

**UNIVERSITY OF DUBLIN
TRINITY COLLEGE**



PROVOST'S REPORT TO COUNCIL ON THE REVIEW OF THE SCHOOL OF CHEMISTRY

1. INTRODUCTION

This report presents the outcome of a review of the School of Chemistry. An external peer review visitation was undertaken on the 19th & 20th of November 2007 by Dr Simon Campbell (former President of the Royal Society of Chemistry), Professor Edwin Constable (University of Basel, Inorganic Chemistry), Professor David Leigh (University of Edinburgh, Organic Chemistry) and Professor Neil Allan (University of Bristol, Physical Chemistry). The internal member of the review team was Professor Alan Matthews, School of Economics, Trinity College Dublin.

The report is based on (i) feedback from the external Reviewers received on the 4th February 2008 and (ii) a submission from the School of Chemistry received on the 22nd February 2008.

The main purpose of the School review is (a) to provide a structured opportunity for the School to reflect on its activities and plans for development, while benefiting from a constructive commentary by senior colleagues external to College; (b) to ensure that quality and standards in teaching, research and administration are being maintained and enhanced; and (c) to ensure that areas of concern in this regard are identified and addressed within an eighteen month timescale. This review process ensures that each School/Aspirant School in College is reviewed systematically once every seven years. The School of Chemistry was last reviewed in April 1999.

2. OVERVIEW OF THE SCHOOL

2.1 Aims and Objectives of the School

The School of Chemistry aims to enhance its existing status as an internationally competitive teaching and research centre. It will continue to develop strategic areas of research at the frontiers of the subject including Medicinal, Organic, Materials and Computational Chemistry. The School aims to promote the advancement and learning of the subject of Chemistry at all levels. It also aims to take a lead role in College, and at national and international levels to further sustain and grow a competitive technological knowledge-based economy.

2.2 Programmes to which the School provides teaching

- Moderatorship in Chemistry
- Moderatorship in Medicinal Chemistry
- Moderatorship in Chemistry with Molecular Modelling
- Moderatorship in Physics and Chemistry of Advanced Materials

In addition, the School provides courses in Chemistry to other Science students and to students of Engineering, Physiotherapy, Radiation Therapy and Dental Science.

2.3 Research

The School's research activities are broadly described as consisting of three main research areas/clusters.

- The synthesis of novel organic and inorganic compounds, which also includes the synthesis of new materials and nanomaterials, and investigations of their potential applications.

- The development of detection and measurement techniques (including the application of electrochemical and fluorescence methodologies).
- The application and development of predictive and modelling computational methods.

2.4 Summary Statistical Profile of the School for the Academic Year 2006/07¹

Full-time Staff FTE	Undergraduate FTE	Postgraduate FTE	School Staff:Student Ratio	Faculty Staff:Student
18	296.37	380.37	19:1	14

¹ Figures from Senior Lecturer's Annual Report approved by Council at its meeting on 5th December 2007.

2.5 Accommodation and Facilities (Physical Resources)

The School occupies ca. 4150m² which is divided between six buildings – the Main Chemistry Building, Cocker Laboratories, the SNIAM Building, the Lloyd Building, the CRANN Building and Oriel House.

The Main Chemistry Building is occupied by the offices and research laboratories of eight academic staff members, the School's Central Office, offices of the Head of School and the Chief Technician, two lecture theatres, one meeting room, three instrumentation areas and several smaller rooms for technical staff. The research area includes four modern synthetic research laboratories. There is also a small seminar room equipped with state-of-the-art projection facilities, several write-up rooms for postgraduate students and two general instrumentation rooms situated in the basement of the building. *The Cocker Laboratories* host the undergraduate synthetic laboratories and preparation rooms and offices for technical staff. *The SNIAM Building* houses the offices and research facilities of five academic staff members, write-up rooms and small instrumentation rooms. Additionally, all practical courses in Physical Chemistry and Materials Chemistry are taught in the SNIAM Building. The building accommodates the School's chemical store and glass-blowing workshop, and some of the x-ray crystallographic and mass spectrometry facility. *The Lloyd Building* accommodates three academic staff in the Physical Chemistry area, the postgraduate course co-ordinator and the Trinity Centre for High Performance Computing (CHPC). The CRANN Building provides research and some office space for two Principal Investigators (PIs) from the School of Chemistry and also includes the research laboratory of Professor Boland, and his research and administrative offices.

