



**Committee for the Evaluation of
Biotechnology & Biotechnology Engineering Study Programs**

ORT BRAUDE COLLEGE

Biotechnology Engineering Study Program

Evaluation Report

April 2013

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Chapter 1: General Background

At its meeting on July 25, 2010, the Council for Higher Education (CHE) decided to evaluate study programs in the field of Biotechnology and Biotechnology Engineering during the academic year 2012.

Following the decision of the CHE, the Minister of Education, who serves ex officio as Chairperson of the CHE, appointed a Committee consisting of:

- **Prof. Moshe Rosenberg**, Department of Food Science & Technology, UC Davis, USA, Committee Chair¹
- **Prof. Gad Galili**, Department of Plant Sciences, Weizmann Institute of Science, Israel
- **Prof. Milica Radisic**, Institute of Biomaterials and Biomedical Engineering, Department of Chemical Engineering and Applied Chemistry, University of Toronto, Canada²
- **Prof. Joseph Shiloach**, Biotechnology Core Lab, NIH- National Institutes of Health, USA

- *Ms. Yael Elbocher* - Coordinator of the Committee on behalf of the CHE.

Within the framework of its activity, the Committee was requested to:³

1. Examine the self-evaluation reports, submitted by the institutions that provide study programs in Nutritional Sciences, and to conduct on-site visits at those institutions.
2. Submit to the CHE an individual report on each of the evaluated academic units and study programs, including the Committee's findings and recommendations.
3. Submit to the CHE a general report regarding the examined field of study within the Israeli system of higher education including recommendations for standards in the evaluated field of study.

The entire process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (of October 2010).

¹ During the first round of visits Prof. Carl Batt of Cornell University was Committee Chair. During the period between the two rounds of visits Prof. Batt resigned due to incomparable disagreements

² Prof Radisic joined the committee for its second round of visits, thus did not take part in the evaluation of Tel Hai College, ORT Braude College and The Hebrew University of Jerusalem

³ The Committee's letter of appointment is attached as **Appendix 1**.

Chapter 2-Committee Procedures

The Committee held its first meetings on March 14, 2012, during which it discussed fundamental issues concerning higher education in Israel, the quality assessment activity, as well as Biotechnology and Biotechnology Engineering Study programs.

In March 2012, the Committee held its first round of visits of evaluation, and visited Tel Hai Academic College, ORT Braude College and the Hebrew University of Jerusalem. In June 2012 the Committee conducted its second evaluation cycle, and visited Ben-Gurion University of the Negev, Hadassah Academic College Jerusalem, Tel Aviv University and The Technion. During the visits, the Committee met with various stakeholders at the institutions, including management, faculty, staff, and students.

This report deals with the Biotechnology Engineering Study Program at ORT Braude College which took place on March 18, 2012.

The schedule of the visit is attached as **Appendix 2**.

The Committee thanks the management of Ort Braude College and the Department of Biotechnology Engineering for their self-evaluation report and for their hospitality towards the Committee during its visit at the institution.

Chapter 3: Evaluation of Biotechnology Engineering Study Program at ORT Braude College

** This Report relates to the situation current at the time of the visit to the institution, and does not take account of any subsequent changes. 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.*

3.1 Executive Summary

The Biotechnology Engineering Program (BTEP) at ORT Braude College (OBC) was established in 1992, the CHE authorized OBC to confer B.Sc. in BTE in 2004, and in 2009 the BTEP received its permanent accreditation. In 2010 the first class of 10 M.Sc students was opened. The program has experienced declining enrollment during recent years and in 2011, 350 undergraduate and 10 graduate students were enrolled in the BTEP. The B.Sc. study program has experienced an excessive attrition rate during recent years and measures directed at overcoming this phenomenon have to be introduced. The program has to develop a concise mission statement and a detailed strategic plan. In general, the curriculum of the BTEP allows educating and training students to assume positions in the biotechnology and related industries, or pursue graduate degrees at research universities however, it needs some modifications and adjustments. The faculty members of the program are properly trained to instruct the curricular elements of the program and are dedicated to their teaching assignment and to the success of their students. The student population of the program is very diverse and all of the different strata of the Israeli society are well represented. The college and the program do not have a core research infrastructure to meet research needs of faculty members and students. The latter has an adverse effect on the promotion process of faculty members, has resulted in a skewed distribution of ranks among faculty members and requires all of the students to carry out their compulsory research project off campus. Although the committee believes that colleges should be focused on instructing undergraduate students rather than on developing new knowledge, a core research infrastructure to accommodate limited-scope research activities of faculty members and some of the students needs has to be established. The promotion process has to be based on assessing success of faculty members in meeting reachable goals without penalizing them for not meeting unattainable objectives. A concept of establishing an individual-specific job description has to

be developed, implemented and used in assessing success of faculty members. Since 2010 the DBTE offers a Master degree without thesis. The academic and research foundations for a high quality graduate studies program do not exist currently at the DBTE and the committee recommends that the Master program will be put on hold until all the foundational pre-requisites for a successful quality Master program have been established.

The BTEP at OBC has the potential to become a stellar program in biotechnology engineering and to successfully meet the current and future needs and challenges of the modern biotechnology industry and research in Israel. The committee has identified several curricular, personnel and infrastructural needs that have to be addressed.

