclyde)

Problems, problems!

Abstract: A semi-autobiographical stroll through some favourite problems that I have encountered over the years (from primary school to IMO).

Other plenary sessions

Sunday 23 July: 14.00

Team competitions:

**ARML
UKMT**

Tuesday 25 July: 11.15

Forums:

**Charlie Gilderdale (NRICH)
NRICH: A resource for all, made in Cambridge**

**Alexandre Borovik (University of Manchester)
Where do mathematicians come from?**

Thursday 27 July: 11.15

Forums:

**John Webb (University of Cape Town)
Journals and teacher support**

**Andrew Jobbings (UK)
The pitfalls of setting "Olympiad" papers and marking scripts**

Social programme

Saturday 22 July: 14.00 onwards

Maths trail

(including the Caius' College stained glass windows: gather at Gonville and Caius' College Porters' Lodge at 16.55)

Sunday 23 July: 20.00

Meg Gardiner (oboe), Sam Hayes (piano)

A short chamber recital

Monday 24 July onwards:

Wren Library, Trinity College: a display of mathematical items (please wear your conference badge to gain access to the College and to the Library)

Monday 24 July: 14.00

"Visits": Various alternatives (Wren Library & Whipple Science Museum; guided tour of Cambridge; punting; Grantchester walk; Kettle's Yard; Madingley Hall & grounds)

Monday 24 July: 20.00

Francesca Massey (Organ scholar, Caius' College and Manchester Cathedral)

A short (35-40 minute) organ recital and talk

Wednesday 26 July: 17.30

Reception hosted by Trinity College on the Bowling Green

19.45 Conference Dinner (Robinson College)

Thursday 27 July: 14.00

"Visits": Various alternatives (Isaac Newton Institute (14.15 & 15.00) and Centre for Mathematical Sciences, Wren Library & Whipple Science Museum; Fitzwilliam Museum (14.20); punting; Kettle's Yard; Madingley Hall & grounds)

Problem refinement groups

Journals (Teaching Room 2)

John Webb

John Carty; Tony Gardiner; Simon Jock; Rahila Jock; Stan Rabinowitz; Peter Taylor

Team (Teaching Room 4)

Stephen Mulligan

Kerry Burnham; Gwyneth Gardiner; Pam Hunt; Pauline Noble; Stephen Power; Momena Rafiq; Mark Saul;

Popular

Primary (Teaching Room 5)

Peter Bailey

Anthony Carter; Simon Chua; Adam McBride; Walter Mientka

Junior (Auditorium Lounge)

Gregor Dolinar

Steve Adrian; Anne Baker; Pak-Hong Cheung; Susanne Gennow; Joe Holbrook; Kevin McAvaney; Josef Molnar; Nicola Shepherd; J. Bryan Sullivan; Raiili Vilt; Alex Voice

Intermediate (Games Room)

Barry Ferguson

Steven Barge; Andrew Bell; Tildash Bituova; Kathy Cohen; Fiona Dunbar; Petar Kenderov; Alan Nambiar; Keith Noble; Howard Reeves; Bill Richardson; Maurice Starck

Senior (Teaching Room 6)

Harold Reiter

Stephen Blasberg; Krzysztof Ciesielski; Gareth Griffith; Tom Griffiths; Thomas Kilkelly; Matthew Miller; Peter O'Hara; Zhanna Sibley

Olympiad

Junior (Teaching Room A)

Bruce Henry

Dace Bonka; Sergey Dorichenko; Carol Gainall; Howard Groves; Nikolay Konstantinov; Fung Yee Poon; Tatiana Shubin; Wen-Hsien Sun; Julia Thornton

Intermediate (Teaching Room B)

Andrew Jobbings

Agnis Anzans; Inese Berzina; Ivaylo Kortezov; Maria Falk de Losada; David Patrick; Gottfried Perz; Jordan Tabov; Iliana Tzvetkova; Michele Webb; Winnie Wood

Senior (Linnet Room)

Gerry Leversha

Sam O. Ale; Husain Al-Attas; Don Barry; Francisco Bellot-Rosado; Ben Burton; Nigel Daniels; Monther Furaide; Khaled Furati; Robert Geretschläger; Steve Oluwaniyi; Irvine Robinson; Andrei Storzhev

Spare: Jaroslav Svrcek, Daley Thompson, Thomas Masiwa, Jozsef Pelikan,

Brief for Problem refinement groups

Background: These daily sessions lie at the heart of the program. But of all the conference sessions they are the least “programmed”. For the Problem Refinement groups to work, it is essential that delegates enter into them in the intended spirit.

