



**Trinity College Dublin**

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

**Report on the Quality Review of  
the School of Chemistry**

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# School of Chemistry Review

## 1. Executive Summary

### 1.1 Key findings of the review including overall assessment of the School

Chemistry is a core discipline of science and is key to the College's stated goal of remaining highly ranked worldwide. It is the central science, in that it branches into many other areas of science and engineering: biology, physics, material science, nanotechnology, medicine, etc. This provides many opportunities in TCD for collaborations with staff in these disciplines.

The research productivity (as judged by the high quality publications; significant competitive external research funding secured) and external (national and international) visibility of the majority of the academic staff in Chemistry is absolutely outstanding. For these reasons, it is necessary that Chemistry work hard to keep its own identity within the College. While many smaller issues and suggestions are given below, the primary overarching concern of the Review Panel is that Chemistry is vulnerable to being split up with a subsequent loss of its own identity. The distribution of academic staff in Chemistry across 8 sites is seriously undermining the prospects for the future viability of the School of Chemistry. Loss of its own identity would have very serious implications in terms of a reduction in the core skills and key facilities/capabilities that define Chemistry as a discipline. As topical, popular areas and themes come and go, it is essential that Chemistry remains a united and collegiate body of staff, with excellent core skills and the drive and ambition to set the new agendas in research and innovation.

The Panel recognizes that the School and College have been operating under enormous financial constraints for much of the period since the last Review, due to the impact of the global financial crisis on the economy in Ireland. This has contributed to a number of critical issues across the College and the School of Chemistry that were not anticipated at the time of the last Review, including constraints on appointments, promotions, remuneration, etc. imposed at Government level and outside the control of the College. In order to attract and retain top quality staff, a transparent promotion system based on merit rather than a quota system is recommended. A serious lack of investment and reduced staff morale were clearly evident to the Panel. It is vitally important that every effort is made by the College to improve these situations as the wider economy and College finances stabilize.

### 1.2 Recommendations for Improvement

- **School Issues**

- a) The Chemistry academic staff should make it a priority now to work together to create a strategic plan that all staff can unite behind and that includes a clearly defined procedure to achieve the defined, measureable goals that they set for themselves. This should be negotiated with the College as a "business plan", with well-defined deliverables (student numbers, research funding, etc.) and milestones put into place and agreed to between the School and the College.
- b) As part of this agreement, and as requested by the School, their academic staff should be allowed to increase to at least 27. This is still a modest number of academic staff in comparison with competitor Chemistry departments elsewhere in Europe and more widely, but will require support in ensuring the necessary laboratory infrastructure is made available to attract strong candidates.
- c) Further, a plan for bringing all staff in the School together into their own building, such as a fully renovated and suitably refitted and equipped version of the current Chemistry building, should be put into the strategic plan.
- d) As stipulated in College policy, all staff hiring decisions should be led by the School, in dialogue with the Institutes, as appropriate; it is essential that the Head of Chemistry and Senior Leadership Team are directly involved in all staff appointments that affect Chemistry. Although this is College policy, it was apparent that the School considers that it presently does not always have this control.
- e) The relationship between the school and the institutes should be re-examined. College policy indicates that the school is placed above the institutes in any strategic decision making processes, including but not limited to academic staff hiring. Based upon the Review process, it is the Panel's view that this did not always appear to happen in practice.

- f) It is recommended that non-EU student recruitment be primarily focused on one country, rather than spread across many nations. This was considered likely to be more successful by concentrating resources, and specifically the USA was deemed to be an attractive target.
- g) The school should involve all academic staff in its decision-making processes, such as hiring, divisional structure, and workload allocation models. This should be done with regular academic staff meetings, where consensus is reached broadly across the school.
- h) Finally, the school should develop its own definition of what constitutes a research active academic staff member, with the aim of: i) achieving expectations for this requirement that allows the school to remain competitive with peer institutions, and ii) for improved workload allocation within the school.

- **Post-Graduates**

The School has a relatively large PhD cohort in comparison to its staff size, although there are some staff with very large groups (mostly associated with the Institutes) and a few very small groups. Arguably, this is common when taking a snapshot view of most departments, however, care is required to ensure that this is sustainable going forwards, and to reduce vulnerability to loss of key staff. Reduction in postgraduate student numbers would have serious consequences, both for research output and for the ability of the School to provide adequate supervision in undergraduate teaching laboratories.

- a) The School's Postgraduate Induction Booklet, should contain a page (to be signed by both PG and supervisor at the beginning of the studentship) that clarifies the roles and responsibilities of both parties.
- b) PG students did not appear to be fully aware of the administrative procedures that needed to be followed on registration and it is recommended that the most important information is made available on an easily accessible web page as well as being provided within the Induction Booklet.
- c) The procedures to ensure good communication between the staff overseeing the PG course content and the postgraduate students should be improved. PG students should be allowed opportunities to comment and influence changes to the content and level of the courses, particularly to ensure they are sufficiently challenging for students at PG level; courses that do not meet expectations, or do not attract a defined minimum number of students, should be reviewed, altered or removed as appropriate.
- d) The postgraduates seemed not to have a sense of being part of a cohort; in order to address this, we recommend introducing an annual PG symposium of talks, posters etc., organized by and for the PG students across the whole of the School of Chemistry. There are opportunities to align this with input from the Careers Office and recent alumni who can offer insights into possible future career pathways for students upon the conclusion of their PhDs.

- **Undergraduates**

- a) A staff-student liaison committee should be formed consisting, for example, of the class representatives, course directors, year coordinators and the DTLUG. It should meet at least once per semester and provide a forum for addressing student concerns and help improve the sense of chemistry community.
- b) The support for undergraduate students carrying out 4th year research projects abroad should be improved by allocating a home supervisor who remains in contact with the student throughout the placement; this should be in addition to the role of International Coordinator and should form the first point of contact if any issues of either a scientific or pastoral nature arise.
- c) Communication between undergraduate students and the Career Office should be improved to ensure that students are aware of the range of career opportunities available to Chemistry graduates.