Major recommendations are:

- Identify and design the specific competitive strength and desired biotechnology-related directions of the program; Develop a concise and focused mission statement and a detailed strategic plan and establish an effective Industry Advisory Board to the program.
- Place the M.Sc. program of the BTEP on hold and do not offer until all the foundational pre-requisites for a high quality research culture that are detailed in this report have been established.
- Critically review and re-design the study tracks of the B.Sc. study program; enhance and strengthen the curriculum of the selected study tracks, and specifically enhance and strengthen the Food Biotechnology study track.
- Restructure the compulsory Research Project to become a 3-4 months course and negotiate opportunities for students to conduct their research at research universities.
- Develop and introduce faculty-member-specific job description and develop a clear set of guidelines that identify and specify, for each promotion step in each of the academic ranks, the requirements for a successful promotion; once the latter has been developed, fully implement a promotion process that is based on assessing success in meeting the criteria and objectives that are stated in the individual-specific job description.

- Pending the introduction of tangible opportunities for conducting research, as part of the criteria for promotion, and until the concept of individual-specific job description has been implemented, base the promotion of faculty members, at all ranks, only on their accomplishments in teaching, community service and outreach activities.
- The college together with the relevant governmental agencies should launch an effort aimed at establishing a core research infrastructure that will allow faculty members and students to conduct SOME LIMITED SCOPE research activities.

3.2 Background

ORT Braude College (**OBC**) is located in the northern city of Karmiel, in the Galilee. The college was authorized in 1994 by the Council for Higher Education (**CHE**) to register students to engineering study programs and became an accredited institution of higher education in 1996. OBC was established to: provide the residents of the Galilee as well as the rest of the population in Israel with high level academic education in Engineering, Science and Management; train highly qualified engineers; play a leading role in the development of the Galilee by providing high quality education to the indigenous population; attract students and professionals from the entire country to Northern Israel. In 2011, 2704 undergraduate students and 50 graduate students were enrolled in the 8 B.Sc. and M.Sc. study programs of the college, respectively. The academic staff of OBC consists of 99 full time faculty members and 243 adjunct lecturers, which collectively constitute an equivalent of 110 full time teaching positions.

The mission statement of OBC is to strive to be the first choice for students and faculty, working to promote excellence in teaching and research while emphasizing each individual's personal needs. The College aims at assuming a leading role in community activity and in the development of the Galilee.

The Biotechnology Engineering Program (**BTEP**) at OBC was established in 1992 and in 1996 the College was authorized by CHE to confer the degree Bachelor of Technology (B.Tech.) in Biotechnology Engineering (**BTE**). In 2004, the CHE authorized OBC to confer the

degree Bachelor of Science (B.Sc.) in BTE, and in 2009 the BTEP received its permanent accreditation. In 2010 the first class of 10 M.Sc students was opened

The number of students enrolled in the BTEP declined from 441 in 2006 to 350 in 2010; the number of new students enrolled in the B.Sc. BTEP declined from 167 in 2006 to 93 in 2010. The annual number of students that graduated the B.Sc. study program grew from 59 in 2006 to 93 in 2010 (including those graduating within 5-7 years).

3.3 Mission, Goals and Aims

The mission statement of the department of BTE (DBTE) is consistent with the overall mission of the college however the committee holds the opinion that it is too broad and lacks focus on specific aims of the program. The committee holds the opinion that a concise and focused mission statement, reflecting the collective vision of the program's faculty members and aligned with the mission statement of the College is needed.

The committee recognizes the value and merits of introducing a broad spectrum of topics and directions related to modern biotechnology engineering, to the program. However, the committee strongly believes that the DBTE has to identify the specific fields in biotechnology engineering where its strength and competitive edge can be successfully highlighted. These fields should then be addressed in the mission statement and be translated into specific objectives related to both academic (teaching and research) and infrastructural aspects of the program. It has to be noted that the areas of focus and strength should also reflect the manner in which the BTEP addresses specific biotechnology-related needs in the Galilee and general needs of the biotechnology and related industries in Israel.

Currently, the BTP does not have a strategic plan aimed at meeting its goals. The committee has identified a critical need for the program to develop a tangible strategic plan with specific long- and short-term objectives, addressing all of the academic- and infrastructural-related aspects of the program. The committee believes that developing and implementing such a plan will effectively tool the program to better assess and design its curriculum, will allow effective planning of faculty and staff recruitment and will also allow planning the program's growth in terms of both number of students and infrastructure.

The DBTE established in the past an Industry Advisory Board (IAB) however, this board meets only infrequently. The committee believes that the DBTE can benefit immensely from establishing and interacting, on a regular basis, with an effective and committed IAB. An effective IAB can provide the DBTE with a comprehensive feedback about its adequacy and can partner with the department in shaping its scope, relevance and growth. The IAB can also assist the department in successfully meeting current and future needs of the Biotechnology Industry in Israel. It has to be noted that IABs are common at similar programs in Northern America and have been proven to be a powerful and effective means that allow establishing meaningful dialogues with stakeholders.

Recommendations

Immediate (full implementation within one year)

- Identify and design the specific competitive strengths and desired biotechnology-related directions of the program.
- Develop a concise and focused mission statement.
- Develop and implement a strategic plan, consisting of tangible short- and long-term objectives, aimed at meeting the goals and directions included in the mission statement.
- Establish an effective Industry Advisory Board to the program and interact with it on a regular basis.

3.4 The Study Program

3.4.1. The B.Sc. Program

The four-year study program is aimed at educating and tooling its students to become effective and contributing professionals in the field of biotechnology engineering. The study program is directed at providing its graduates with the theoretical foundation, applicable knowledge and practical skills that are needed in order for them to either successfully pursue career, as biotechnology engineers in the relevant industries, or graduate studies.

