Committee for the Evaluation of Biology/ Life Sciences Study Programs

Technion – Israel Institute of Technology

Faculty of Biology

Evaluation Report

November 2010

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Chapter 1- Background

At its meeting on October 23, 2007 the Council for Higher Education (CHE) decided to evaluate study programs in the field of Biology/Life Sciences during the academic years 2004-2008.

Following the decision of the CHE, the Minister of Education, who serves ex officio as the Chair of the CHE, appointed an Evaluation Committee for the evaluation of the academic quality of biology/Life Sciences studies in Israel. The Committee consists of:

- **Prof. Michael Levitt, Department of Structural Biology, School of Medicine, Stanford University, USA - Committee Chair**
- **Prof. Ueli Aebi, M.E. Muller Institute for Structural Biology Biozentrum, University of Basel, Switzerland**
- **Prof. Yigal Cohen, Faculty of Life Sciences, Bar Ilan University, Israel**
- **Prof. Nicole Le Douarin, Institute of Embryology, College de France, France**[1]
- **Prof. Shlomo Rotshenker, Department of Medical Neurobiology, The Hebrew University Medical School, Israel**
- **Prof. Daniel Simberloff, Department of Ecology and Evolutionary Biology, University of Tennessee, USA**

Ms. Marissa Gross- Coordinator of the Committee on behalf of the CHE.

Within the framework of its activity, the Committee was requested to submit the following documents to the CHE:

1. A final report for each of the institutions, which would include an evaluation of Life Science study programs, the Committee's findings and recommendations.
2. A general report regarding the status of the evaluated field of study in Israeli institutions of higher education.
3. Recommendations for standards in the evaluated field of study.

The Committee's letter of appointment is attached as **Appendix 1**.

The first stage of the quality assessment process consisted of self-evaluation, including the preparation of a self-evaluation report by the institutions under evaluation. This process was conducted in accordance with the CHE's guidelines as specified in the document entitled "The Self-Evaluation Process: Recommendations and Guidelines" (October 2007).

[1] Prof. Le Douarin was unable attend the second round of visits due to personal reasons.

Chapter 2 - Committee Procedures

The Committee held its first meetings on May 8, 2009. At this meeting committee members were given an overview of higher education in Israel and a description of the Israeli CHE. They also discussed Biology/Life Sciences study programs in Israel and fundamental issues concerning the committee's quality assessment activity.

During May 2009 Committee members conducted full-day visits to two of the eight institutions whose Biology/Life Sciences study programs the committee was requested to examine: Hebrew University in Jerusalem and Tel Aviv University. The committee visited the remaining six institutions, the Ariel University Center, Bar Ilan University, the Open University of Israel, the Weizmann Institute of Science, the Technion - Israel Institute of Technology, and Ben Gurion University during March 2010.

During these meetings, the Committee met with the relevant officials at each institution, as well as with faculty members, students, and also conducted a tour of the campus.

This report deals with the Biology/Life Sciences Programs of the Faculty of Biology at the Technion – Israel Institute of Technology.

The Committee's visit to the Technion took place on March 14-15, 2010

The schedule of the visit, including the list of participants representing the institution, is attached as Appendix 2.

The members of the committee thank the management of the institution and the Faculty of Biology for the frank self-evaluation report and for their hospitality towards the Committee during its visit.

Chapter 3 - Evaluation of Biology Programs at The Technion*

3.1. General Background

The Technion opened its doors in 1924. In 1962, the Technion was recognized by the Council for Higher Education. In 1971 the Department of Biology was established as an independent academic unit. Increasing teaching and scientific research activities necessitated new facilities and the recruitment of staff members. In view of the rapid development of molecular aspects in biology, it was decided that the main emphases of the Department of Biology would be biochemistry, genetics, and molecular and cellular biology. In 1988, the Technion Senate decided to change the status of the biology academic unit from a Department to a Faculty. In 1992, the building housing the Faculty was expanded with an adjacent wing, creating space for eight new laboratories. However, this was not followed by a significant increase in faculty members: the faculty had 21 members in 1990 and currently has 24 members.