3. EXTERNAL PEER REVIEW REPORT

SUMMARY OF REPORT

The Reviewers begin their report by stating that *"The School of Chemistry at Trinity College is the foremost centre in Ireland and has made significant advances since the last review through increases in research active staff, postgraduate numbers, publications and research income and in bringing teaching and research facilities up to modern standards."* They also note that *"particular progress has been made in the conversion of short-term positions to permanent contracts."* Notwithstanding this progress, the Reviewers feel that the School faces significant issues with regard to availability of space and the relationship between the School and CRANN. They strongly urge the School and the College to come together to define the value of Chemistry within the College Strategic Plan and to agree plans for the future development of this School, which they feel are critical *"if the School is to retain its National pre-eminence and its international credibility."*

TEACHING

The Reviewers note that while undergraduate student numbers and entry points appear to have been maintained, *"there are still worries over attracting the best students to science and chemistry"*. There is a need, they feel, for improved marketing of Chemistry within the Moderatorship programme as there is a low conversion rate to Chemistry in year 3, and they highlight the lower points requirements for Physics and Chemistry of Advanced Materials and the low uptake of the Moderatorship in

Chemistry and Molecular Modeling as cause for concern. The Reviewers suggest that a fall in the number of 1st and 2.1 degrees in Chemistry may be an issue of concern for the future and recommend that *“the School and College...address the question of degree result versus entry level qualifications with urgency.”* In addition, they note that *“the mathematical ability of incoming students gives increasing cause for concern.”*

The Reviewers report that undergraduate comments regarding course notes, tutorials and access to staff are generally positive but suggest that *“feedback on written work could be improved.”* They also advise that health and safety standards should be improved overall.

With regard to the undergraduate curriculum, the Reviewers note that staff have *“resisted the temptation to avoid areas of the subject that students perceive as difficult”* and note that *“model answers are rated highly, marking is fair and there is a high standard of pastoral care.”* They recommend that best practice in the EU should be assessed to aid in assigning ECTS credits to courses in years 3 and 4. The Reviewers commend the existing outreach activities but suggest that they should be expanded given the reduced interest in science at second level and the need to increase the numbers taking mainline Chemistry. They recommend assessing best practice from UK initiatives such as the Royal Society of Chemistry’s ‘*Chemistry for our Future*’ programme, and lobbying government and funding agencies for increased investment in science. Interaction with industry should be strengthened and out placements should be reviewed in terms of opportunities and credits. They suggest that issues such as improved access, inclusiveness, diversity and e-learning should be reviewed.

RESEARCH

The Reviewers commend the School on the progress that has been made over the past 5 years in terms of increasing the number of postgraduate students, research publications and research funding to the School. They advise, however, that *“space constraints are impeding applications for large grants that require additional postgraduate students, and the recruitment of international stars.”* The Reviewers note that *“there is a solid core of international researchers, some of whom should be promoted to full professor,”* and that there is also a *“research tail”* which must be critically addressed. They note that *“internationally rated staff carry similar teaching loads to those less active”* and suggest that *“mechanisms to address rewards and performance improvement should be developed.”* The Reviewers note that there are a number of highly active mid-career members of staff who need to be nurtured if they are to be retained in College. In addition, they feel that *“the appointment of high-level, internationally known candidates is critical”* if the School is to retain its national pre-eminence. The Reviewers state that *“the College and School do not appear to offer competitive start-up packages for new staff”* and note that it is customary in the UK for a studentship to be offered to new lecturers. They do not get a strong sense of interactions or collaborations with industry, which they feel *“does not reflect the importance of the chemicals sector to the Irish economy.”*

Inorganic Chemistry

The Reviewers state that Inorganic Chemistry is one of the strongest performing disciplines in the School in terms of research output, funding and training of graduates and postgraduates. Since this has been achieved through a concentration on Materials Chemistry, the Reviewers are surprised to see how little involvement there is with CRANN and suggest that *“the inorganic team should be core members of CRANN.”* They recommend in the short term a high level appointment to a Chair in Inorganic Chemistry and an additional lecturer position, without which *“this discipline will be sub-critical and no-longer able to maintain an international profile or even national pre-eminence.”*

Organic Chemistry

The Reviewers feel that Organic Chemistry is *“currently the strongest of the three disciplines in the School with some truly excellent researchers”* and they commend the initiative shown by researchers in the School in securing funding for improvements in infrastructure and advanced instrumentation. They feel that there is an urgent need to promote and reward some young and mid-career staff in the School who have outstanding publication records and are of an international calibre. They also express concern, however, that there are a number of relatively young staff in the School who have been unable to establish *“any kind of effective research programme after several years in the post”* and advise that *“the introduction and effective management of a tenure track system is essential.”* The

Reviewers note that the newly refurbished organic research laboratories, while of good quality, are overcrowded and they suggest that this raises safety issues. They recommend that solvent purification columns should be introduced to replace (hazardous) solvent stills and they conclude this section by commending both the teaching of the academic staff in Organic Chemistry and the performance of its students.