Successful graduation of the program requires completion of 165 credit points (CP). Although in general, the B.Sc. curriculum is appropriate for training engineers in the multidisciplinary field of Biotechnology, the committee has identified some difficulties, deficiencies and challenges that have to be addressed.

Chapter 3.2.1 of the SER indicates that for each of the specialization tracks “...students must complete obligatory (22.5 CP) and elective (10-11 CP)”. The committee holds the opinion that the number and scope of the elective courses that are offered by the program is relatively limited and that a broader range of topics, relevant to the field of modern biotechnology engineering, is missing from the curriculum. Among such topics are: process design, reactor design, advances in material science etc. It is not apparent, from the material reviewed by the committee, to what extent students of the BTEP are encouraged to enroll in courses offered by other departments of the college. Courses addressing nano-systems and nano-technologies in biotechnology are not included in the curriculum

The BTE program offers five specializations (tracks):

- (1) Environmental Biotechnology
- (2) Food Biotechnology
- (3) Pharmaceutical Technology
- (4) Cellular and Molecular Biotechnology
- (5) Biomaterials

The committee reviewed the CP distribution of the different track-specific courses (as described in the SER and in the additional material that had been provided by the program) and has identified some deficiencies. Some of the specialization tracks (Food Biotechnology,

Biomaterials) offer a limited number of lab sessions (3.3 and 1 weekly hours, respectively), rather than designated laboratory courses that are designed to complement theory classes. Three of the specialization tracks offer designated laboratory courses with a total CP ranging from 1 to 2.75. The extent to which laboratory sessions are included in non-laboratory classes ranged among the tracks from 0.5 to 1.65. The committee is concerned by the significant among-specialization-tracks differences in laboratory components. Training students at the bench is important to the quality and effectiveness of study programs in biotechnology, and introducing students to a broad array of analytical tools and procedures is of prime importance. The committee thus recommends enhancing the extent to which designated laboratory courses are included in the curriculum of the different study tracks in a way that eliminates the among-specialization tracks differences.

The committee has recognized deficiencies in course paths that constitute the different specialization tracks. In some cases, such as the food biotechnology study track, the curriculum consists of some basic courses and falls short of introducing the proper breadth and depth that is required in a modern Food Biotechnology study track. For example: a course in Food Chemistry is not offered; food materials and physico-chemical properties of foods are not instructed, fermentation in food processing is not instructed, etc.

The Biomaterial track does not offer courses addressing physical and functional properties of materials (other than a course in structure and properties of polymers) and there is no laboratory course where methods for material characterization and testing are instructed. Although the program offers tracks in Pharmaceutical-, Food- and Biomaterial-Biotechnology, the concepts associated with colloidal systems seem to not be instructed. The latter represents a deficiency that has to be addressed.

Information included in the SER and in additional material that had been provided by the program indicated that about 50% of the BTE graduates become employed by the Food and Pharma industries. Information that was conveyed to the committee during its visits to Israel indicated that the food industry has a need for well trained food engineers. Many of the graduates of biotechnology engineering programs in Israel, including 24-25% of those graduating BTE at OBC, assume positions in this industry. Considering the current state and

structure of the BT industry in Israel it has to be realized that (unfortunately) employment opportunities for those holding a B.Sc. degree in biotechnology are relatively limited and that there are very significant among-sectors differences in employment opportunities. Only less than a combined 15% of those graduating the BTE program at OBC become employed by the biomaterials and molecular biology sectors. The proportion of those who become employed by the environment- and chemistry-related sectors, combined, is less than that employed by either the food or the Pharma sectors. Only about 20% become employed as Biotechnology engineers. This data and the fact that only one other program in Israel provides training in food engineering renders the Food Biotechnology study track at OBC a special and important study track. The committee strongly believes that this study track has to be enhanced and further developed. The food biotechnology track should be designed to educate and train the students in food chemistry, food microbiology, food materials, food technology and engineering, food fermentations, and advanced topics in food biotechnology. The committee holds the opinion that strengthening and improving the food biotechnology track will significantly enhance the attractiveness, competitive edge and relevance of the B.Sc. study program of the DBTE at OBC.

As has been indicated in section 3.2, the DBTE is likely to benefit from identifying areas and specific fields in biotechnology engineering where the strength and competitive edge of the program can be highlighted. These focus areas can then be developed to become highly competitive specialization tracks. It must be noted that the committee does not recommend limiting the breadth of instruction. Additionally, the committee believes that not all of the major disciplines that are associated with modern biotechnology should be developed into designated study tracks and that concepts that are not included in designated study tracks can be effectively instructed through multi-disciplinary courses in biotechnology engineering. The committee recognizes the fact that the latter requires re-thinking and re-designing parts of the curriculum.

The committee believes that no program in BTE can excel in all of the disciplines associated with modern BT. The committee thus questions the merit of the existing six study tracks as well as the capability of the program to attain the desired academic quality in all of

these tracks. The committee holds the opinion that specialization study tracks should only be offered if:

- A tangible need in the marketplace exists
- A significant enrollment (to the specific track) has been evident in recent years
- A comprehensive and in-depth curriculum can be offered by the BTEP

Reviewing and re-structuring the study tracks and their constituent course has to be aligned with the process of developing the strategic plan of the BTEP. Once the desired and relevant study tracks have been identified, the teaching resources, academic- and non-academic-staff and infrastructure that are needed for each of the study tracks have to be carefully assessed in order to identify and quantify needs and deficiencies. Outcomes of this assessment have to be prioritized and addressed in the strategic plan of the program.