- **Staff**

- a) Annual performance and development reviews should be introduced for all staff (academic and preferably also support staff, requiring College-level policy) and a pragmatic workload model should be used as a tool to fairly allocate duties to academic staff.

- b) The workloads carried by the support staff are high, placing significant pressure on individuals and serious vulnerability to the smooth running of the School should a member of the team be absent. The volume of work is impacting negatively on the functioning of the school, particularly within the administrative roles. We recommend one additional member of Administrative staff be appointed.
- c) The School Executive should carry out a review of administrative and technical support provision and draw up transparent guidelines to clarify the level of support provided. Further, the annual review of the support staff should include input/feedback from academic staff.

- **Finances**

- a) The overhead return to the School lacks clarity; seemingly often being negotiated after the funding award is made. In some cases the overhead going to the School of Chemistry is unreasonably small in comparison to other similar Universities. A set percentage of overheads must be agreed between the College and the School and adhered to, recognizing that Chemistry is an expensive discipline and should be properly resourced. The overhead to the School should be at least comparable to that going to any of the Institutes.

- **Safety**

- a) Basic safety needs to be taken seriously by all staff and students at all levels. We recommend introducing an annual safety lecture with attendance by all staff and postgraduate students to regularly emphasize and refresh familiarity with the regulations.
- b) The safety committee needs to take responsibility for and be empowered to do its job. Safety audits should be carried out at random and more frequently than once per year.
- c) College-wide issues, such as the recent delay in waste pick-up, are potentially very serious safety hazards, and prompt action is needed to remedy these types of issues in future.

## **2. Strategic Direction and Planning**

The School provided a very detailed SAR document that clearly set out their current status, challenges and strategic directions. The School is striving, under challenging infrastructure, financial and staffing conditions, to meet the expectations of the College with regard to the E3 initiative, innovation and entrepreneurship strategy, increasing student numbers and the global relations strategy while striving to maintain and increase their national and international research impact.

It is the strong recommendation of the Review Panel that it is now very timely to bring the School of Chemistry together to develop a strategic plan that all academic staff have input into, and for all academic staff to unite behind the plan and work towards its fulfillment. Some staff members were less aware than others of the School's strategic plan and its importance. The problem appears to arise from a lack of communication regarding decisions being made that affect staff. The Panel felt strongly that for the relatively small number of academic staff in the School, coupled with the 'fragmentation' caused by the distribution across 8 sites, and the strong influence of the Institutes, the management structure in Chemistry was unnecessarily complex. Specifically, we recommend that the role of the disciplines be reviewed carefully to determine whether it adds value. The membership and role of the Executive Committee should be reviewed, and the decision-making should be more transparent. School meetings, involving all staff members, should be held more frequently and at regular intervals to seek engagement and ensure good communication. We believe that this is vital to drive the School forwards and ensure its future success. We also recommend that the School formulates a mid-term plan to develop the estate and bring dispersed research groups and experimental infrastructure, including teaching facilities, together, as far as is feasible, within an attractive, refurbished central site for the School.

The College needs to work with the School of Chemistry to implement their plan, and thus agreements should be put into place between the School and College, containing specific milestones that are accompanied by the release of promised resources.

There was a general fear amongst the Panel, and echoed by discussions with staff, that Chemistry can lose its identity and the research can be consumed and primarily identified with individual institutes. In the last School Review, the tension with the institutes was noted, and apparently this has not yet been resolved.

It was noted then, and again now, that there is a significant risk moving forward as all the research-active Chemistry staff are being associated with institutes, leaving teaching to be the primary role of the School. It is also clear that association with the Institutes and their resources has been very successful in attracting significant research funding for academic staff and this has had a very positive impact on the research activities and reputation of members of the School. However, there is a clear tension here to ensure that the Institutes are not a drain on the School, and to ensure that Chemistry retains its identity as a key discipline, able to drive the development of new interdisciplinary research initiatives in the future.

Due to the success of the Institutes and the central research role of Chemistry as a discipline, most academic staff members are aligned with at least one. Therefore, this leads to a split allegiance that can further cause a fracturing of the School.

To solve this, the School of Chemistry needs to have priority in decision-making processes concerning the hiring of staff, in practice as well as on paper. External funding in association with Institutes seems to drive hiring and dictate strategy, thereby directing what Chemistry does. The perception of the Panel is that, in contrast to stated policy, the Institutes consider themselves to sit above the School in terms of importance and decision-making; this was even stated on a few occasions during discussions. It is important that this issue is addressed.

The School of Chemistry is vulnerable to losing its identity within the College, not only due to the influence and significant additional resources centered in the Institutes. In addition, the academic staff is currently dispersed among 8 sites. This leads to a fragmentation of the mission of the School. Further, it is a costly split, because it has led to a duplication of large instrumentation and inefficiencies in technical support. We note e.g. that in the future it is likely that all NMR facilities will be required to recover their helium due to rapidly rising costs, and therefore such instrumentation is best placed at a single location.

We realize that for the sustainability of the School under the present funding model in Ireland, there is a need for an increase in non-EU student enrolment, into both Undergraduate and Taught-Masters programmes as part of the Global Relations Strategy. The College is targeting 113 non-EU students in 2016/17 across TR071 Science and the four degree moderatorship programmes that Chemistry has full or shared responsibility for, and has a focus on China, Brazil, India, and the USA. It is difficult to see how the small staff in Chemistry will be able to sustain such a broad international recruitment effort. The Review Panel suggests a greater focus on one country/region to lower the overall resources required to recruit and support these students - we strongly recommend that the US market should be the priority. Ireland is viewed extremely positively in the USA, there are many students of Irish descent, and the fees charged by TCD are very competitive (average to lower than average) against a US College Education. We believe that getting more than 100 students from the USA is quite feasible if the effort is focused.