In 2004, an external committee recommended further expansion of the Faculty of Biology. Technion management adopted the recommendation and initiated a new program: LSE for Life Sciences and Engineering. LSE and nanotechnology invested in infrastructure and recruitment of new faculty members. A new life sciences building is currently under construction, which will house state-of-the-art infrastructure for modern biological research equipment including microscopy and imaging, cell separation, proteomics and bioinformatics. In addition, five new faculty positions were generated by the LSE and Technion management in the past two years. Based on the evaluation committee of 2004, the Faculty of Biology has made significant revisions in its study programs.

.In 2007-2008, 366 BSc students, 39 MSc students and 61 PhD students were enrolled in the Faculty of Biology.

3.2 Executive Summary

The Faculty of Biology at the Technion faces difficulties due to a lack of equipment and an aging infra-structure. Nevertheless, we found a dynamic, optimistic, forward thinking faculty, with good teaching abilities under the solid leadership of the dean. The new LSE building which is in the final stage of construction will offer better facilities and a friendlier atmosphere to the Faculty of Biology. The BS, MS and PhD students we met were of good quality and dedicated to research. The young faculty members were happy to be at Technion, giving up positions in other universities in Israel or abroad. They were given generous start-up packages and general support. The Faculty is not divided into departments. The Faculty of Biology offers one study program in Biology and four study programs in cooperation with other faculties (chemistry, medicine, computer sciences, chemical

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** This Report relates to the situation current at the time of the visit to the institution, and does not take account of any changes that may have occurred subsequently. The Report records the conclusions reached by the Evaluation Committee based on the documentation provided by the institution, information gained through interviews, discussion and observation as well as other information available to the Committee.*

engineering). No programs are available in organismic biology and ecology. The aging infrastructure does not seem to interfere with the good research output that was above average from 2004 to 2008 with 9.8 papers per faculty member with an average of 15 citations per paper. This research output was achieved at a modest cost of $87,823 per paper or $5,835 per citation (see Table 1).

3.3 Goals and General Situation

The mission statement is described as follows:

"The mission of the Faculty of Biology is to educate students and to conduct research at the highest level of the scientific disciplines that constitute the area of life sciences, with an emphasis on molecular and cellular biology. This mission translates into the following more specific goals:

- *To endow graduates with strong theoretical and practical tools for the analysis and design of biological experimental systems with a major emphasis on modern molecular and cellular biology.*
- *To educate a new generation of researchers in the graduate programs, in particular PhDs, who will be leaders in academia and industry in Israel in the years to come.*
- *To conduct research at the level of the best universities in the field worldwide.*
- *To be at the forefront of the rapidly expanding boundaries of life sciences and other multidisciplinary sciences and engineering fields, such as nanoscience, biophysics, bioinformatics and engineering."*

3.4 Curriculum

Strengths:

- There are 5 programs for the BSc degree which fit a diverse student population: **Bachelor of Science (BSc) in Biology**, **in Molecular Biochemistry**, **in Medical Laboratory Sciences**, **in Biochemical Engineering** and in **Computer Science with a focus on Bioinformatics**. The Molecular Biochemistry track provides good education in both chemistry and biology. The Medical Laboratory track provides good training in operating clinical labs. The Biology track prepares students for academic and industrial careers in broad fields of biomedical sciences. The Biochemical engineering track makes students fit for the biochemical/biomedical industry.

Weakness:

- The Technion has historically minimal strength in ecology, evolution, and biodiversity, and there are currently not sufficient number of courses in ecology or evolution.
- Teaching labs suffer from lack of facilities.
- The Medical School is located downtown, making access difficult and time-consuming.

Recommendations:

- There should be a Technion-wide committee to coordinate the courses that are part of joint Faculty programs. Since Biology is affected by these changes, they should be party to making them and have control over the courses that their students take.
- Teaching should be expanded to include more courses in organismic biology, ecology and evolution.
- A shuttle bus should be made available between the Biology campus and the Medical School.
- The budget for teaching labs should be increased.

3.5. Teaching and Learning

Strengths:

- All the students are given the opportunity to do rotations in research labs.
- Some lectures are recorded and made available online.

Weaknesses:

- Elective courses in medicine are full before Biology students can register.

Recommendations:

- Provide smaller core classes for Biology students.
- Make sure Biology students have some priority in registering to electives in other Faculties.

3.6.1 BS Students

Strengths:

- Students were generally satisfied.
- Most will go on to an MSc at the Technion
- Most have taken a Research Project.

Weaknesses:

- There are not enough elective courses available during the 3rd year. Many of the courses are not open every year. Often courses are taken according to the exam schedule.
- Chemistry classes are oversubscribed.
- There is a lack of courses in plant sciences.