Information included in the SER and discussions during the committee's visit to OBC indicated that, in many cases, laboratory sections (of a specific course) are offered as a cluster of sessions that are condensed into a few successive days rather than being offered throughout the semester. The committee believes that this "clustering" can be introduced only when absolutely needed. Such situations are where the clustering offers a clear academic and learning advantage over what is offered by a series of separate lab sessions and where a given laboratory session consists of a series of time consuming sequential operations and procedures. In such cases, students should be provided with sufficient time to process the data and prepare laboratory reports.

The 4-year curriculum of the BTEP includes a 7-month long internship project (16 CP) where students are engaged in a full time research at different off-campus facilities (laboratories or industries). The committee recognizes the value and merit of including a research project in the curriculum and applauds the program for designating the research project as a compulsory requirement. The committee, however, holds the opinion that the length of the internship and the number of CP designated to it are excessive. The committee feels that the program's difficulties in student retention (especially during the first two years), the identi-

fied curricular challenges and the fact that many students do not graduate after four years call for re-thinking the duration of the research project.

The committee holds the opinion that a 3-4 months research internship (with an appropriate adjustment of the CP), preferably in the summer between the 3rd and the 4th year, or after completion of all other required CPs, will allow strengthening the curriculum and enhancing the course structure of the different tracks. It will also allow, to a certain extent, a better distribution of the course load throughout the four years of study. The committee also holds the opinion that the extent to which the students are monitored and supervised during the internship by the program's faculty has to be enhanced.

The committee recognizes the fact that research infrastructure to allow students to conduct their research project on campus does not exist at OBC. The committee believes that the leadership of OBC and the DBTE should initiate a serious dialogue with research universities, such as the Technion, in order to establish opportunities for students of the BTEP to conduct their research project in the research laboratories of PIs at these institutes. The committee believes that such opportunities exist and holds the opinion that once an understanding to allow the latter has been established, funds to cover some of the direct cost of the research should be negotiated with the relevant governmental agency.

Data included in the SER and information conveyed to the committee during its visit to the program indicated that the BTEP struggles with a significant dropout rate. Overall attrition rate ranged, during the years 2006-2010, from 26 to 41% with 67% of dropout occurring after the freshman year. Discussions held by the committee with both faculty members and students of the BTEP suggested that, **in potential**, the high attrition rate could be attributed (among other things) to a combined influence of:

- Less-than-desired academic level of some of the incoming students, in general, and their knowledge gap in Mathematics, Chemistry, Physics and Natural Sciences, in particular.
- A misconception about the true nature of studies towards a degree in engineering that is shared by many of the incoming students.

- Excessive course load and instruction pace during the first four semesters.
- Challenges in attaining desired learning outcomes.
- Possible challenges with teaching skills of some of the instructors.

The committee recognizes that fact that the academic background of students admitted to the DBTE is very heterogeneous and applauds the college and the DBTE for offering a unique and important opportunity to high school graduates that cannot be admitted to BT or BTE programs of research universities in Israel. However, the committee holds the opinion that the reported attrition rate is excessive and that an immediate effort (by the BTEP), aimed at significantly reducing this rate, is needed.

It has to be recognized that being an engineering program in nature, the BTEP presents to all students a significant academic challenge. The committee strongly believes that ensuring the appropriate academic level of the incoming students is of critical importance to the mere existence of the BTEP. Although some students can close a knowledge gap while being enrolled in the program, many cannot. The committee thus has identified a need for the BTEP to establish a mandatory preparatory course sequence, aimed at closing the identified knowledge gap of the incoming students. The committee believes that a successful completion of the preparatory program (passing grade of 75-80) should become a pre-requisite for admission.

Information conveyed to the committee during its visit to OBC indicated that a significant number of incoming students have misconceptions about engineering in general and BTE in particular. The latter has been identified as one of the potential causes for the high attrition rate. The committee has identified a need to instruct a compulsory introductory course, ("Seminar in Biotechnology Engineering") during the first semester. Similar to what has become a common practice in many Engineering programs in the USA, this course should consist of a series of presentations, delivered by the senior faculty of the PTEP, where all the concepts associated with the engineering program and the multidisciplinary nature of Biotechnology Engineering are presented, at an appropriate level.

The number of applicants to the B.Sc. BTEP dropped from 212 (in 2006) to 129 (in 2010); the number of admitted students decreased from 162 in 2006 to 99 in 2010 and the number of freshmen enrolled in the program dropped from 147 in 2006 to 94 in 2010. The decline in student enrolment is a concern and poses a challenge to the program and the college. The committee is not convinced that either the college or the BTEP fully understand what has led to this declined enrollment. The committee suggests that this trend will be thoroughly investigated and appropriate remedies will be introduced, if needed.

Recommendations

Intermediate (full implementation within 2-4 years)

- Critically review and re-design the study tracks of the B.Sc. study program, as detailed in this report. Offer only those study tracks that can be justified and sustained, according to the criteria that are detailed in this report.
- Enhance and strengthen the curriculum of the selected study tracks to meet challenges and deficiencies that are detailed in this report. Specifically, enhance and strengthen the Food Biotechnology study track.
- Offer “clustered laboratory sessions” only when absolutely needed.
- Increase the proportion CP allocated to electives courses in the B.Sc. curriculum.
- Encourage students to enroll in relevant courses offered by other study programs of the college.
- Restructure the compulsory Research Project to become a 3-4 months course, to be taken either after the third year of studies or after completing all other courses. Negotiate opportunities for students to conduct their research at research universities.
- Instruct a mandatory preparatory course sequence, aimed at closing the identified knowledge gap of the incoming students. A passing grade of 75-80 should be used as a pre-requisite for admission.
- Include a minimum grade of matriculation test in physics in the admission criteria.

