

**REPORT BY THE PEERS**  
**VISIT TO THE FACULTY OF MATHEMATICS**  
**UNIVERSITY OF VIENNA**  
**14-16 JUNE 2010**

Pekka Neittaanmaki

Gilles Pisier

Dan Segal

Gilbert Strang (Coordinator)

Contents:

- **Introduction**
- **Overall Issues A-F**
- **Teacher Preparation and Student Facilities**
- **Bachelor's and Master's Program**
- **Doctoral Program and Faculty Governance**

**Introduction**

The University of Vienna has a very strong and active Faculty of Mathematics. It becomes steadily and rapidly stronger and it is moving to an importance that goes far outside Austria. This is the result of excellent work by the entire Faculty and its Dean, and very significant support from the Rektorat for new professorships.

These facts made it a pleasure for the Peers to visit the Faculty, where we received an extremely warm welcome. We feel that we learned very much and we have ideas to express. Often these are suggestions to make the work more effective (teaching as well as research). Everyone should understand that we think about the Faculty very favorably, and our purpose in these suggestions is to help make it successful in all ways.

Some of these suggestions are not in the power of the Faculty to execute. Changes outside the Faculty would be needed, even changes in the law. We still include these suggestions.

Other ideas in these pages can be proposed for direct action. Always this needs colleagues who are willing to put the 'good of the whole' as high priority. We saw much evidence to encourage us in this outward-looking, open-minded direction. We are very optimistic.

To mention one of our ideas on this opening page (and the last page), we looked for a practical way to allow the Faculty to share in planning and implementing future decisions. The Dean has done an exceptional job, and his success has made possible the Faculty's success. With changes coming in the future, we think an executive committee that has representatives from all levels within the Faculty could help that success to continue.

Here are collected our thoughts and hopes for the Faculty. They are not in any mathematical order!

## A

### Career structure and role of professors

There seems to be noticeable dissatisfaction among faculty members below the level of full professor. This is related to two separate but connected issues.

#### 1. Career structure of junior staff

Junior faculty members have no job security. Many positions have a fixed 6-year time limit, which is bad not only for the occupier of the position but also for the department which needs the position filled and has to find a replacement candidate, whether or not the current incumbent is performing well. As a result many of these people feel demoralized (at least one has resigned in despair after years of uncertainty about his future).

Most of the junior positions seem to be dependent on external grants obtained by the various research groups within the faculty. This cannot be compatible with sensible long-term planning of faculty structure.

Proposal: the faculty should create a number of tenure-track positions at assistant-professor level. This will

- \* help to maintain/improve the long-term balance of the faculty in terms of age and experience
- \* ensure that excellent young scientists will be attracted to the University of Vienna as a realistic career option
- \* allow junior staff to feel secure and well-motivated. As long as they perform well they can be confident of a long-term position.

This will also have advantages from the point of view of raising the Vienna faculty's research profile. There is a world-wide shortage of good job opportunities for young academic mathematicians, and Vienna is in a good position to make a number of such opportunities available. If they are sufficiently attractive (in terms of longer-term career development prospects) they will bring in rising stars who will be the big names of the future. The strength of a department often depends heavily on professors whose long-term work, in fact their lifework, is inside the department.

## 2. Promotions to full professor.

This is a different issue. A number of distinguished senior faculty members are associate professors. It seems difficult if not impossible for them to be promoted to full professor within the faculty, and some discontent has been expressed regarding the situation.

Compared with Germany, for example, the number of top-class universities in Austria where a professor might receive a 'Ruf' is rather small. In view of this it would be reasonable to enable the occasional promotion of an associate professor to a full professor. This would be a 'personal chair' in the British sense. This need not happen very often: but it could be used to rectify obvious anomalies in cases where the most senior and internationally distinguished leader of a research group within the faculty is not a full professor.

The existence of this possibility would also help to make early-career tenure-track positions more attractive to future star mathematicians (who on the present system might feel 'there is no point getting on the career ladder in Vienna since it leads nowhere').

It has been suggested that there is not a level playing field when internal candidates apply for a full professorship in competition with outside candidates. We have no way of knowing if this is true. If there is a bias against internal candidates it is wrong. If there is no such bias the perception is nonetheless there and has a bad effect on morale.

The situation would in any case be much improved if there were less of a sharp distinction between the roles of full professor and associate professor: for example

- \* faculty decision-making can be more widely shared, not restricted to the narrow clique of full professors;

- \* secretarial and other support should be equally available to all faculty members on the basis of need, not on the basis of status.

- \* The salary differential may be too high. In the UK for example the ratio (professor's salary) : (reader's salary) does not usually exceed 3:2.

## B

### Doctoral studies funding

Before taking on a PhD student, the intending supervisor has to prepare a project and submit it for a grant to an outside agency. This is not a suitable procedure especially in the case of Pure Mathematics. Mathematics does not advance by 'projects' as if it were an experimental science or engineering. Usually, a beginning doctoral student is given a number of subject-areas and suggested problem areas to explore; she or he then gradually focuses on a specific topic where s/he feels able to begin making a contribution. It is a gradually developing process of education in research methods and strategy. In the most successful cases it leads to significant research output.