Whether you see yourself primarily as a problem creator, or a marker, or an administrator or just a competition consumer, it is clear that the success of any competition structure depends on “good problems”, and on developing a coherent philosophy concerning what constitutes a “good problem”. The question of “What constitutes a good problem?” can only be addressed by working with particular problems. *But one also needs to know the target population:* a particular question may have all the features of a wonderful problem, yet be hard to use in a particular country - either because it is too familiar, or because it is out of reach of most of the target group. So we need to identify “underlying principles” that apply in different contexts.

Some delegates may be unenthusiastic about “inventing” or “adapting” problems. But it is important for all of us to struggle with the question of “What are we trying to achieve? And what kind of problems help us to achieve this goal?”. There may be no universal answers, since delegates work in very different contexts. Thus, while ideas may begin to converge by the end of the week, it is unlikely that any group will achieve unanimity. However, the Problem Refinement Groups provide an opportunity to work with other delegates to reflect on such questions, and to discover that we all have, or can develop, an ability to “tweak” ordinary questions to create much improved problems. *Hence we urge all delegates to attend, to contribute to, and to learn from these sessions as best they can.*

Starting point: Each day each group will be provided with its “seed-corn” – a set of 5+ problems, which serve as a starting point. The given problems should in no sense be seen as “ideal”: indeed, many of them are being used precisely because they are “rejects” (that is, reasonable problems which have been proposed, but not been used for some reason). You should use the given problems as raw material – as a springboard for your individual and collective imagination.

There is no need for groups to be restricted by the given problems. However, we suggest that each group should start each day by working *in pairs* on the given problems, one at a time; to find ways of tweaking each given problem to make it “better”, or “more interesting”; and then to use the resulting refinements as the basis for an on-going discussion as to what these words (“better”, “more interesting”, etc.) mean.

Once you have extracted what you can from “tweaking” the given problems, you are welcome to use the given problems in a looser way to inspire more creative thoughts about more serious variations or alternatives.

Goal: At the end of each morning session, each group is expected to produce a list of what the group judges to be a selection of “the best five” variations which the group has produced that morning (“best” that is for the *user*, not just for the problem enthusiast). The list should be headed with your group name (e.g. “Popular Primary”) and the “problem type” considered that day – if there is such a descriptor (e.g. “Geometry”, or “Junior H-type”).

These lists will be posted each day for others to enjoy, and will (we hope) be collected and circulated to delegates after the conference.

Delegates' presentations

Sunday 23 July: 11.15-12.45

Auditorium Don Barry: *The ARML contest: Power, team and individual rounds*
I will illustrate three of the key ingredients in ARML – a team competition for senior high schools: the Power Question, the team round, and the individual rounds.

Misael Fisico: *The Mathematics Field Day in the Santa Clara Valley*
I shall describe this competition for middle and high school students (grades 6-12) that complements existing provision.

Dace Bonka: *The mathematical content of junior competitions in Latvia*
Mathematics competitions in Latvia are of a high standard. The problems are balanced between areas, discrete/continuous, deductive/algorithmic, prove/calculate/construct, easy/medium/hard. We elaborate and illustrate features of a classification.

Monday 24 July: 11.15-12.45

Auditorium Tom Griffiths: *MathChallenge@Western*
MathChallenge is for students who enjoy mathematics and who may wish to work at olympiad level. It has just completed its tenth year, with a registration this year of 320 students, eight teachers (from elementary to university level) teaching in six different classes from age 8 to age 18.

Tatiana Shubin: *Math circles for students and teachers*
Students may discover real mathematics through involvement in competitions. Many more, even gifted students, do not at first respond to a competitive environment. Math circles serve both groups. I describe the San Jose Math Circle, now in its 8th year, and the promising concept of “math circles for teachers”. We discuss how these activities complement each other.

Joe Holbrook: *Build a better math trap.*
This is the story of a high school 200 member math team based on a Grade 9-12 population of 400. They were the 2005 US AMC Champions, won the Mandelbrot Competition in 2004-6, placed students in the USA olympiad squad for the past three years, with an IMO Silver medallist in 2005. Our goal is to find, nurture, sustain and develop talent over an extended period – starting in grade 4.