The introduction of Blackboard as the Virtual Learning Environment is a positive feature, and greater use can be made of this for aiding students' learning while managing the staff resources efficiently. This could be one of the priorities if fixed term Teaching Fellow(s) are appointed (e.g. against staff buy-outs on large grants), and would benefit both students and the academic staff across the School.

### **3. School Organization and Management**

The School has been operating under very difficult financial constraints over the last 8 years since the financial crisis. This has made the job of managing the School extremely challenging, and has prevented implementation of many of the substantive recommendations from the previous Review.

It would be advantageous to the School if the organization and decision-making processes in the School were more transparent. Communication needs to be improved between the academic staff of the School with the Executive Committee. While it is understood that having an Executive Committee is part of the College organizational structure, in the case of the School of Chemistry we advise that it become more interactive with the staff as a whole, to get proper buy-in. The Executive Committee should routinely bring important decisions to the staff for their input and thorough discussion. Either the decisions should be signed-off in a staff meeting, or the members of the Executive should be representing the opinions of all members of their group (currently the disciplines). Access to the Executive minutes via the School

homepage should be expanded to include all academic and support staff. Moreover, to keep the decision-making process as broadly representative of all opinions as possible, there should be regular meetings involving all the staff. In essence, the Executive should be the voice of the academic staff.

We advise the School to reconsider whether the split into I, O, P (inorganic, organic, physical) subsections aids or hinders the advancement of Chemistry within the College. Staff across the School expressed opinions on both sides of this issue, and the academic staff should discuss it collectively. As a group, the reviewers do not have a strong opinion either way, albeit it should be noted that many Chemistry departments are dropping this designation for research and hiring purposes and it was also felt that it introduced another unnecessary level of management for what is a relatively small School. In the early 21<sup>st</sup> century, the disciplines are really only teaching related, to ensure coverage of materials across all the main areas. If the School decides that the disciplines' structure should be retained, we recommend other ways are found to simplify the management structure and reduce the overall workload for a relatively small group of senior staff.

We further suggest that, if the disciplines remain, any individual can declare themselves as part of any, and as many, discipline(s) as they desire. The onus would be placed upon that person to share teaching in each discipline. There was a general feeling that this is a good idea, with a few exceptions. Thus, this is again a topic that should be discussed by the academic staff as a whole, with a vote taken as to what is the best policy for the school. We are concerned that having disciplines has the potential to be insular, and divide the power of the school into factions, and the Review Panel stresses that this is a critical time for the staff to cooperate and act as one voice.

The award of Athena Swan Bronze is very positive for Chemistry, and this will help to bring further changes that will be beneficial, for example, increased opportunities for younger staff to get involved in the decision-making processes. It is clear that a number of improvements in terms of introduction of more flexible working arrangements have been made, and the impression from the SAR document and from discussions with staff is that these have been positively received. There is clearly opportunity to build upon this to improve the working environment for all members of the School.

The staff workload should be adjusted based upon a set of transparent guidelines established by the School as a management tool to help deliver its mission and strategy. The current workload document is very complex, listing many details of how time is spent. It is not really useful as a tool to adjust workloads. We recommend that the criteria in the Workload Model be critically assessed to determine which of these activities are essential and sustainable in a School of its size. In this context, a definition is needed to be agreed on what 'research-active' means within Chemistry, in the context of expectations of the School of Chemistry that is competing with other Chemistry departments internationally, thereby not relying on that provided by the College that is rather generic as it applies to all Schools in the College. The onus is on the School to adopt a model and a process that works for them – without being too complicated, but decide what will be considered appropriate in all areas: research, teaching, and service/administration.

We recommend that an annual review (appraisal) process should be strongly encouraged at School level with the aim, initially, of achieving the full participation of all academic staff. This will help to address a general feeling that there is a lack of recognition for doing a good job, and an excessive administrative burden. The review process can be a quantitative tool for distributing workload as well as a means of recognizing success and identifying support needs and/or training requirements. It is not meant to be a punishment for academic staff to teach more, or do more administration, but instead a means of ensuring a fair distribution of responsibilities and a proper use of each staff member's talents and attributes, allowing them to put their creativity into tasks, and should be viewed positively in a supportive staff environment. We also believe that class size should be part of the workload algorithm for teaching.

Importantly, we realize that funding for research is often cyclical, so each individual academic staff member should be allowed a reasonable time to rebuild/reinvigorate their research activity before being given additional duties; indeed the possibility of the School/College providing some modest resource (time,



pump-priming funds) to help with this should be considered. This suggestion does not arise from a feeling that there is a significant fraction of the staff that is not research active, but instead simply as a 'check and balance' system that will create an atmosphere of expectations for all staff, and provide an opportunity for staff to remain research active during lean times.

There is a concern that the balance of power, particularly related to academic staff appointments, has shifted strongly towards the TRI. Although staff appointments must be carried out with the agreement of both School and TRI, the role of the School appears to have been diluted. While it is clear that the previous hires that did initiate from the Institutes have been excellent, the concern is to strike the right balance of where the power resides between the School and the Institutes. If new hires are not aligned with School strategy, they can block other essential appointments. On this basis, it is conceivable that TBSI could request Chemistry to hire an immunologist because such a person is needed in TBSI, but it may not a priority for Chemistry. On the other hand, it was not clear how Chemistry would go about hiring an outstanding quantum chemist if this were their priority, without this person fitting into a particular Institute.

As part of the 5-year external quality review of the Institutes, it would be advisable to consider whether the School(s) are made stronger by the success of the Institutes, along with the other criteria listed in the 2013 "Policy on Trinity Research Institutes".