A better system is for the department to have a certain number of PhD positions available each year, and offer these to suitably qualified students. The funding should be independent of any specific 'project'. The *source* of the funding is a separate question: possibilities include

- \* faculty money set aside for the purpose
- \* 'Graduate college' for Vienna, perhaps joint with other institutions such as TU
- \* 'Teaching assistantships'. A graduate student could be paid to assist with the teaching of undergraduates, for example taking part in problem classes or marking students' written exercises. This system has the added benefit of providing graduate students with valuable hands-on teaching experience, which is necessary before they can be appointed to a full-time assistant or associate professor position with serious teaching responsibilities.

## C

### Secretarial support

This seems to be in short supply in all areas of activity, resulting in an additional heavy non-academic workload for academics whose professional skills could be put to better use.

This is particularly evident in the management of practical matters connected with PhD students from abroad. We will include recommendations to establish a post, shared with other faculties, to help international students and visitors.

## D

### Bachelor degree curriculum (short comments)

It is regrettable that the bachelor course allows no options beyond the stark binary choice of 'scientific' vs 'vocational'. We hope that more flexibility can be introduced, at least by offering three or four further

options in the third year. There is no (theoretical) reason why a student should not learn (for example) topology, group theory or number theory in place of (for example) logic, differential equations or functional analysis. In an area like Mathematical Biology, the student already needs to learn a completely different science! Choice is usual in other countries. It also used to be allowed in Vienna under the Diploma system: the reaction against that system has perhaps been too extreme, in the nearly complete removal of options.

## E

### Research profile

The recent expansion in Applied Mathematics seems very fruitful. Several research groups are showing impressive dynamism and productivity. The large number of grants from various sources, and of individual prizes, is evidence of their success.

It is important at the same time not to lose the faculty's traditional pre-eminence in Pure Mathematics. A strong appointment in (algebraic) topology would enhance the profile. A further appointment in algebra more on the algebraic/arithmetical geometry side would complement the already strong group in algebra/arithmetical.

As remarked elsewhere, it would be desirable to establish several new permanent (or potentially permanent) positions below full professor level, thereby building for the future and attracting top quality mathematicians at an early stage of their careers.

## F

### Good points

#### teaching

- \* The first-semester introductory course to university mathematics
- \* Personal attention to students in pro-Seminars etc.

#### research

- \* High academic profile of many faculty members (examples - director of ESI, management committee of MF Oberwolfach; similar activities on the applied side; editors of many journals; prizes and invitations to speak at the ICM; research collaborations with world leaders such as Kontsevich.
- \* Goedel centre: this is one of the world's major centres for mathematical logic. Attracts leading visitors from all sides of the subject. Very successful in attracting grants for doctoral students and post-doctoral research positions.

## **Teacher Preparation and Student Facilities**

### First year studies

The drop-out rate of students is relatively high. From many students who enter, only 30-40% continue after the first year, and most of them are students of teacher education. The numbers of dropouts are simply too high. Moreover, the output of Master's and PhD degrees is low in comparison with the resources (17 professors, 21 associate professors, 21 assistant professors, and other teachers).

A tutor system, plus improvements for the motivation and guidance of students, and career planning as well as new teaching methods (e.g splitting students into 2-3 groups) should be implemented. Moreover, it would be beneficial to inform the students about career possibilities as mathematicians and researchers of the department as well as to give already first-year students more possibilities to meet professors involved in research.

There are several activities (and possibilities) in schools to spread information about mathematics in society. These efforts should be increased.

### Student facilities

In planning the move to new buildings, students' group work in Bachelor's, Master's and PhD level should be taken into account. Moreover, Master's and PhD students should guide younger students in student working spaces in order to achieve a common family-like atmosphere.

### Teacher education

About two thirds of the students finishing a Master's degree graduate with a degree from teacher education. There will be an increase in the demand for these teachers because of the retirement of school teachers. Therefore, the volume should be increased. Resources should be allocated to teacher education accordingly.

The group is very active in collaboration with schools, editing school books, and doing research in the field.

There should be a possibility also for teachers to complete PhD theses and to do habilitation work. A special national graduate school could be organized for teachers having at least 2-3 years of teaching experience. There are very good experiences in Finland about research-oriented teachers: many of them develop their teaching methods, measure the impact, publish research papers and then publish the overall results as PhD theses.

---

## **Bachelor's and Master's Program**

The desirability of more students at all levels is widely agreed by the Faculty. There are several connected issues in this direction. Here are four subheads:

- 1) Attracting students as they leave school and enter the university.
  - 2) The program at the start of their studies
  - 3) The complete Bachelor's program and requirements
  - 4) Future Master's programs in named areas of strength to attract students in those specific areas.
- 

1) The didactics team is working hard, within their limited size, to develop good contacts with schools and teachers. The Faculty website could be upgraded in attractiveness—it should have a welcoming as well as an informative purpose for prospective new students. Outreach is important, and several faculty have done a lot.