Recommendations:

- Allow more elective courses in the 3rd year.
- Create a Chemistry class specifically for Biology students.

3.6.2. MSc students

Strengths:

- Three out of five did their BSc degrees here, and 4 out of 5 will go on to do a PhD at the Technion.

Weaknesses:

- There are not enough new courses offered. Most of these courses were already taken during BSc training. In addition, lab courses are needed for graduates.

Recommendations:

- Offer more courses to MSc graduate students.

3.6.3. PhD students

Strengths:

- All are satisfied by the fact that groups are small and there is enough lab space.

Weaknesses:

- Course selection is poor.
- According to Technion regulations, a student's PhD committee must meet only once.
- There is no input from external minds besides the supervisor.

Recommendations:

- Expand course selection (for example Animal Physiology)
- Allow the PhD committees to meet more often to guide/control the students' research progress.

3.7 Human Resources: New Junior Faculty

Strengths:

- All newly recruited faculty members made a very good impression on the committee.

Weaknesses:

- The Faculty has limited access to state of the art equipment.
- The tenure process and official status of junior faculty members does not appear transparent to them.
- About 5 or 6 tenured faculty members are reaching retirement age. The faculty should create a strategic recruitment plan for the upcoming years.

Recommendations:

- Invest in modern equipment.
- The tenure process should be transparent and proper information should be provided to the junior faculty concerning the necessary steps to achieve tenure. The Dean and Senior faculty members should meet with junior faculty to discuss their future tenure in the Institute (mentoring by senior faculty).
- Keep the dynamic research atmosphere by recruiting more excellent young members.
- Create a strategic recruitment plan.

3.8 Infrastructure

The committee visited the new Life Sciences and Engineering (LSE) building, which is still under construction. Once this building is in use, the Biology Faculty will get 8 new labs.

The committee also visited the MALAT building where teaching labs are located. The building is old and equipped with old infrastructure. Some complaints were heard about the lack of equipment. The committee was informed that because of the antiquated equipment, certain exercises are not conducted and that this situation was due to a deficit budget over the last five years and a lack of government support.

Strengths:

- Eight modern labs will be given to the Biology Faculty in the new LSE building.
- PIs expressed satisfaction with space in the research laboratories and their own equipment.

Weaknesses:

- Poor infrastructure in old buildings.
- There is no funding for infrastructure and shared equipment.
- There is only one lecture hall specifically for the Faculty of Biology.

Recommendations:

- Improve infrastructure, teaching labs and classrooms.
- Invest greater resources in modern equipment for shared use by all faculty.

3.9 Research

We choose to evaluate research at the Life Sciences Faculties in a consistent manner using the total number of citations to all the papers published by current faculty at Technion during the five year period 2004 to 2008. This involved web harvesting from the Web of Knowledge (downloading all the Technion papers for 2004-2008), data curation (ensuring names are correct, eliminating duplications), and special purpose programming (summing the citations for the current faculty of Life Sciences). Using the cumulative Impact Factor of the journals in which each paper was published gives a very similar result although the numbers are different as many journals are not assigned an impact factor. This data as well as other summarizing data is given in Table 1 below.

Strengths:

- In the five years since the Faculty of Biology was externally evaluated in 2004, research output has attained superior quality in terms of the total number of citations per faculty. It is also economical in terms of the cost of a paper in terms of grant funds and support for postgraduate students (see Table 1 below).
- Overall, the relatively small group of 24 faculty do exceptional well in research with limited facilities and institutional support.

