

## **Response to the Committee for the Evaluation of Chemistry Studies**

### **The General Report**

**U. Peskin**

**Vice dean for undergraduate and graduate studies**

**and**

**A.Hoffman**

**Dean**

**Schulich Faculty of Chemistry**

**Technion.**

**May 15, 2012**

This document contains the response of the Schulich Faculty of Chemistry at the Technion to the general report of the committee for evaluation of Chemistry studies.

Our response contains: I) a general perspective, II) references to some of the specific issues raised by the committee in the body of the report, and III) our detailed answer to each general recommendation made by the committee. The Schulich Faculty of Chemistry would like to thank the committee chaired by Prof. Richard Eisenberg for their recommendations. We believe that on the whole the implementation of most of their recommendations will improve the teaching of chemistry at both undergraduate and graduate levels.

#### **I) A general perspective**

In stating, “Despite its intellectual, historical and economic importance, interest in chemistry has declined significantly in recent years”, the committee referred to the classical definition of Chemistry (Organic, Physical, Analytical, etc.). Considering new branches and evolution within the past 15-20 years, interest in Chemistry has actually increased dramatically. Indeed, the number of high school students who study “chemistry” has declined in Israel, but new tracks, “technological chemistry”, “biotechnology” and others were established for the chemistry-oriented students. Similarly, at the University level most chemistry-oriented students can be found in other study programs including, e.g., “material engineering”, “biochemistry”, “biotechnology”, and not in Chemistry. This continues on to graduate level studies with the emergence of new interdisciplinary programs (“Nano-technology”, “Energy”, etc) and may happen in the future at the faculty level with the establishment of national “excellence centers”.

Given this situation the classical fields of Chemistry are facing two major challenges:

- 1) Competition from chemistry-based new branches and programs
- 2) A growing demand to academically support and feed those new branches and programs.

We believe that the future of Chemistry at research universities depends on the ability to preserve the active classical research fields of Chemistry while providing the proper level of academic support for the emerging new Chemistry-based fields. A healthy symbiosis between attractive and developing new chemistry-based fields and the established classical fields with the sustainable body of knowledge and skills is essential.

## **II) Comments on selected issues**

### *High school preparation.*

We agree with the committee that high school education has a profound effect on the decline of interest in Israeli chemistry. In particular, the establishment of new “technology-oriented” study programs turned resources away from Chemistry as well as other basic sciences. The Faculty is actively taking actions in order to promote the studies of high school Chemistry, including the establishment and operation of the Chemistry Olympiad and the Archimedes project for high school students, but these activities are not a substitute for a clear policy of the ministry of education to encourage the studies of basic science and Chemistry in particular at the national level, at the expense of “technology oriented” programs which fail to provide the needed basis.

### *Undergraduate Programs.*

The Faculty will actively promote the institution of a new 4-4.5 year “direct to M.Sc.” track for students of appropriate capabilities. A major portion of the credits required in this track will be performance of research, leading to a M.Sc. thesis. We believe this new program addresses some fundamental issues brought up by the committee. In particular, the net teaching load in formal courses both during first and second degree would decrease, while the weight of research work and research skills developments would increase.

### *Recruitment of faculty in chemistry fields that fulfill a national interest.*

The recruitment of new faculty is primarily based on the quality of research. Traditionally, basic science is preferred in universities over applied science. The high risk – high gain nature of basic research and the respective funding models makes it appropriate for the research university model. At a national level, it might be plausible to encourage the establishment of applied research institutes, with different funding models, but a too strong mixing of industrial demands for research into the research universities contradicts the research university model, and should not be adopted lightly. In this respect the U.S. example should be regarded with caution.