We recognize that by College policy the Institutes are not considered to be permanent, and can be derecognized and their space reallocated. After all, research themes and strategies come and go over time, while the core disciplines remain. However, we also recognize that this becomes difficult when an Institute has its own building. Thus, it should always be the primary thrust of Institutes to increase the visibility, funding, awards, and publication records of members of the Schools, and not the other way around. We suggest that should be included in the criteria by which Institutes are evaluated. Currently, CRANN is bigger than a school, with staff drawn from six schools and associated institutions and situated in multiple buildings. TBSI has nearly 70 PIs over five schools.

Our advice does not overlook the excellent track record of success of the Institutes, but instead is a comment upon the perception/observation that the Institutes seem to have a disproportionate influence on the scientific and engineering directions of the College. We would, therefore, like to see strategic decision-making and the future of institutes become more embodied in the Schools.

It is extremely positive that AMBER secured their funding and is doing such an excellent job bringing industrial collaborations to the School of Chemistry. Keeping an eye on the goal of maximizing research and infrastructure, as well as their primary goal of industrial collaborations, should be first and foremost, while planning for AMBER2 should be a secondary concern. Further, the tension between AMBER and CRANN was mentioned several times, and thus the relationship between these entities needs to be delineated.

There is a large administrative burden placed on the academic staff that is commonly covered by support staff at other colleges and universities. The administrative support for creating grants, preparing the associated budgets and forms and reporting, is very small. Lack of access to appropriate TCD administrative support for PIs is exacerbated by the fact that the existing administrative staff appears to be substantially overburdened. This is counter to creating a first class research institution. We would recommend another administrative hire in the School. Additionally, it would be desirable and would improve relationships between the School and the Institutes, to allow all academic staff, whether directly affiliated or not, to benefit from the extra staff that exists in the Institutes. For example, CRANN has its own grant preparation support, mock interviews, and tech transfer. These facilities are quite effective and helpful, but this should really be opened up to all staff in the Schools that participate, not just academic staff that are members of an Institute.

As a final note in this section, we advise the College that when a member of staff wins a grant (e.g. ERC) which buys out a significant fraction of their teaching responsibility, the salary saving should contribute to the appointment of a temporary lecturer/teaching fellow, i.e. someone who will not be engaged in research.



With multiple grants available, it should be possible to employ one or two full-time, temporary teaching staff. Such appointments can benefit the School as a whole, by lowering the teaching responsibilities of other academic staff, because the appointee can teach full time, as well as providing an opportunity to encourage positive innovations in the teaching and learning area. Further, it avoids the research success of a few individuals causing an increased burden on other members of the School.

#### **4. Safety**

It was apparent that an emphasis on safety, implementation of rules and monitoring is in some need of attention at both School and College level. While each research group must take this very seriously, it was clear that some changes are required. The safety committee should do a quarterly inspection of all laboratories (not just once a year), with detailed reports created for unsafe practices that are given to the Academic Staff, with a one-month time-scale for correction. The school safety committee should also be empowered by the Head of School and the College safety team to close laboratories temporarily if safety procedures are not being followed or unsafe practices are not being corrected within the given timeframe. Communication needs to be improved to ensure that actions are completed and that those involved are informed. The safety committee should have the responsibility for generating standard operating procedures (SOPs) for various categories of chemical hazards, while each research group should have a group-specific safety manual with regularly updated risk assessments (signed off by the responsible academic) and relevant training procedures.

Waste solvent collection was a serious problem during the visit of the Panel. There were delays, office closures, and irregular collections. This creates a significant safety hazard and must be addressed by the Safety Officer at College level to ensure it does not continue.

Lastly, we recommend that all solvent manipulations should normally be performed in suitably ventilated hoods. It was apparent that organic solvent fumes permeated the undergraduate laboratories, and solvent manipulations in the research labs also occur on benches. It will require both changes in working practices and refurbishments to both teaching and research laboratories, but it is important to recognize that these are the standards to which modern laboratories are being constructed worldwide, and should be a priority for TCD.

#### **5. Teaching and Learning**

While improvements in communication, career awareness and some aspects of course content are suggested, it is clear that staff in the School of Chemistry work hard to provide a strong educational experience for the students. The Panel's impression from the discussions was that students at all levels were generally content.

The use of PhD students to assist with the practical training and grading in teaching laboratories is in line with other Chemistry departments. However, although training and marking schemes are available, the PhD students that we spoke to mentioned a lack of information and specifically a lack of mark schemes. It would appear that better communication is required. It is important to retain staff overview of the marks awarded and feedback provided to the UGs.

The appointment of the new RSC Education Coordinator within TCD is a very positive move, and will contribute strongly towards both increasing interest in Chemistry among school students, and to the resources available for smoothing the transition from school to university and, potentially, the current challenges arising from the transition from Year 2 to Year 3. The training provided to UG and PG students to enable them to engage effectively in outreach in schools also adds a further dimension to their experiences at TCD, as well as fostering relations between the students.

#### **Undergraduate**

The Panel was concerned that the very small class sizes for some of the Chemistry-specific courses is putting pressure on the teaching workload of staff. Some rationalization would appear to be needed, particularly in view of the School's likely contribution to the new Energy Science moderatorship as part of the E3 initiative, which will bring an additional teaching requirement.

The undergraduates voiced a number of concerns. Firstly, they commented that starting as Science majors (TRO71), rather than Chemistry, creates a very difficult third year transition in the present structure. They indicated that this has caused an unusually high failure rate in some years, which seems to be very undesirable for both the School of Chemistry and the students. The Review Panel did not understand why students should not be allowed to choose Chemistry at the outset if this was their desire, but note the recommendations of the review of TR071, which are being implemented and should improve this situation. We recommend close monitoring for evidence of improvements.

Secondly, while the undergraduates were very positive about the research projects, some students commented that they were assigned to staff with very small research groups, with advisors that are not around, and therefore with little guidance. Clear guidelines are needed concerning expectations regarding academic supervision. A modified project allocation process should aim to improve the distribution of students to staff, ensuring adequate supervision, and to better manage student expectations concerning the allocation of project topics. The opportunity for students to go overseas for their senior project is very attractive and important for marketing. However, the Panel had concerns that some of these students appear to receive little oversight from staff while on Placement. We suggest that they should be assigned a home mentor for their overseas projects, with scheduled email/Skype/face-to-face (as appropriate) check points to monitor their well-being, research progress and quality of placement experience.