2) Very essential work is now being done to introduce new students to the big step from school mathematics to university mathematics—a big change in level and in approach. A book was created and published to present this early material. Special attention is absolutely needed here: It sets the whole tone for courses to come and for student decisions. This opening course must be cared for by the faculty.

It is understood that a fairly large number will drop out early because of the system. Many should drop out, they do not know what university mathematics is and were not prepared. But there is a large second group—deciding to continue or to quit. They need encouragement to continue!

Even if these are not 'natural mathematicians' who will be the top students, still they have selected mathematics and the Faculty must help them to develop and not to quit. The program of studies ahead of them will strongly influence their decision and this is discussed in the next paragraphs.

3) It was a big effort to obtain Faculty agreement on a unified program. Now it is a very big work for the Dean of Studies to administer this program. It is natural that this program will continue to change and evolve! There will be evolution in the formulation of program content, and in the day-to-day teaching decisions. And also evolution in the administration of the program by the Dean of Studies, which is so central to the Faculty's work.

The Peers suggest that the program continue to develop greater flexibility. Many universities have found that as mathematics develops, there is no longer a single sequence like algebra-analysis-geometry that extends all the way to the end of Bachelor's studies. This is three years only, but already in that time choice is needed. We think more choice is naturally coming in the program and can be carefully welcomed.

Actually the administration of the study program is a very large job, and Professor Cap needs one or probably two other Faculty members to join him. They will give representation to more fields of mathematics. We hope and believe in the direction of more options. There must be open discussion of the evolving program, not expecting a radical change but definitely to evolve in a way that will **\*\*attract and retain more students.\*\***

4) For Master's programs in specific areas we see advantages and disadvantages. Computational Sciences is a proposal already made—it seems to us attractive.

**\*\*We strongly support the viewpoint of Dean Rindler and the Faculty that mathematics is one organic subject.\*\*** It is a world of ideas and methods that grows and changes with time, and still keeps its unity. Let us keep centrifugal force << centripetal force.

A good Master's program in a specific and active area can attract students—this is a result desirable for all. Vienna is already famous in areas like logic. Part of the reason is visibility. New areas must have the possibility to become visible also. On balance, we encourage groups of faculty to attract new groups of students—and 'program identity' is realistically important to provide a focus for this attraction.

### **Notes on Organization**

We have observed several somewhat old-fashioned, hierarchical traditions which should be reorganized. Several formal decisions are made on senate level (curriculum etc), whereas faculty-level decision is appropriate in many cases. The teacher system is too hierarchical, and the salary and the duties are not in balance. Teaching duties among professors vary greatly. There should be real team organization.

The names of positions are confusing, and eventually the system should be renewed according to international standards. We did not get a clear report on how recommendations of previous evaluations have been taken into account, apart from some new positions.

Computational sciences

There are excellent possibilities to create international-level research, as well as PhD and Master's level programmes in applied mathematics and computational sciences. The programme should be based on

rigorous mathematical research and education, and it should have a different profile than the scientific computing programme in UW or the computational engineering programme of TUW.

### **Doctoral Program and Faculty Governance**

There has been a suggestion to organize PhD students into teams that would work on the same project or similar themes. While it is certainly a good idea to structure their work into groups it would be an error to try to create complete groups in advance and to recruit the members all at the same time. Indeed, it is much better to have a "roll over" structure with the more senior participants teaching the newcomers as they join the project. The funding of PhD students is being done mainly using soft money coming from outside grants. Because of this, the principal investigators have to plan ahead their recruiting, with little margin for adjustment (there are serious difficulties when suddenly a very good applicant appears past the usual deadlines). We suggest the creation of a "back up" fund at the department level that would be designed to support PhD students for certain limited periods, allowing the professors in charge more time to gather complementary support from other sources. This will allow the recruitment of PhD students that otherwise would have to be turned down for lack of an adequate support plan. Of course, the students and the corresponding projects would have to be carefully selected by the department.

In general, it seems that little help is available from the University staff to help with practical problems related to the recruitment of foreign PhD students and visitors (e.g. visa problems, lodging and so on). This certainly could be improved if a member of the office staff had this in his/her responsibilities. Maybe an office for international students and visitors shared by 3 or 4 faculties would solve this problem. If such an office already exists at the university, apparently it is not sufficiently effective or sufficiently known among faculty members.

The peers have observed a general sentiment of frustration among associate professors for various reasons. Of course one main point quoted was the quasi-impossibility for promotion to Full-professorship, even though many of them definitely would well deserve such a promotion. But, besides that, the peers believe that the situation and the morale of this group could be improved by much more consultation with them! Perhaps they could elect representatives that would report to the Dean, perhaps another form of consultation would be more suitable. The impression that only the opinion of full professors counts definitely should be counterbalanced by doing more consulting with the other professors.