Physical Chemistry

The Reviewers acknowledge that Physical Chemistry has an impressive research record in recent years, *“with particular strengths in computational theory and modeling, nanoscience and thin films, and photochemistry”*. However, they feel that *“the scope of Physical Chemistry should include materials related research, which should not be restricted to CRANN.”* Without recruitment to replace staff nearing retirement, the discipline will, they feel, be *“below critical mass”* and they recommend the appointment of new lecturers and *“a new senior appointment to a Physical Chair to provide substantive leadership”* without delay. One possibility, they suggest, is a joint lectureship with Inorganic Chemistry in crystallography.

Postgraduates

Commenting on the School’s plan to expand postgraduate numbers from 90 to 160 over the next 5 years, the Reviewers feel that *“this will not be possible due to lack of short and long term space.”* Coupled with the College’s plan to stabilise undergraduate numbers, the Reviewers feel that the College should *“consider the implications of a static chemistry school, particularly with respect to attracting internationally competitive chairs with significant research teams.”* They applaud the idea of a joint research school with UCD, which they feel, would produce higher quality postgraduate courses as a result of the larger pool of outstanding lecturers from which to draw. They report that feedback from postgraduate students was generally positive with no regrets over choice of course or College. The Reviewers feel, however, that the lack of communal meeting areas within the School is a barrier to developing social contacts between students from different disciplines. The School’s external examiners have commented that PhD candidates are *“weak with respect to chemistry outside their area”* and recommend that this issue be addressed in order to promote a broader understanding by postgraduates of the School’s overall research programmes. They also recommend that the impact of lack of funding for Dublin Postgraduate Chemistry should be clarified.

The Reviewers report that there are concerns amongst postdoctoral workers regarding lack of laboratory and office space and that both graduates and postdoctorals highlighted a shortage of Computers and limited IT support in the School. In addition, concerns over safety were raised.

CRANN

The Reviewers state that *“College does not appear to have organizational strategies to develop Schools and Institutes in parallel”* and report that there is a concern that the latter will be favoured. From their experiences in the European environment, they recommend that cross-School and interdisciplinary Institutes *“are best financially operated at a level under that of Schools.”* The fact that CRANN can appoint personnel or occupy space that impacts on the Chemistry ARAM without the agreement of the Head of School, they feel, undermines the ability of the Head to run the School efficiently. With regard to PIs, the Reviewers express the concern that criteria for appointing PIs is not clear and although PI appointments are made to the School, advertising and recruitment is carried out unilaterally by CRANN. They feel that while PIs are expected to carry out their normal academic duties in the School, CRANN (or Science Foundation Ireland (SFI) in the case of one President of Ireland Young Researcher Award (PIYRA) researcher) has greater influence over where and how teaching duties for PIs are fulfilled. The Reviewers suggest that the School and CRANN should urgently seek clarification from the College regarding the funding model for CRANN - on the one hand the School has no influence over CRANN budgets but the ARAM generated surplus may be used to cover CRANN deficits rather than fund School activities, while on the other hand *“CRANN sees itself making a positive contribution to Chemistry”* as they feel they are giving away all their ARAM credits. The Reviewers recommend that there should be representation from the School on CRANN’s decision making bodies and *visa versa*. They also urge the College to *“make ‘normal’ chair appointments in Physical Chemistry and Inorganic Chemistry as a highest priority”* and that these appointments should not be driven by CRANN.

PHYSICAL INFRASTRUCTURE

The Reviewers commend the “*significant improvements*” in accommodation that have been made since the last review, “*apparently virtually all through external funding raised by staff with little or no support from College funds.*” They note that while the teaching laboratories are of particularly high standard, there is an issue with overcrowding in the research laboratories such that any increase in numbers would pose a safety risk. The Reviewers feel that the limited amount of space available for expansion will significantly curtail the School’s objective of increasing its postgraduate numbers and will have a knock-on effect in terms of the School’s ability to retain and recruit staff, apply successfully for funding and maintain reasonable staff-student ratios. The overall effect will be “*a significant period of no growth for Chemistry.*” Additional space may become available when the chemistry extension is vacated by CRANN but would require refurbishment if it were to be used for synthetic chemistry. The requested space allocation for Chemistry in the proposed biosciences building may not provide sufficient space to unify the whole School, which the Reviewers recommend in order to achieve “*quantifiable improvements in efficiency, output, innovation and interdisciplinary research.*”