- Instruct a compulsory introductory course, (“Seminar in Biotechnology Engineering”) during the first semester.
- Develop and introduce new elective courses addressing current and advanced topics related to modern biotechnology engineering.
- Include the concepts pertaining to nano-systems in biotechnology engineering in both compulsory and elective courses.

3.4.2 The M.Sc. Program

The M.Sc. program of the DBTE at OBC offers a non-thesis Master degree. The committee agrees with the program’s administration and faculty members that a need to enhance and update the knowledge of professionals from the industry exists. However, the committee strongly believes that this need should not be met, at this time, by an M.Sc program at the BTEP at OBC

The committee holds the opinion that the first and most important objective of a college is to be focused on developing, maintaining and delivering excellent undergraduate study programs that effectively educate and train students to either assume positions in the industry or pursue higher degrees at research universities. Yet additionally, the committee believes that the main effort of the college and its programs should be aimed at disseminating existing knowledge rather than at developing new knowledge.

An effective, high quality and relevant graduate studies program has to be built on strong foundations of research culture. The latter requires, as a pre-requisite (among other things), faculty members (at all ranks) that are actively and continuously engaged in research as well as an elaborated, properly equipped and maintained, physical research infrastructure. At present, these foundational infrastructures to support a graduate studies program do not exist at the BTEP program at OBC.

The committee holds the opinion that the BTEP should focus on addressing the difficulties and challenges associated with its undergraduate studies and direct all of its resources

and efforts at developing a stellar B.Sc. program in biotechnology engineering. The committee has arrived at the conclusion that the graduate studies program in the BTEP has to be placed on hold and should not be offered until all the afore-mentioned foundational pre-requisites for a high quality research culture have been established.

The committee recognizes the need to provide professionals from the biotechnology industry with means to advance and update their knowledge and believes that this objective has to be met by developing and offering extension courses. This approach is very common and widely used by numerous first-class universities in the USA.

Recommendations

Immediate (full implementation within one year)

- Place the M.Sc. program of the BTEP on hold and do not offer it until all the foundational pre-requisites for a high quality research culture that are detailed in this report have been established.

Intermediate (full implementation within 2-4 years)

- Develop and offer extension courses to advance and update knowledge of professionals from the biotechnology industry.

3.5 Teaching & Learning Outcomes

Appropriate teaching methods are used in the classroom and laboratories and the extent and scope to which information and teaching technology is utilized is adequate. Currently, the evaluation of the teaching is based on feedback provided by students in the form of course evaluation questionnaires, in a process coordinated by the Teaching & Learning center at OBC.

The learning outcomes of all the courses that are offered by the BTEP are being assessed based solely on student's grade. In recent years it has been recognized that grades alone cannot serve as effective tools in assessing learning outcomes. Institutions of higher educa-

tion in the USA and Europe have recognized that a full commitment to teaching and learning must include assessing and documenting what and how much students are learning and using this information to improve the educational experiences.

A detailed concept of Learning Outcome Assessment, that allows defining desired learning outcomes (for each course) and quantifying the success with which these outcomes have been acquired by students, has been developed and introduced in numerous academic programs. An effort, to establish a matrix of learning outcomes, had been launched by the BTEP and the committee commends the program for this important initiative. This effort has to lead to a complete implementation of the concept of Learning Outcome Assessment.

Recommendations

Intermediate (full implementation within 2-4 years)

- Introduce and implement the Learning Outcomes Assessment concept as the main tool for evaluating the learning outcomes of all the courses and other instructional activities that are offered by the study program.

3.6 Human Resources

3.6.1 Faculty members

Teaching activities at the department of Biotechnology Engineering are conducted by four different groups of academic staff: Senior academic staff, junior academic staff, senior adjunct lecturers and junior adjunct lecturers. There are 18 lecturers (both seniors and juniors) and 21 adjunct lecturers which are not full-time employees of the college. The committee has found the academic level and training of the faculty members (at all ranks) to be adequate for meeting the curricular tasks of the program. The committee feels that the program has developed an excessive dependency on adjunct lecturers.

Faculty members with whom the committee met during the committee's visit to OBC, expressed dedication to their teaching responsibilities. All of the faculty members with whom

the committee met expressed dedication and enthusiasm to their teaching responsibilities yet some of them expressed frustration about the lack of proper appreciation (by the program and college) for their efforts. Some faculty members explained that although they would like to become involved, to some extent, in research activities, the lack of research laboratories on campus prevents them from accomplishing this goal and adversely affects their promotion. Faculty members of the program are encouraged to enroll in seminars that are offered by the Teaching & learning Center and the committee commends the college and the BTEP for making this important opportunity available to the faculty members.

Information included in the SER indicates that the general guidelines for promotion (including tenure) take into account both the research and teaching activities of the individuals. The SER also details the mechanisms and procedures associated with the faculty promotion process. The committee recognizes the fact that the inability of the faculty members of the BTEP to conduct research impairs their promotion to the professorial rank, where evidence of significant research accomplishments is required. The committee is concerned by the fact that there is only one full professor in the program and that several junior faculty members have not been promoted for many years, in part, because they could not establish research activities and publish as required.