Table 1: Quantitative Analysis of the Faculty of Life Science at **Technion**

Topics Evaluated (CHE Appendix)	Evaluation Criteria	Values	Topics Evaluated	Evaluation Criteria	Values
The Academic Faculty	Number of faculty (PI): All	24	Research Papers	Period Analyzed (2004-2008)	0
	Lecturers	0		Total Self-reported	250
	Senior Lecturers	9		Total Web of Science	276
	Associate Profs.	8		Number of Papers per Faculty	11.5
	Full Profs.	7		Number of Citations per Faculty	172.5
	Active Emiriti	2		Annual Publications per PhD/yr	0.82
	New faculty in last five years	5		Annual Faculty Publications /year	2.30
	Retired faculty in last five years	2	Impact	Number Papers	276
The Students	Number of students: Total (2008)	478		Number Citations	4,140
	BSc (2006)	421		Total Impact Factor	1,064
	BSc (2010) as percent of 2006	104%		Total Impact Factor/PI	44.3
	BSc (2008)	366		Papers with 2 or more PIs	4
	MSc (2008)	39	Total Support ($x1000)	Total Grant Funds	15,760
	PhD (2008)	61		Total Graduate Student Funds	4,896
	Postdocs (2008)	12		Total Research Funding	20,656
Student / Faculty Ratios	BSc students per faculty (2008)	15.3	Resource/ Faculty	5 Year Total Grants per faculty	$656,667
	MSc students per faculty (2008)	1.6		5 Years PhD Funds per faculty	$204,000
	PhD students per faculty (2008)	2.5		Total Research Funding	$860,667
	Postdocs per faculty (2008)	0.5		Lab. Space per faculty (m2)	90
	Ratio of TAs / Faculty	2.5	Effectiveness	Cost of a Paper	$74,841
The Study Program	Number of Teaching Assistants	61		Cost of a Citation	$4,989
	MSc Student Stipend (NIS/month)	3,911		Relative Cost of Paper	0.89
	PhD Student Stipend (NIS/month)	5,063		Relative Cost of a Citation	0.68

Chapter 4 – General Recommendations

Strengths:

- Very strong support is provided for new recruits who are the essential life-blood of the academic endeavor.
- Very good research output relative to other faculties of Life Sciences in Israel.
- Housing of 8 labs in the new LSE building will encourage cooperation with Medicine and Nanosciences.

Weaknesses:

- There is a decline in the quality of the infrastructure and the teaching facilities. The committee recommends allocating funds to teaching facilities and increasing the number of classrooms for the faculty.
- Adequate funds need to be devoted to recruitment to replace retired faculty. Moreover, a strategic plan should be created concerning future faculty recruitments.
- More attention needs to be given to ecology and evolution.
- There should be a Technion-wide committee that coordinates the courses that are part of joint Faculty programs. Since the Biology Faculty is affected by these decisions/changes, it should be part of this committee and have control over the courses that its students have to take.

Opportunities:

- The planned School of **Life Science and Engineering**[2] will change how things are run at the Technion. This offers opportunities and challenges to the Faculty of Biology that can best be approached by insightful discussions amongst the faculty. The Life Sciences today are more confronted with engineering aspects and themes (e.g. tissue engineering,

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[2] The Dean provided the following statement by email:
"Mission of the Life Science School including Medicine, Biology, Biotechnology and Biomedicine, to be established by the academic year of 2011/12.
The Life Science School is under construction and we are now establishing the study programs and its academic structure. One certain thing is that the medical school at the Technion will go into a four year program while the pre-medicine studies will be carried out at the Neve Shaanan campus under the frame of this school. Our mission is to include in it also the Biotechnology and Food Engineering and Biomedical Engineering Faculties. There will be several study tracks including biological sciences, pre-medical studies, biochemical engineering and biomedical engineering as well as additional tracks like bioinformatics. A student in this school will start in the first three semesters with general basic courses and then decide whether to continue for an eng track (four years), scientific track (3 years), pre med track (3 years) or one of the other combinations mentioned above. Basic courses will be general to all students (not like now that there is a course for every faculty) and will be delivered by the best teachers."

nanomedicine, etc) as engineering is similarly incorporating many aspects of biology in particular by principles and processes occurring in cells.

Signed by:

Prof. Michael Levitt, Chair

Prof. Ueli Aebi

Prof. Yigal Cohen

Prof. Shlomo Rotshenker

Prof. Daniel Simberloff

Appendix 1: Letter of Appointment (Sample)

מדינת ישראל

STATE OF ISRAEL

Minister of Education

May 6, 2009

Prof. Michael Levitt
Department of Structural Biology,
School of Medicine, Stanford University,
USA

Dear Professor Levitt,

The State of Israel undertook an ambitious project when the Israeli Council for Higher Education (CHE) established a quality assessment and assurance system for Israeli higher education. Its stated goals are: to enhance and ensure the quality of academic studies; to provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel; and to ensure the continued integration of the Israeli system of higher education in the international academic arena. Involvement of world-renowned academicians in this process is essential.