### *Setting up a uniform system of credits.*

The Committee points to the lack of a uniform system of credits for the Chemistry degrees at different universities. Indeed, different universities have different methods of counting credit points for lectures, TA hours, lab hours etc. Even the duration of an academic hour differs significantly between universities (e.g., 45 minutes in Bar Ilan vs. 50 minutes in the Technion). Since each university sets the rules for all of its programs, it is unlikely that a uniform credit system for Chemistry will be established. It would be desirable, however, to establish a uniform test for the level of graduating students at a national level (similar to the examinations for lawyers, MD's etc). Such a test could provide a genuine measure for comparing the value of degrees by different universities.

### III) Response to the general recommendations

- **Greater emphasis in the first-degree program on undergraduate research in the curriculum.**
- **Reduction in the number of the upper-level elective courses required in the Bachelor's degree to facilitate students doing research. This may also allow movement of small number of courses from the second year to the third to ease compression in the program.**

The Faculty agrees with the committee that undergraduate students should obtain more experience in how research is performed, and to improve their critical and creative thinking while doing so. The faculty had already taken measures to encourage the undergraduate students to perform research, such as establishing a new extended (6 points) elective course “A special Research Project in Chemistry”, in which students would be required to perform a research project, prepare a final report and to present a poster during a faculty event dedicated to undergraduate research. Students who choose to take this course would be exempt from other upper level elective courses.

The Faculty would act to promote students participation in research, including the introduction of a new summer camp. In parallel, realizing the extra effort involved in teaching undergraduate students to perform research, the faculty would act to increase external support (from Technion, government and industry sources) in funding undergraduate students research work.

The Faculty will actively promote the institution of a new 4-4.5 year “direct to M.Sc.” track for students of appropriate capabilities. A major portion of the credits required in this track will be performance of research, leading to a M.Sc. thesis.

- **Use of the "Direct to Ph.D." track more generally at the start of graduate studies.**

A majority of the faculty members believe that the present method of accepting students to graduate studies is preferable to the suggestion that all students be accepted as doctoral candidates. The Faculty already supports the moving of as many students as possible from the M.Sc. track to the “direct-Ph.D.” track, but only after they have proven themselves in at least a year of graduate studies and research.

- **Reduction in the number of formal course credits in the combined Masters-Doctoral program.**

The Faculty supports the recommendation to reduce the number of formal courses in the Masters and Doctoral studies. The required number of credit points in graduate studies is set by the institute (Technion) graduate school. The Faculty recommends that the graduate school would consider lowering this number for science faculties. (Today, this number is set according to the number of credit points in the first degree, and does not properly reflect the actual load and needs of the graduate studies).

- **Greater use of English in advanced studies should be done, such as in the writing of the doctoral proposal.**

As many Technion graduate courses, Chemistry graduate courses are typically based on learning materials (books, exercises, lecture notes) in English. In many cases, where international students attend, the lectures are given in English.

- **Recruit the best new faculty through broader searches. There are legal questions here that need attention in the context of recruiting non-Israelis. The fact is that competition for talented new faculty around the world is getting more competitive, and if Israel wants to maintain its status as having some of the best chemistry programs while experiencing declining national interest in the subject, it will need to recruit more widely.**

The Faculty agrees that such recruitment can be beneficial, within the labour laws of the State of Israel and the requirements of the Technion (ability to teach in Hebrew).

- **Recruit more women to Chemistry faculties. This may require special new programs and reexamination of criteria for new faculty candidates.**

The Faculty agrees and has recently recruited two new female faculty members. The Faculty will actively seek out outstanding female and other graduate students (from populations not represented in the faculty) and seek to provide guidance on the performance of meaningful post-doctoral research in Israel that can lead to recruitment.

- **Institution of a funding program for mid-career and senior scientists to obtain funds for new equipment and laboratory refurbishment.**

The Faculty will continue to emphasize to its faculty members to submit proposals for infrastructure (equipment and manpower) and will strive to obtain matching funds typically needed for such procurement.

- **Increase efforts to have new laboratories ready for use within a few months of the arrival of new faculty.**

The Faculty agrees and will actively work with the Technion administration to provide the financial support need to provide these resources and space.