The committee welcomes the opportunity that is provided to faculty members of the program to trade up to 4 teaching hours with research activities. However, the lack of research laboratories at the program's facilities and the overall heavy teaching load do not allow faculty members to enjoy this opportunity in a productive manner. In light of the aforementioned difficulties and challenges, the committee strongly believes that the way in which faculty members are assessed for their accomplishments and, consequently, promoted, has to be modified significantly.

The committee's opinion is that promotion of faculty members should be based on assessing their success in meeting objectives defined by an individual-specific job description.

The committee holds the opinion that it is imperative for the program (and thus the College) to develop and introduce, without delays, faculty member-specific job descriptions

where the proportion of effort, to be directed at each of the academic activities (teaching, research and community service), are clearly defined. The individually-tailored job descriptions have to be developed through a dialogue with each faculty member and should include only attainable goals. This will allow better and more flexible distribution of teaching load among faculty members and will also allow tailoring individual-specific activity profiles that reflect the capabilities and aspirations of individual faculty members. Once the concept of individual-specific job description has been defined and accepted, a clear set of guidelines that identify and specify, for each promotion step in a given academic rank, the requirements for successful promotion, should be developed and published. The committee is aware of the fact that introducing this concept calls for a dialogue between the college and relevant governmental agencies. The committee strongly believes that such a dialogue has to be initiated by the college as soon as possible.

The committee would like to highlight the fact that the concept of introducing faculty member-specific job descriptions is common in many highly reputable universities all over the world.

The committee holds the opinion that the promotion process of faculty members should include solicitation of assessment letters from external reviewers, as detailed in the recommendations below.

Recommendations

Immediate (full implementation within one year)

- Pending the introduction of tangible opportunities for conducting research, as part of the criteria for promotion, until the concept of individual-specific job description has been implemented, base the promotion of faculty members, at all ranks, only on their accomplishments in teaching, community service and outreach activities.

Intermediate (full implementation within 3-4 years)

- Develop and introduce faculty-member-specific job descriptions where the proportion of effort to be allocated to each of the academic and administrative activities of the faculty member are clearly defined
- Once the concept of individual-specific job description has been established and defined, develop and implement a clear set of guidelines that identify and specify, for each promotion step in each of the academic ranks, the requirements for a successful promotion.
- After establishing and introducing the revisions, as described above, fully implement a promotion process that is based on assessing success in meeting the criteria and objectives that are stated in the individual-specific job description.
- Include in the promotion process of faculty members (at all ranks) with a significant research component (more than 20%), and faculty members that are considered for promotion to the professorial rank, a dossier evaluation by 3 outside reviewers, to be solicited from relevant academic programs abroad.

3.6.2 Students

Enrollment to BTEP has declined in recent years (see section 3.3) and this trend represents a challenge. There seem to be different opinions, among the faculty members of the program, about the reasons that have led to the significant decline in enrollment. The committee strongly believes that factual information about the latter has to be established.

The population of students admitted to the BTEP is academically heterogeneous and reflects the goal of OBC - to provide opportunities to a broad spectrum of students from all socio-economical and ethnic sectors of the Israeli society. The committee commends OBC, in general, and the BTEP in particular on their social sensitivity and for providing a broad population of students with an opportunity to enroll in an academic program. For many of these students the latter is an opportunity that cannot be matched at other academic programs. The BTEP admits students with learning disabilities and other challenges and the committee commends the program for installing specific tools aimed at assisting students

with learning disabilities and difficulties. The committee recognizes the challenges associated with the program's admission policies and commends the program on its success in supporting and promoting its students.

The committee reviewed information about the academic profile of students admitted to the program and holds the opinion that the minimum academic requirements for admission to the B.Sc. BTEP are relatively low, especially when grades of matriculation tests in Mathematics and Chemistry are considered. The minimum required grade in Chemistry (3 units) is 60 and that in Math (4-5 units) was 60 during 2006-2009 and was increased to 70 and 75, respectively, in 2010. The committee holds the opinion that these minimum requirements for an engineering program are probably too low and might have led, among other things, to the significant attrition rate during the first two years of studies. The committee also holds the opinion that the engineering nature of the program calls for including a minimum grade of matriculation test in Physics in the admission criteria. Yet additionally, since 2007, the minimum requirements for automatic admission to the program were decreased. The committee believes that the program has to re-assess its admission criteria and, as described earlier in this report, introduce a mandatory preparatory program to significantly enhance the academic level of academically challenged incoming students, especially in Math, Eng. Chem. and Phys.

The BTE program at OBC is a 4-year program yet only about 30% of the students were able to graduate after 4 years (during the reviewed years). For the rest of the students 5, 6 and even 7 years were required. The committee recognizes the needs of some students for an additional semester or even a year, however, the committee is concerned by the extremely low level of graduation after 4 years. The committee has recognized a critical need for the program to launch an effort directed at enhancing the successful graduation rate within 4 years of studies. It can be expected that that implementation of some of the curriculum-related recommendation that are included in this report will assist the BTEP in addressing this challenge.

The students with whom the committee met during the visit to OBC were all very appreciative of the program and of the opportunities it has provided them with. Some of the

students expressed dissatisfaction with the teaching skills of some of the instructors and indicated that complaints are being addressed only to a certain extent. Students felt that the course work load during the first year of studies is excessive and that the challenges presented by the engineering courses are very significant. Students with whom the committee met highlighted some reasons that had led them to apply to the program. Among these are: reputation as a program that supports its students; recommendations made by former graduates, and failure in admission to competitive programs at other colleges or universities. Some students indicated that a significant number of students (many of whom fail to complete the program) enrolled to the program assuming it will be “applied biology” rather than an engineering program. Recommendations aimed at addressing some of these challenges have been included in different parts of this report.