The undergraduates appear to have little idea as to what their career options will be upon graduating. Thus, a greater presence of and interaction with the career office is advised. One specific suggestion is to introduce a career day that is specifically focused upon chemistry majors within the College.

Another useful procedure is to track the career destinations of the Chemistry graduates to create a database that current and future chemistry majors can look to for understanding their potential employment opportunities.

The staff-student liaison committee does not seem to function very effectively at present - our recommendation is to introduce a clear process to enable both UG and PG students to feedback views, concerns *etc.* to a body of staff charged with responding and making the necessary adjustments to improve things. This will likely have the added advantage of increasing the sense of community in the School, which will be positive.

Regaining RSC accreditation is essential for Chemistry as it provides an external validation from the Professional Body that the course content is at the level commensurate with that for a professional career in Chemistry. It is thus important for the reputation of the School and the career prospects of the graduates. It will also be vital to attract the best students to TCD. A key consideration here is the strain on practical provision owing to space restrictions in the teaching labs. The Panel recommends that the practical chemistry provision is maintained at the level required for RSC accreditation (at least 300 timetabled hours for bachelor's programmes, exclusive of project work), and that the implications of over-crowded labs with increasing numbers of undergraduate students are carefully reviewed in the context of both the student experience and safety. For comparison, comparable UK chemistry UG labs would typically have a fume cupboard for every 2 students in synthetic teaching labs (4 students per fume cupboard for 1<sup>st</sup> year). This may require reconsideration of the level of practical provision made for students on other (non-Chemistry) degree programmes.

The RSC may also be able to support the School in raising the profile of career opportunities and professional training for students at UG and PG levels, and the appointment of the RSC Education Coordinator in TCD is an opportunity to strengthen these connections.

## **Post-Graduates**

The quality of the PhD provision is generally high and there are some excellent research facilities, mainly associated with the Research Centres or Institutes, providing a world-class environment for research. Thus, the graduate students were happy with their decisions to have chosen TCD for their PhD studies, and this is a further testament to the excellent job that the research-active staff is performing.

There are, however, some areas where improvements could be made. Communication within the School should be increased on many levels, including with the postgraduate community. The postgraduates seemed not to know the initial procedures upon starting their research degrees at TCD, and relied on information received by speaking with more senior students in their respective research groups. We recommend that induction packs and information regarding procedures be placed on the Blackboard site or on an internal web page as a repository for all key information, including safety instructions and procedures. As with the undergraduates, the postgraduates seemed to have little insight into what career options were available to them, nor how to go about getting a job. Thus, stronger connections with the Career Office are necessary.

Clear delineation of the responsibilities of advisors and students would be helpful, for example, in the form of a document that is a signed agreement between students and advisors as to their respective duties. This can be produced by the staff (via the director of the Graduate School), with student input, and is an excellent way to achieve a clear understanding of the roles each are meant to play.

Due to the fragmentation of the school over many locations, the students do not feel part of a cohort that go through the same experience as a unified group. We suggest introduction of an annual postgraduate symposium day to be organized by the students, bringing all post-graduate students together to present talks and posters on their research. Presentations from alumni could be arranged, and a representative from the career office should be present to discuss career options at the end of the degree, provide interview and CV guidance *etc.* as appropriate. This type of event could be a very positive experience for this student group during their time at TCD.

The DubChem graduate programme, along with the introduction of the structured PhD, are excellent initiatives allowing a broad range of specialist courses to be made available to postgraduate students. However, it is considered essential to review the content of the offered courses on a regular basis and to rationalise this, particularly in view of the overall pressures on academic staff to deal with increasing numbers of UG students as well as increasing administrative burdens. The most popular courses according to the students were the “Master Classes”, which are delivered as intensive short courses over Friday/Saturday sessions. These were praised for the relevant content of the courses as well as for the networking opportunities they provide for the students. In contrast, a number of the DubChem courses are too dilute, without a high enough level of content to be appropriate for a postgraduate degree. It is important not to soften the courses just to make them applicable to a broader audience.

Further, the postgraduate students feel that they spend a large amount of time doing courses that are not useful to them, just to achieve the required credits. On balance, we feel that the requirement for 30 credits is too high and suggest that 15 credits would be sufficient to ensure that the Postgraduates have sufficient time to focus on research, while developing their advanced knowledge and skills through attending PG courses. There should also be more flexibility in allowing credits from other disciplines, where appropriate. Therefore, we suggest that the School should revise their graduate courses to offer training appropriate to the advanced level of the students while at the same time lowering the overall credit requirements. This should be carried out in consultation with the students.

## **Post-Doctoral Associates**

The School has a number of senior and experienced PDRAs. They clearly contribute strongly to the excellent research emerging from TCD. The PDRAs that we met were very positive about working in the College and the opportunities, support and mentoring they receive from the staff. This was somewhat in contrast with the undergraduates and postgraduates, and may reflect the level of maturity, as well as having been in academic research for longer. The Panel noted that it is excellent that post-doctoral associates have the opportunity to contribute to teaching at an appropriate level (with the necessary training), and this

should be looked upon favorably.

## **6. Research Activity**

The research activity and productivity of the School of Chemistry are outstanding. The accomplishments of the academic staff over the review period are superb, particularly given the external funding climate and their administrative burdens. For a small School by international standards, it is extremely productive and does disproportionately well. As a whole, they are remarkably successful with funding and high profile publications – a jewel in the TCD crown! 25% of the staff has had ERC awards, with many large grants awarded in the last 5 years. These successes should be celebrated and communicated widely. The strategy towards winning these prestigious awards is clearly very effective.