This most important initiative reaches out to scientists in the international arena in a national effort to meet the critical challenges that confront the Israeli higher educational system today. The formulation of international evaluation committees represents an opportunity to express our common sense of concern and to assess the current and future status of education in the 21st century and beyond. It also establishes a structure for an ongoing consultative process among scientists around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial endeavor.
It is with great pleasure that I hereby appoint you to serve as Chair of the Council for Higher Education's Committee for the evaluation of Life Sciences/ Biology Studies.
The composition of the Committee will be as follows: Prof. Michael Levitt- Chair, Prof. Ueli Aebi, Prof. Yigal Cohen, Prof. Nicole Le Douarin, Prof. Shlomo Rotshenker and Prof. Daniel Simberloff.
Ms. Lilach Weisz will coordinate the Committee's activities.

In your capacity as a Chair of the Evaluation Committee, you will be requested to function in accordance with the enclosed appendix.

I wish you much success in your role as a Chair of this most important committee.

Sincerely,
Gideon Sa'ar
Gideon Sa'ar
Minister of Education
and Chairperson of the Council for Higher Education

Enclosures: Appendix to the Appointment Letter of Evaluation Committees
cc: Ms. Riki Mendelzvaig, Secretary of the Council for Higher Education
Ms. Michal Neumann, Head of the Quality Assessment Unit
Ms. Lilach Weisz, Committee Coordinator

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Appendix 2: Schedule of Technion On-Site Visit

Biology/Life Science –schedule of site visit- Technion

First Day: Sunday March 14, 2010:

9:00-12:00	Closed Committee Meeting	
12:00-12:30	Lunch	
12:30-13:15	Opening session with the heads of the institution and the senior staff member appointed to deal with quality assessment	Senior Executive VP - Prof. Paul Feigin Deputy Senior VP - Prof. Moshe Sheintuch Dean of Graduate School - Prof. Moshe Shpitalni
13:15-14:00	Tour of campus (Including classes, laboratories, offices of faculty members, computer labs etc.)	Laboratories Building (MALAT), Computer class and auditorium Drs, Debby Lindel and Sigal Svaldi-Goldstein
14:00-14:45	Meeting with academic leadership of Faculty	Prof. Gadi Schuster
14:45-15:30	Meeting with the academic heads of the department	Profs. Gadi Schuster, Yona Kassir, Dan Zilberstein, Benjamin Horwitz, Reiter Yoram,
15:30-16:15	Meeting with representatives of relevant departmental committees *	Prof. Yona Kassir Prof. Dan Cassel
16:15-17:30	Meeting with Senior Academic Faculty*	Profs, Yael Mendel, Oded Beja, Arie Admon, Zeev Arad, Shimon Gepstein, Gera Eitan, Tali Haran
17:30-18:00	Closed-door working meeting of the evaluation committee	

Second Day: Monday March 15, 2010:

Time	Subject	Participants
9:00-10:15	Meeting with Junior academic faculty*	Drs. Yoav Arava, Amnon Harel, Sigal Savaldi-Goldstein, Itai Yanay, Debby Lindel, Phylippa Melamed, Nabie Aube
10:15-11:00	Meeting with adjunct lecturers*	Drs. Gal Ribak, Sara Zelig, Fabian Glazer, Tamar Ziv
11:00-11:45	Meeting with B.Sc. students**	Students: Michal Ohayon, Mati Facterman, Shani Ben Shimon, Irena Seladcevich, Hanan Chori, Boris Shnier, Aviv Sharon, Noa Oron.
11:45-12:30	Meeting with M.Sc. students**	Students: Fridman Keren, Lavee Dagan, Tsygakov Polina, Yosefzon Yahav.
12:30-13:15	Meeting with PhD students**	Students: Kliouchnikov Elena, Avrani Sarit, Goldman Adele, Shaulov Lihi.
13:15-13:45	Lunch	
13:45-14:15	Closed-door working meeting of the evaluation committee	
14:15-15:00	Summation meeting with heads of the institution and of the department	President - Prof. Peretz Lavie Senior Executive VP - Prof. Paul Feigin Deputy Senior VP - Prof. Moshe Sheintuch Dean of Graduate School - Prof. Moshe Shpitalni Dean - Prof. Gadi Schuster

* The heads of the institution and academic unit or their representatives will not attend these meetings.
** The visit will be conducted in English with the exception of students who may speak in Hebrew and anyone else who feels unable to converse in English.