Most students expressed their gratitude to the program and its teaching staff. The committee commends the program on its accomplishments in developing open and warm relationships with its students.

Recommendations

Intermediate (full implementation within 2-3 years)

- Assign an *ad hoc* committee charged with the task to develop understanding about causes that have led to declined enrollment and identify directions that might be needed in order to enhance enrollment.
- Review and adjust the minimum requirements for admission to the BTEP, and include the grades of matriculation tests or compulsory preparatory course in Physics in the admission criteria.
- Launch an effort to significantly increase the proportion of students that graduate the B.Sc. study program after four years.
- Establish a mandatory preparatory course sequence, aimed at closing the knowledge gap of the incoming students in Mathematics, Physics, English and Chemistry. Success-

ful completion of the preparatory program (passing grade of 75-80) should be installed as a pre-requisite for admission.

3.7 Research

Information included in the SER and discussions held with academic staff of the BTEP and administrators of OBC indicated a desire to promote and enhance research activities in the BTEP. Both the college leadership and the faculty of the program perceive research to be of importance to the quality of the BTEP. The committee believes that involvement of faculty members in research, to a limited extent, carries value and is likely to positively impact both the teaching quality and the professional development of faculty members. However, it has to be recognized that, being a part of a college, faculty members of the program are to be expected to direct most of their effort at instructing the undergraduate study program, with only limited involvement in research, when possible.

Regardless of its intended limited scope, the research program of the BTEP has to be designed to highlight the specific academic strengths and collective competitive edge of the program and its faculty members (see section 3.3 of this report). This systematic approach has not been established yet and the committee strongly believes that it has to be developed. Once the competitive research areas/directions have been identified, multi-disciplinary research groups, consisting of faculty members from the BTEP and other academic programs/departments have to be established.

No core infrastructure that can support even a limited-scope research program of the faculty members of the BTEP exists at the program's facilities, and thus involvement of faculty members in research is critically dependent on collaborations with researchers from other institutes. The extent to which such collaboration exists varies among the faculty members and, in most cases, research activities are not carried out on a regular basis. The lack of research infrastructure also dictates that all the compulsory required Research Projects of the students of the BTEPs need to be conducted at off-campus facilities.

An opinion, suggesting that research activity of faculty members can be carried out in the teaching laboratories of the BTEP, has been shared with the committee during its visit. The committee does not support this approach and holds the opinion that teaching laboratories cannot and should not be used for research activity of faculty members of the BTEP.

The committee has identified a critical need for the **college together with the relevant governmental agencies** to launch an effort aimed at establishing a core research infrastructure that will allow faculty members and students to conduct **LIMITED SCOPE** research activities on campus. The committee also believes that the leaderships of OBC and the BTEP should, pro-actively and strongly, encourage and support the faculty members of the program in developing and submitting competitive research-infrastructure-building grant proposals.

Although the SER suggests that there is investment in research activities, it is mainly directed at allowing faculty members of the BTEP to attend scientific conferences. The latter is important to the development and performance of faculty members but cannot be considered as research activity.

Research activities of the faculty members of the BTEP during the 2006-2011 years have yielded publications, however, most of them are not in the form of research papers in reputable peer-reviewed journals relevant to the field of biotechnology and biotechnology engineering, but rather in the form of conference abstract and book chapters. It has to also be noted that research addressing engineering aspects of biotechnology has not been developed by the faculty members of the program.

The volume and quality of the research activities and the publications resulted from these activities varied considerably among the researchers. Except for two faculty members that published (each) about 10 peer-reviewed publications during the years 2006-2011, all other faculty members published 1-4 peer reviewed publications during this period of time. Research funds, awarded to the faculty members of the BTEP and directed at conducting on-campus research activities were very limited.

Recommendations

Intermediate (to be fully implemented within 2-3 years)

- The college together with the relevant governmental agencies should launch an effort aimed at establishing a core research infrastructure that will allow faculty members and students to conduct **SOME LIMITED SCOPE** research activities.
- Design the research programs of the BTEP to highlight the academic strength and competitive edge of the program and its faculty members (see section 3.3 of this report).
- Establish multi-disciplinary research groups consisting of faculty members of the BTEP as well as of other academic programs/departments and appoint a senior faculty member (at the professor rank) to lead each group.
- Do not utilize teaching laboratories of the BTEP for developing and supporting research activities of individual faculty members.
- Maximize the extent to which Research Projects of undergraduate students are aligned with the identified research directions/groups and develop opportunities to conduct at least some of these projects on campus.
- Develop new tools and mechanisms (and/or improve existing ones) to proactively encourage and support faculty members in developing and submitting research and infrastructure building competitive grant proposals.

3.8 Infrastructure

The infrastructure of the teaching facilities is appropriate and satisfactory. The teaching laboratories are properly equipped to meet the goals of the undergraduate studies curriculum. The library of the program is well organized and meets the needs of students and staff. The committee was impressed by the services, learning tools and access to information (both on and off-campus) provided by the library, to students and staff. The committee is concerned by the lack of appropriate research infrastructure that would allow the program's

faculty members and students to conduct some research activities, as explained in section 3.7 of this report.