While there have been dramatic improvements in instrumentation in the last five years, the Reviewers recommend that “*further investment in equipment and technical staff is still required*” and that “*the concept of developing a state of the art instrument suite to service chemistry and the wider college needs should be supported.*”

ORGANISATIONAL STRUCTURE AND PLANNING

The Reviewers feel that the management structure in the School is clumsy and over-complicated (involving the Head of School, three Heads of Discipline, a Director of Research, a Director of Teaching and Learning Postgraduate, and a Director of Teaching & Learning Undergraduate) and that this structure “*weakens the overview role of the Head of School.*” They report concern regarding the decision making processes and dissemination of information within the School, in particular the ability of the Executive Committee to deliver open and transparent decision making. They feel that the Executive Committee is not functioning effectively and that “*the Executive should take decisions after consultation, particularly seeking advice from the Schools Committee.*” Communication between committees, staff and students appears poor and the Reviewers suggest that there is significant room for improvement.

The Reviewers report that “*the School does not believe it plays any part in College decision making, and there are clearly significant issues with respect to central versus devolved management.*” They recommend that “*communication between College and School should be improved with a clearer definition of roles, responsibilities and accountability.*” With regard to budgets, the Reviewers report concern that “*little SFI overheads are distributed to the School*” and note that further financial pressure is being experienced as other Schools become self sufficient for chemistry teaching. They state that “*the doubling of research funding since 2002 and largely self-sufficient refurbishment and instrumentation programmes do not seem to have been matched by College support.*”

APPOINTMENTS

The Reviewers feel that external appointments to the Chairs of Physical and Inorganic Chemistry are essential to maintain competitiveness. Given the space constraints, however, they feel “*it would be difficult to appoint one high calibre internationally acclaimed external candidate, let alone two*” and suggest that “*consideration should be given to appointing two internal candidates of international standing*” followed by two new lecturers.

RECOMMENDATIONS

The Reviewers make the following recommendations:

1. *That the School and the College should define the contribution and value of Chemistry to the College Strategic Plan.*

2. *That the School and the College should develop a 5-year plan for Chemistry that addresses short and long term space issues and that facilitates expansion of staff and students.*
3. *That the College should develop a financial and organisational strategy to develop Schools and Institutes that resolves recruitment, appointment and budget conflicts.*
4. *That a representative be appointed from Chemistry and CRANN to each others decision making (not overview) body.*
5. *That the College should communicate how ARAM will be applied in future and define responsibilities and accountability of College, Deans and Heads with respect to, budgets, hiring and other significant issues.*
6. *That the College should consider appointment of internal candidates of international stature to Inorganic and Physical chairs followed by two new lecturers.*
7. *That the College should create competitive start up packages for new staff.*
8. *That the School should reward internationally performing staff with appropriate promotion and teaching loads, and address research tail.*
9. *That the probation process for new staff is examined and applied more rigorously.*
10. *That the School should develop stronger interactions with industry.*
11. *That the School should expand outreach to maintain numbers and quality of science entrants.*
12. *That the School should improve conversion rates to chemistry at Year 3.*
13. *That the School should establish consistent safety practice and standards throughout the School.*
14. *That the School should consider whether the current organisational structure could be simplified to avoid over management and duplication within a school of 20 staff.*
15. *That the current administrator should be formalised as the School Administrator.*
16. *That communication within the School and across College should be improved.*
17. *That the College should introduce a tenure track system.*
18. *That the School should introduce solvent purification columns.*
19. *That the School should address the question of degree results versus entry level qualifications.*
20. *That the impact of lack of funding for Dublin Postgraduate Chemistry should be clarified*

4. RESPONSE FROM THE SCHOOL

Commenting on the Reviewers Report, *“the School notes with pride the strong endorsement by the Reviewers of its internally-driven development during the past five years.”* It urges the College to also recognise the significant advances that have been made since the last review and to appreciate that this is an on-going process which will require a significant expansion in physical accommodation if the School is to realise its full potential. Failure to acquire appropriate space will impede expansion of both academic staff and postgraduate student numbers, and with five actual or potential staff members due to join the School before October 2009, the School will struggle to find laboratory and office accommodation for them. The School is seriously concerned that *“College has been unable to make any decisions relating to allocation of space in the Chemistry extension building, previously occupied by SFI, and vacant since the Autumn of 2007.”*