The College appears to recognize that Chemistry is one of the highest performing Schools, and that although the Institute/School split is good for a lot of staff, it creates an identity crisis for Chemistry. Importantly, the College cannot conceive of not having a Chemistry department. The fear, however, is it could become a service department for teaching if funding, research, and positions become dependent upon an Institute. Thus, many of the issues discussed above under the title of management have a direct impact on research productivity.

There is currently a high senior to junior staff ratio within the School, however the five new academic posts that are being proposed should help to reduce this and ensure that the School has a strong future. The future of hiring, and thereby research, should be based on strategic decisions by the School, in consultation where appropriate with the Institutes, and an agreement reached with the College to find a means of implementing the School's vision.

## **7. Finances**

### **7.1 Finance and Funding**

The most serious problems lie in the small, variable and over-committed overhead return to Chemistry, which makes planning, prioritisation and investment extremely challenging. Given the staff success in large EU and other funding schemes, the Panel would have expected to see a higher return of overheads to the School – this is a source of some of the low morale among the staff.

It is not clear how it is distributed when involved with institutes, and it appears that overheads can even be negotiated rather than being a set rate. This makes it extremely difficult for the school to plan their future allocations. There should be a set overhead return rate. It is the unanimous opinion of the Panel that more overhead should go to the School. Services that are paid for by overhead, such as tech transfer, are available only to the P.I. s in CRANN, but this is in part paid by chemistry overhead.

The College should recognize that Chemistry is an expensive discipline, and if the College wants to be strong in this area, this has to be accepted. An income/expenditure ratio of 1.3 compared to an expected 1.6 is to be anticipated.

A "business plan", acting as an agreement and contract between the College and the School, could be used to gradually raise the overhead return to the School. With set milestones for Chemistry to accomplish, their overhead return could be adjusted upwards. For example, an agreement could be reached as to an appropriate income/expenditure ratio that will lead to the goals that Chemistry sets for itself.

A diverse funding stream is important for sustainability. The School has performed extremely well in achieving ERC funding and this is expected to continue. The increase in philanthropic funding that is helping to support new appointments is also very positive. A challenge going forward will be to retain or increase the size of the graduate school and find support to cover stipends and fees for the PhD students. The new E3 initiative may provide opportunities to find significant industrial sponsorship for chemistry postgraduate students and research activities.

## **7.2 Staffing**

In general, the staff appears to be overburdened, and lack support. There is a need for improved career development opportunities. This situation threatens the ability of the School to retain skilled and key staff at all levels. We were very impressed with the administrative staff, the technical staff, and the teaching staff. They have done a remarkable job under very severe financial restraints.

The primary issue around the support staff is the limited promotion opportunities if they remain in the same School, and the delays that have been imposed by an external governance body. This leaves the School of Chemistry vulnerable to loss of key technical/administrative/teaching staff. We understand this is due to financial problems outside the control of the College, however, it is important to recognize those individuals who contribute effectively to the smooth running of the School. This could be in the form of a 'one-off' bonus; the increase in collegiality that such a gesture could bring would be very good for the School.

The technical staff is struggling to fulfill their duties due to staff reductions. Because the mechanical shop and electrical shop are gone, the School of Chemistry suffers from a lack of support infrastructure. We definitely recommend not losing the glass-blowing workshop on top of these other reductions. The technical staff seem to spend a considerable amount of time servicing old equipment. The number of these individuals cannot be further reduced without a major breakdown in the running of essential research facilities.

The technical staff should have more opportunity to undertake professional development relevant to their roles. We recommend that a modest budget be provided to facilitate CPD (external to TCD if appropriate) for the support staff. For promotion, they must do something more, beyond their regular job. While this is reasonable, opportunities appear to be lacking.

## **8. Administration**

The workloads carried by the Administrative staff are unreasonably high, placing significant pressure on individuals and serious vulnerability to the smooth running of the School should a member of the team be absent. The volume of work is impacting negatively on the functioning of the School as it is leading to further pressures on academic staff to undertake admin duties - unsustainable in the medium term. We recommend that one additional member of Administrative staff is appointed.

## **9. Relationships and external engagements**

Staff in Chemistry are involved in many active collaborations with other disciplines within TCD (mainly through the Institutes and on Faculty committees) and externally. They play a prominent role in RSC committees and as assessors for prestigious international funding programmes such as ERC and FET as well as sitting on review panels for other national funding agencies.

## **10. Communication and Marketing**

### *10.1 Internal Communication*

The communication links between the School Executive Committee and the rest of the academic staff and between staff and students are less than optimal due predominantly to the fragmented nature of the School. Reintroducing regular academic staff meetings would help improve the communication, introduce more transparency and help to improve staff engagement and morale. Similarly reintroducing (or reinvigorating) a staff-student liaison committee and finding ways to bring the student body together with staff for more informal social occasions would help to develop a "chemistry community".

There is scope to improve the dialogue between College and School to work towards a pragmatic strategic plan for improvements to the School infrastructure and the development of metrics for achieving the necessary future support from the College.

### *10.2 External Communication and Marketing*

The School's Global Officer carries a large responsibility for international marketing of degree courses and also for ensuring visibility for the School on the marketing materials distributed by the Institutes and Research Centres. The two activities are quite distinct and also both time-consuming and essential and it might be advisable to move responsibility for developing the research visibility and publicity for the School's substantial research achievements onto the Director of Research.

There is a danger with the recent expansion in international recruitment activities that the School is spreading itself too thinly and, considering the pressures that staff are under and the efforts required to attract international students along with the additional administrative and pastoral demands that this implies, the School should consider focusing the activities where there is likely to be maximum return for a minimum additional effort. However, it should also be stressed that the School-specific central infrastructure and teaching facilities urgently require refurbishment and efforts will need to be made with significant input at College level to improve the conditions for UG students before a significant long term increase in well-qualified international students is feasible.