3.9 Quality Assessment

The committee commends the program for preparing a thoughtful and detailed Self Evaluation Report. The program has demonstrated quality-driven philosophy and significant capabilities in self assessment and continuous improvement. The committee is satisfied with the leadership and team work effort that have been demonstrated by the program and college leadership as well as by faculty and staff that were engaged in preparing the SER.

The committee has identified a need for the program to establish a quality assessment committee, consisting of faculty members that will be charged with the task of leading the quality assessment efforts of the program. It is important that once the program has developed its strategic plan, a systematic self evaluation process, aimed at continuously assessing the extent to which objectives of this strategic plan are being met, will be established.

Recommendations

Immediate (full implementation within 1-2 years)

- Establish a quality assessment committee to lead the continuous quality assessment effort; launch a systematic self evaluation process aimed at assessing the extent to which objectives of the strategic plan are met.

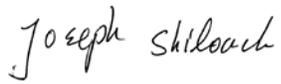
Signed by:

A handwritten signature in black ink, appearing to read 'M. Rosenberg', with a long horizontal flourish extending to the right.

Prof., Moshe Rosenberg,
Chair

A handwritten signature in black ink, reading 'Gad Galili', written in a cursive style.

Prof. Gad Galili

A handwritten signature in black ink, reading 'Joseph Shiloach', written in a cursive style.

Prof. Joseph Shiloach

Appendix 1: Copy of Letter of Appointment



May, 2012

שר החינוך
Minister of Education
وزير التربية والتعليم

Prof. Moshe Rosenberg
Department of Food Science & Technology
University of California, Davis
USA

Dear Professor Rosenberg,

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 Biotechnology and Biotechnology Engineering Studies.

The composition of the Committee will be as follows: Prof. Moshe Rosenberg (Chair), Prof. Gad Galili, Prof. Milica Radisic, Prof. Joseph Shiloach.

Ms. Yael Elbocher will coordinate the Committee's activities.

In your capacity as 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 Chair of this most important committee.

Sincerely,

Gideon Sa'ar
Minister of Education,
Chairperson, The Council for Higher Education

Enclosures: Appendix to the Appointment Letter of Evaluation Committees

cc: Ms. Michal Neumann, The Quality Assessment Division
Ms. Yael Elbocher, Committee Coordinator

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כתובת אתר ממשל זמין: <http://gov.il>

כתובת אתר המשרד: <http://www.education.gov.il>

Appendix 2: Site Visit Schedule

Biotechnology and Biotechnology Engineering –Schedule of site visit- ORT Braude College Sunday, March 18, 2012

Time	Subject	Participants
10:00-10:30	Opening session with the heads of the institution and the senior staff member appointed to deal with quality assessment	Prof. Arie Maharshak , Acting President of the College Prof. David Shoikhet , Vice President for Academic Affairs Mr. Ilan Hefter , Chair, OBC Quality Management Committee Dr. Michal Maoz , Coordinator of the Self-Evaluation Process
10:30-11:00	Meeting with the Head of the Department of Biotechnology Engineering	Dr. Nicholas Harris , Department Head
11:00-12:00	Meeting with senior faculty and representatives of relevant committees (teaching/curriculum committee, admissions committee, appointment committee)*	Associate Professors: Azhari Roza D.Sc, Grozovski Maria Ph.D. Senior Lecturers: Harris Nicholas Ph.D., Kepten Ilana D.Sc., Knani Dafna D.Sc., Langbeheim Harry Ph.D., Maoz Michal D.Sc., Sabbah Isam D.Sc., Wolf-Litman Ofra Ph.D. Ilan Hefter M.Sc.- Chair, OBC Quality Management Committee Nisim Sabag Ph.D. - Chair, Committee of academic affairs Orna Muller Ph.D. - Head, TLC - Teaching & Learning Center Eli Raz Ph.D. - Founder and Head of "Academic Excellence" program
12:00-12:45	Meeting with Junior Faculty*	Lecturers: Gottlieb Judith D.Sc., Mor Lea D.Sc., Weiser-Biton Rivka D.Sc., Weitz Iris Ph.D., Sammar Marie D.Sc. Senior Teachers: Cohen Tova M.Sc., Rouhana-Toubi Amal Ph.D. student
12:45-13:30	Meeting with Adjunct Faculty*	Head of the Microbiology laboratory - Milouda-Migal: Ronit Ben-Abraham-Shumer Ph.D. Pinchas Shlomai M.Sc Manager of Materials & Corrosion R&D Laboratory Oil Refineries Ltd., Haifa; Chair of Israel Association of Chemical Engineers and Chemists: Alec Groysman Ph.D. Head of Biotechnology dep. practical eng. OBC & R.A at Migal: Sigal Korem Ph.D President CSO Enki Biotech Ltd.: Ofer Markman Ph.D. Environmental & process eng. consultant: Ofer Raize Lecturers at OBC: Idit Golani D.Sc Hana Faiger Ph.D., Ecaterina Roth M.Sc.
13:30-14:15	Lunch – Closed door working meeting of the committee	In the same room

14:15:-15:00	Tour of campus (classes, library, offices of faculty members, labs etc.)	Mr. Isaac Ramot , MLS, Library Manager.
15:00-15:45	Meeting with B.Sc. students* ***	Up to 8 students
15:45-16:30	Meeting with M.Sc. Students* ***	Up to 8 students
16:45-17:15	Closed-door working meeting of the committee	
17:15-17:45	Summation meeting with the heads of institution& department	Prof. Arie Maharshak , Acting President of the College Prof. David Shoikhet , Vice President for Academic Affairs ; Dr. Nicholas Harris , Department Head