Meet the people shaping the future of science

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The numbers game

Why are there so few women mathematicians? *Ragni Piene*, a Norwegian who recently became the first woman to join the executive of the International Mathematical Union, says the problem is sociological. Girls, she tells *Stephen Battersby*, are rarely encouraged in mathematics and have no role models

Photo: Marcel Leliënhof

Isn't it startling that no woman had ever been appointed to the top body in mathematics?

It's shocking. There have been lots of qualified women.

But people often say that men have more mathematical brains.

I used to get upset at that. I would say it was all to do with how people are taught, the paths they are encouraged to follow, and what kind of things they play with.

Early on, girls do as well as boys in geometrical tests. But then they lose interest. One explanation has been that boys played with geometric toys like Meccano erector sets and Lego, whereas girls get given dolls and other toys. So, the argument runs, girls do not develop the same ability for visualising objects. As I recall it, when girls are made to play more "constructive" games, their performance in geometry tests improves. Is the difference caused by their playing with different things? Or do they play with different things because their brains are different? Or does something happen to girls as they get older to make them lose interest in mathematics. Now I'm not so sure.

Whatever, the differences are not so great that they would affect the number of female mathematicians. These are small differences in mean test scores - whereas variations within both the male population and the female population is enormous. One shouldn't promote the idea that women are so different that geometry is difficult for us. If you tell women, "it's OK that mathematics is difficult for you", some actually believe it. I don't see why it should be an excuse.

So the lack of women in mathematics is a sociological problem?

I think so. Of course there are women who do not want to do much mathematics, and maybe some who should not. But the same is true for many men. It's better to encourage women to do it than not.

How would you do that?

You have to begin at the beginning, and make sure that you give real equal opportunities. Girls should get the same encouragement as boys, from an early stage. We also need role models. You might know that you don't need to be a man to do mathematics - but if you see only men doing it, then you get the idea that it would be strange to be a woman doing it. It's hard, though, to increase the visibility of women in times like these. Mathematics departments are being cut down. They're hiring fewer people instead of hiring more.

In the UK, women make up 38 per cent of mathematics undergraduates, but only about 2 per cent of full professors.

You see that in any field where things are changing fast. In Norway, more than half the medical students are female - but of course they are not yet professors. In mathematics and physics the change seems to be much slower. That's harder to explain.

It may be something particular to appointments to top jobs. For example, around half the people in Norwegian politics are women. We vote for party lists rather than constituency candidates. The more votes a list gets, the more of the people on it get into Parliament. I think 80 per cent of these lists have a male candidate at the top. The parties may claim that women don't want that top place. Maybe in some cases the women aren't asked at all. It is just assumed that if they were asked they would say no. We shouldn't be naive about the power position.

Could that be happening in mathematics?

There are a lot of women who would have said yes, had their colleagues proposed them for the International Mathematical Union (IMU) executive committee. But not many national organisations have proposed women. There is more concern about geographical balance than gender balance. You have to find a country willing to propose a woman.

Why were you proposed?

I was proposed by the Nordic countries. For the past 8 years there has been a Swede on the committee, so Sweden felt it was fair to have someone from Denmark or Norway. I don't know whether they thought a woman might have a better chance. But the Norwegian chair did think that having a Norwegian on the committee would be useful in setting up the Abel prize, which was awarded for the first time this year.

What's your connection with the prize?

I was in a group that worked to establish it. We met with government ministers and lobbied in Parliament. We heard nothing until the prime minister gave a speech as part of his election campaign and announced that the government had decided to create the prize. We had asked for about ¤20 million, which we thought would be enough for a prize as big as the Nobels. But the prime minister said it wouldn't be enough, and gave us ¤25 million.

You are known for your work in algebraic geometry. Can you give us a flavour of that?

If you want it very down to earth, it has to do with solving polynomial equations…

How about even more down to earth than that?

Say you have two unknowns x and y, and x^2 plus y^2 equals 1. Plot points satisfying that equation, and you get a circle - a geometrical figure. Generally, the solutions of such equations give you geometric objects. You have a deep and subtle interconnection between algebra and geometry.

Much of my work is in enumerative algebraic geometry - that is, counting geometrical objects. For example, if you draw three circles in a plane you can ask how many other circles you can draw that touch all three. The answer is eight, and it was worked out by Apollonius, an ancient Greek mathematician.

This kind of question came up again in the 19th century, and yet again about 15 years ago when theoretical physicists started exploring string theory, in which particles are strings and not points.

Developing their mathematical models meant counting algebraic objects - for example, the possible configurations of loops of string in variously dimensioned spaces.

But my mathematics is not physics. I'm just doing algebraic geometry, and it's mainly interesting from a mathematical point of view.

What kind of mind do you need to grapple with this?

You need to have a way of visualising it. In most of what we do we can't really visualise because the solutions aren't in ordinary three-dimensional space, but you need to imagine that you can see things.

Do you know why you became a mathematician?

My father was a mathematician and a very enthusiastic teacher. When he became head of a teachers' college here he was always testing his ideas on me and my brother. While skiing we would play with equations in the snow. It became a game. Also later on I had some excellent teachers at high school.

But I didn't really know I was going to be a mathematician. I started studying it at university by default. I was thinking about other things - archaeology, or languages - but it seemed easier just to start on mathematics. And then I was stuck.

And what attracted you to algebraic geometry?

I started studying it while I was a student for a year in Paris, and this was the big thing in France. Also it was really fun mathematics. I like things to be exact, and algebra is exact mathematics. And I've always liked geometry since high school. We did a lot of drawings - old-fashioned projective geometry. I always found that fascinating. So it was the mixture of the visualisation and the rigour of algebra. It's a nice field - you should try it.

Now that you have broken into the IMU, what bastions are still to be stormed?

I really hope that during my lifetime I'll see a woman get a Fields medal for her mathematical work. That would show that things are changing.

Do you think it will happen?

I used to say "yes, of course", but now I'm less certain. In some places, things are going backwards. In France, for example, I fear that 10 years from now there will be far fewer women mathematicians. They have these élite universities, *les écoles normales supérieures*. They recruit the best students and give them wonderful teachers, good conditions, extra money and everything: and most top French mathematicians come from these schools. They used to have separate intakes for boys and girls: as many men were admitted as women and the women did great. But in 1985 they started to have a joint intake. This year, of the 39 people entering the mathematics programme in Paris, only one is a woman.

Why?

It's hard to explain. Maybe it's a psychological thing - that if women have to compete with boys then suddenly they don't do as well as if they are only competing among themselves.

Could this be a lesson for other countries?

For some. In Norway, schools were integrated so long ago it's hard to

start separating groups. In the UK, the tradition of having separate schools may make it easier.

Do you have any similar problems at the University of Oslo?

Some of our men students have this attitude that mathematics is something so special, that you have to be particularly adept - and you have to think about mathematics day and night, otherwise you are not really serious. Some of the women think about things other than mathematics sometimes, so they wonder whether they can be as serious as the men. Sometimes women have less self-confidence than men. But there are all kinds of individual variations.

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