## **School Response to the External Reviewer's Report**

### **School of Chemistry**

On behalf of the entire School community I would like to acknowledge the evident care and consideration that the external reviewers have exercised in creating their report. The report itself presents a thorough review of all aspects of the School's management, activities and mission and it reflects the wealth of experience and differing perspectives of the reviewers. Particularly pleasing was their international benchmarking and external validation of the School's many research outputs and achievements; 'The accomplishments of the academic staff over the review period are superb, particularly given the external funding climate and their administrative burdens..... a jewel in the TCD crown! 25% of the staff has had ERC awards, with many large grants awarded in the last 5 years. These successes should be celebrated and communicated widely.'

While the report complements the School on its high-profile research successes and its on-going commitment to teaching excellence, it also provides a commentary on where and how improvements might be made. It offers a wealth of ideas to help rejuvenate operations at School level and to redefine the discipline within the College so that it can move forward more strongly into the next 7 years. Not all of these ideas are new, and many reflect underlying funding issues but the report does serve to put these back into the spotlight and prompt renewed action from those serious about the future of this School. In the words of the reviewers, 'the College appears to recognize that Chemistry is one of the highest performing Schools' and yet leaves it to operate with an insufficient non-pay budget and a 'small, variable and over-committed overhead return'.

#### **High-level recommendations**

##### **(i) to initiate a School-centric research culture**

The reviewers identify on-going tensions between the School and its cognate Institutes and raise concerns about the 'disproportionate influence' of the Institutes in setting the research agenda of the College; 'The perception of the Panel is that, in contrast to stated policy, the Institutes consider themselves to sit above the School in terms of importance and decision-making'. The external panel recommend that steps are taken to redress this imbalance in a way that recognises the transient nature of the Institutes and their funding platforms. They propose that the Schools are given greater ownership of the resources, personnel and space that are currently under Institute control.

##### **(ii) to consolidate the School via a unified site**

The reviewers forcefully recommend that the School regroups physically onto a unified site. They see this as vital to protecting the integrity and coherence of the discipline.

The panel noted that there were warnings, initially raised in the 2007 quality review, in relation to the potential negative impact of fragmentation on the School. In 2015 the longer-term consequences are more evident. The School's physical footprint across 8 on- and off-campus sites, and the increasing commitments of staff (academic and support) to both Institutes and the School, are seen by the reviewers as threats to 'the core skills and key facilities/capabilities that define Chemistry as a discipline'. It is their view that the College's view of the School is being weakened by the fact that its 'research can be consumed and primarily identified with individual institutes'. They write that despite the quality of Chemistry's research achievements, its role in underpinning the strategic directions in two mature research institutes, and the further prospect of it doing the same in emerging ones (Cancer, E3) is threatening the 'identity' and 'future viability' of the School of Chemistry. The reviewers give witness to an over-stretched staff, with split loyalties and working in disparate locations, struggling to perform and deliver as effectively as they might otherwise. They believe that the development of a new purpose built and flagship Chemistry Centre will inject new purpose into the School, strengthen its voice and mean that the discipline is better positioned to reset the College's research agenda.



The process of acting on this core recommendation has started. With the new Dean of FEMS, the School management are exploring the feasibility of reclaiming sections of the Main Chemistry Building by knocking-down the current extension and building-upward on the site (approx. 750m<sup>2</sup>). The project aims to consolidate elements of the School's research and teaching activity (currently in SNIAMS, Lloyd, CRANN and TBSI) into this new Chemistry extension and thereby reduce the School's footprint in other areas of College that are under considerable pressure for space. This new build will provide a consolidated and refurbished area for a central Chemistry Instrumentation Facility incorporating the existing NMR instrument suites and new diffraction equipment. The space will be able to house analysis apparatus and 3D printing equipment to support the School's growing number of ERC research programmes (Profs Schmitt, McDonald, Boland and Nicolosi). In this manner the core needs of the discipline will be met as will the growing demand for an advanced research-level teaching laboratory (through joint MSc and PhD programmes with Thapar and Soochow Universities).

The School is actively engaged in formulating the strategy behind this vision, in evaluating the risks (via external consultancy) and in devising the most effective philanthropic funding campaign (with support from the Trinity Development Office and Faculty Office). The School is willing and able to put forward 'a business pact' for consideration by the College, as recommended by the external panel, on the expectation that where School-set objectives are met there is a commensurate return from College on the endeavour.

### **(iii) to improve internal communication**

**Management:** The school acknowledges the need for better communication with its internal stake-holders. In response to this recommendation it has already re-aligned its meeting schedules and expanded and revised its committee memberships. The reviewers also proposed an analysis at School level of the role of the Head of Discipline. The School intends to evaluate this as soon as possible with a view to determining whether these positions are exacerbating the fractures identified within the School community.

**Workload model:** The recommendation to use the workload model as a tool for work distribution is acknowledged but this has been problematic in the past. As a result it currently operates as an individual self-reflection exercise. The School Committee will determine how the current form might be re-designed to provide a mechanism for (i) identifying key activities essential to the School mission (ii) to equitably assign administrative and teaching duties (iii) to define at School-level the meaning of the term 'research-active'.

### **(iv) to address staffing levels and career development**

**Staffing levels:** The reviewers recommend an expansion of the academic staff (to at least 27), the employment of temporary teaching fellows, an additional administrative officer, and the input of resources to maintain the glass-blowing workshop. The School agrees with these recommendations, however, they will need to be reviewed in the context of the School's Strategic Plan and are likely to need additional funding streams.

**Performance Reviews and professional development:** The reviewers recommend performance reviews for all staff. These have been introduced and are mandatory for all newly recruited staff in the School in the first 12 months of appointment and are undertaken annually for Ussher appointees. The College is proposing to pilot annual performance reviews for all administrative staff and the School would welcome guidance on its introduction at School level. The reviewers highlighted the lack of opportunity for technical staff in particular to avail of continuing professional development. The School is providing limited resources to enable its technical support staff to undertake professional development courses although this is done on an *ad-hoc* basis because of the lack of resources. The School would welcome access to resources at College level to enable this.