Tuesday 25 July: 14.00-16.15

Auditorium Steve Blasberg: *A hybrid - the American Invitational Math exam (AIME)*
AIME is technically close to “multiple-choice”, but the questions have an “olympiad” feel to them. I give a brief description of the contest and present some problems from past competitions.

Sergey Dorichenko: *Mathematics circles*

I describe some Moscow high school "Math Circles": How do they attract students? What are the goals? What topics are covered? How are the problems chosen? Etc.

David Patrick: *Building an internet problem solving community*

I give background to building our internet portal for students & teachers from around the world – including an on-line problem discussion forum with nearly 20 000 members and 450 000 messages, Worldwide Online Olympiad Training (WOOT), and the USA Math Talent Search.

Nikolay Konstantinov: *The distant study group (or math circle) of Kvant*

The editorial board of Kvant has a program to allow subscribers with less experience to learn to solve simple problems. This is the "distant study group (or math circle) of Kvant". Participation has recently grown. Questions are grouped by topic and by difficulty: we give examples.

Garden Room Petar Kenderov 10: *MATHEU – a project to support high ability students*

I will give a brief description of MATHEU - an EU-project which has generated interesting materials intended to stimulate and encourage able students.

Maurice Starck 20: *An unexpected happy end for Soddy's "kissing circles"*

I describe a procedure for generating the sequence of circles in Soddy's famous theorem. This is extended to "kissing spheres"

Krzysztof Ciesielski 20: *An unusual form of competition*

I describe a test used as the entrance examination for the Jagiellonian University, that produced some surprising results, and that could be used as a new kind of competition.

Wednesday 26 July: 11.15-12.15

Auditorium Ben Burton: *Informatics olympiads: mathematics through code*

The IOI is the second largest of the science olympiads. Students solve algorithmic tasks by writing computer programs: in a sense these are like mathematics olympiad problems in which students communicate their solutions by *writing code instead of proofs*. We explain how informatics olympiad problems are structured; we then focus on a discussion of the mathematics that underlies them and on the benefits and challenges of expressing mathematics through code.

Inese Berzina: *The evolution of algorithmic problems in competitions*

Algorithms are central to modern applications of mathematics. We consider six aspects of algorithms – the application and analysis of an algorithm, its development and optimization, proving the correctness or non-existence of an algorithm. We also give examples of problems linked to: non-deterministic algorithms, probabilistic algorithms, parallel algorithms and algorithms dealing with incomplete information.

Garden Room Alexander Soifer 60: *Imagining the real, realizing the imaginary: the choice in mathematics*

"Despite initial widespread distrust, today the vast majority of mathematicians accept the axiom [of Choice, and so accept ZFC] without hesitation and utilize it in algebra, analysis, logic, set theory, and topology" (G. Moore). Is this a good thing? In a series of 2003-2005 papers, Saharon Shelah and I constructed graphs whose chromatic number is finite and small in ZFC and infinite uncountable (if exists) in the alternative Robert Solovay system of axioms that includes ZF, DC (Dependent Choices) and in which every set of reals has length (Lebesgue measure). What are we to conclude? "In set theory, as in geometry, all axiomatic systems are not equal. Thinking carefully about their meaning and the consequences of each one of them, and asking ourselves (as it is done in geometry) what the particular usefulness of this or that axiom is in expressing and addressing issues of mathematical physics, may be relevant once again and could lead to a revolution of set theories, similar to the revolution in non-Euclidean geometries." (J-P Delahaye). I shall present our work in the light of such remarks.

Wednesday 26 July: 12.20

Auditorium WFNMC Business Meeting

Wednesday 26 July: 14.00-15.30

Auditorium Simon Chua 20: *My work in the Philippines*

Harold Reiter 20: *The Michigan MATH Challenge*

The Michigan Autumn Take Home challenge is a team event for undergraduates. Teams of two or three have 3 hours to tackle 10 problems dealing with topics in the undergraduate curriculum. I discuss some of the 2005 problems.

Jaroslav Svrček 20: *On two similar problems of the Czech Olympiad 2006*

I present two interesting graduated problems on systems of trigonometric cyclic equations and analyse student solutions.

Agnis Anzans: *The "Baltic Way" competition: history, lessons, influences*

This event started in 1990 for countries round the Baltic Sea (and Iceland). Teams of 5 students may cooperate in any way they choose during the allocated time and present one solution for each of 20 problems. The standard is between the IMO and national olympiads. We give details and share materials.