The School would welcome the introduction by College of a tenure track system and *“is taking positive action to encourage all members of academic staff to be research-active.”* With regard to the Reviewers recommendations for immediate Chair and lecturer appointments in inorganic and physical chemistry, the School fully agrees with the need for both junior and senior appointments in these disciplines and reports that *“permission to fill one chair has been granted, and the School will soon seek to progress this matter.”* The School, however, urges the College to *“re-assess its position regarding a second appointment at chair level, together with associated lectureships.”* While the School notes the Reviewers’ suggestion that the chair appointments be filled from internal candidates of international stature, it is of the strong view that *“all academic appointments should be open to international competition, at the same time welcoming applications from internal candidates of appropriate calibre.”*

The School is keen to develop its relationship with CRANN through “*constructive interaction and dialogue*” and reports that “*following recent discussions with CRANN, both Chemistry and Physics are now represented on the CRANN executive.*” With regard to the Reviewers recommendations that the School and College come together (i) to discuss the contribution and value of Chemistry within the College Strategic plan, (ii) to agree a development plan and (iii) to communicate how ARAM will be applied in future, the School “*would welcome, and will actively seek opportunities to constructively discuss these matters with a view to benefiting the entire College community.*”

In response to the Reviewers recommendation to expand the School’s outreach activities, the School lists six ongoing outreach activities and reports that “*two members of staff are currently developing demonstration lecture presentations that can be delivered to secondary schools, and undergraduate students participating in the School’s internal Broad Curriculum exercise also make presentations to Schools.*”

Commenting on the Reviewer’s suggestions that Government and funding agencies should be lobbied for increased investment in Science, the School believes that “*the College and Faculty, in consultation with all of the relevant Schools, should take leading roles in lobbying for increased investment.*” It agrees with the Reviewers’ suggestions that interaction with industry should be strengthened, and reports that the School is “*already working on a programme of bringing leading industry figures into the School to engage with the academic staff and to learn more about what we can offer.*”

With regard to the Reviewers comments concerning the Physics and Chemistry of Advanced Materials and Chemistry with Molecular Modelling courses, the School responds by stating that the points for the Advanced Materials course fluctuate year to year and that the requirements for the course are “*higher than those for TR071 Science in terms of subjects and grades.*” The Chemistry with Molecular Modelling is a new course which needs time to become established and does not require significant additional teaching as many of the modules are taken by other students. The School feels that “*teaching of the sciences and mathematics at secondary school level must be further strengthened if third level science degree courses in Ireland are to continue to compete internationally.*”

The School is delighted to note that the Reviewers received positive reports of the undergraduate programmes from both the students and the reports by external examiners. With regard to variation in understanding of safety standards, the School reports that it has run safety workshops for undergraduate students and performed annual Safety Audits. They are “*continuing to improve safety training for both undergraduate and postgraduate students, and accept that earlier entrants may need to have their knowledge updated.*”

With regard to postgraduate students, the School is taking steps to ensure that it is one of the leading graduate schools in chemistry in Europe by heading collaboration with UCD to form Dublin Chemistry (DubChem). The School reports that “*this has allowed the development of a programme of postgraduate lectures and courses which it would have been impossible for either institution to achieve alone. This programme aims to ensure that students are aware of recent developments in broader range of areas of chemistry, one of the points raised in the report.*”

Finally, the School agrees that in some respects the governance structure is overly complicated and is “*quite prepared to consider changes to these structures, although these may require College approval if they deviate from the set prescription.*” The School does not consider that communication within the School is ‘poor’ and reports that the School Executive has continuous contact with the School’s Committees through their respective Directors, who are members of the Executive. Minutes of Executive meetings are made available immediately once approved, and are also circulated prior to School Committee meetings. The School is considering the creation of an internal web site to post the meeting’s agenda prior to meetings, and the approved minutes of all committees within the School.

5. RECOMMENDATIONS TO COUNCIL AND BOARD

In light of the review report and the responses from the School of Chemistry:

1. The School of Chemistry working closely with the Dean of the Faculty of Engineering, Mathematics and Science should consider the detailed recommendations (1-20) of the Reviewers, and make arrangements to address these as far as practicable.
2. Prepare a ten-year needs assessment of space, and from this develop a two year and a five year space plan.
3. Develop a plan for involvement of industry, and identify other key stakeholders, and from this consider the establishment of a School Advisory Board with external representation.

College should:

4. Develop, as a matter of priority, guidelines for financial governance of research institutes.
5. Review the ARAM to ensure that the resource allocation model supports financial devolution to academic units.

Provost

28 March 2008