### **(v) to reinvigorate the school's safety culture**

**Safety:** The reviewers were critical of the extent to which good safety practices are enforced in the School. The report proposes the empowerment of the School safety officer and more frequent inspections. The School welcomes these recommendations and sees them as key to enhancing and continually refreshing its

safety culture. Post-review it has taken immediate steps to raise awareness at all levels of School safety policies and practices. The School agrees with the recommendation that its research laboratories should be equipped with additional fumehoods. The resources and space needed to reach the levels proposed [‘comparable UK chemistry UG labs would typically have a fume cupboard for every 2 students in synthetic teaching labs’] however, is currently beyond that of the School. The proposed Chemistry extension project will address many of these issues.

**(vi) to enhance the student experience**

**Postgraduates:** The reviewers recommend better induction, a postgraduate colloquium to bring the postgraduate cohort together and to build a greater sense of community, and a review of the DubChem courses/ credit system. The School agrees with these recommendations.

**Undergraduates:** The School agrees with the recommendations to strengthen staff/student interactions, to provide students going abroad in their final year with internal project supervisors, and to further the opportunities for engagement between the Careers Office and Chemistry undergraduates.

**(vii) to target a specified Non-EU student market:**

The School welcomes the input of the reviewers to its non-EU student recruitment strategy and their recommendation to focus on the US market. A post-review meeting with representatives of the Global Office at Faculty level has raised the issue. Despite considerable activity at School level there is no Faculty level policy for marketing recruitment into the General Science TR071 entry stream. The School’s global officer (shared with Physics) will be attending the Trinity US Open Days in March 2016 to assess the prospect of targeting the US undergraduate student market.

**(viii) Finances**

The reviewers while commending the outstanding achievements of the School, sound a note of caution. In their view ‘a serious lack of investment and reduced staff morale were clearly evident’ leading to a situation that cannot continue indefinitely. The reviewers and the School recognise that its income (due to the cuts, which have targeted weighted income) is insufficient to cover its core activities. Given the ‘expensive’ nature of the discipline the reviewers recommend that in reality ‘an income:expenditure ratio of 1.3:1 compared to an expected 1.6:1 is to be expected’ by the College.

A significant number of the recommendations require additional resources and investment and as suggested by the reviewers a fairer distribution of overheads is one way to address this; ‘It is the unanimous opinion of the Panel that more overhead should go to the School’. The return to the School of its total research overhead has declined year on year (27% in 2014/15 i.e. 248k€ of 1.2M€) and it is being used primarily to support staff - 2.5 FTE technical staff, 0.4 FTE global officer and 0.4 FTE research programme officer. There is no doubt that with increasing student numbers and projected further cuts to its income, the School will continue to face difficult resourcing decisions. It has already proved necessary to cut the laboratory contact hours to freshmen students so that they are now below RSC accreditation levels. The reviewers expressed serious reservations about the consequences of this actuality.

**Conclusion**

The external review report of the School of Chemistry is considered, thorough and constructive. It contextualises the School’s achievements and offers a blueprint for how the School management can work with the Faculty Dean and College Officers to shore-up Chemistry’s continued success.

**Sylvia Draper**

Head of School of Chemistry, March 2016

**Dean's Response to the External Reviewers' Report**  
**School of Chemistry**

On behalf of the Faculty I would like to thank the External Reviewers for their detailed and considered report arising from their recent review of the School of Chemistry. In doing so I would also like to acknowledge the enormous efforts of the School's staff in developing a research profile that the Reviewers describe as "absolutely outstanding" while at the same time making substantial contributions to research and teaching right across the spectrum of science, engineering and medicine in the University. I look forward to working with the School to address the helpful recommendations made by the reviewers. Areas of particular focus will include:

1. supporting the School in implementing the Reviewer's recommendations concerning safety.
2. ensuring that the School remains a coherent entity that maintains "its own identity within the College" while continuing to underpin multidisciplinary activities being pursued in cognate Trinity Research Institutes (TRIs) and other centres. In this regard I welcome the recommendation that the School seek to consolidate as much of its activity and infrastructure as is feasible in an "attractive" "refurbished" single site. I note that the School is already developing proposals in this regard, which might be attractive for philanthropic as well as other funding.
3. facilitating the staff to "work together to create a strategic plan that all staff can unite behind and that includes a clearly defined procedure to achieve the defined, measureable goals that they set for themselves" and that is supported by a "business plan, with well-defined deliverables (student numbers, research funding, etc.) and milestones put into place and agreed to between the School and the College". Such a plan would serve to underpin recommended increases in staffing and other resources to the School. Again I note that work on the development of such a plan is ongoing and, indeed, hopefully near to completion.
4. facilitating a review of the role of the disciplines within the School and whether they add value to the delivery of the School's mission as well as the implementation of the conclusions arising from that review.
5. working with the School to refocus its international student recruitment strategy taking on board the reviewers' comments about the potential for US student recruitment as well as reviewing the appropriateness of the School's course offerings for international students.

In additions to these areas of focus I note the Reviewers' comments about the need for the creation of a more appropriate School-specific workload allocation model, the "very small" size of some classes, the hiring of teaching fellows, and the importance of RSC accreditation. I also acknowledge that there is a sense that there is some misalignment of the missions of the School and of the TRIs to which its members belong and that more needs to be done to ensure that they are fully aligned. While I cannot see a justification for the assertion that "External funding in association with Institutes seems to drive hiring and dictate strategy", I believe that the development of a School strategic/business plan represents the perfect opportunity for the School to engage with the cognate Institutes about its goals as it brings forward a strategic staffing plan.

**Vinny Cahill**

Dean of FEMS, March 2016