



EVALUATION OF LIFE SCIENCE STUDIES

TECHNION

COMMITTEE FOR THE EVALUATION OF LIFE SCIENCE STUDIES IN
ISRAEL

March 2023

Section 1: Background and Procedures

- 1.1** In the academic year 2022, the Council for Higher Education [CHE] put in place arrangements for the evaluation of study programs in the field of Life Sciences and Biology in Israel.
- 1.2** The Higher Education Institutions [HEIs] participating in the evaluation process were:
- Achva Academic College
 - Ariel University
 - Bar Ilan University
 - The Hebrew University
 - The University of Haifa
 - Technion
 - Tel Aviv University
 - Weizmann Institute
- 1.3** To undertake the evaluation, the Vice Chair of the CHE appointed a Committee consisting of¹:
- **Prof. Lynne Regan** – Institute of Quantitative Biology, Biochemistry and Biotechnology, Edinburgh University, UK. *Committee chair.*
 - **Prof. Joseph Buxbaum** – Department of Psychiatry, Icahn School of Medicine at Mount Sinai, USA.
 - **Prof. Edna Cukierman** – Cancer Signaling & Microenvironment Program, Fox Chase Cancer Center / Temple Health, USA.
 - **Prof. Orna Elroy-Stein** – Shmunis School of Biomedicine and Cancer Research, Tel Aviv University, Israel.
 - **Prof. Mark Hauber** – School of Integrative Biology, The University of Illinois at Urbana-Champaign, USA.
 - **Prof. Bruno Lemaître** – School of Life Science, École polytechnique fédérale de Lausanne (EPFL), Switzerland.
 - **Prof. Carol Shoshkes Reiss** – Department of Biology, New York University, USA.
 - **Prof. Shai Shaham** – Developmental Genetics, Rockefeller University, USA.
 - **Prof. Vincent Tropepe** – Department of Cell and System Biology, University of Toronto, Canada.

Anat Haina served as the Coordinator of the Committee on behalf of the CHE.

- 1.4** The evaluation process was conducted in accordance with the CHE's Guidelines for Self-Evaluation (January 2022). Within this framework the evaluation committee was required to:
- examine the self-evaluation reports submitted by the institutions that provide study programs in Life Sciences and Biology;
 - conduct on-site visits at those institutions participating in the evaluation process;

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

- submit to the CHE an individual report on each of the academic units and study programs participating in the evaluation;
- set out the committee's findings and recommendations for each study program;
- submit to the CHE a general report regarding the evaluated field of study within the Israeli system of higher education including recommendations for standards in the evaluated field of study;

1.5 The evaluation committee examined only the evidence provided by each participating institution — considering this alongside the distinctive mission set out by each institution in terms of its own aims and objectives. This material was further elaborated and explained in discussions with senior management, lecturers, students, and alumni during the course of each one-day visit to each of the institutions.

1.6 In undertaking this work, the committee considered matters of quality assurance and quality enhancement — applying its collective knowledge of developments and good practices in the delivery of higher education in Life Sciences and Biology (mainly from European and North-American countries) to the evaluation of such provision in Israel.

Section 2: Executive Summary

The Life Sciences Evaluation Committee was very impressed with the Faculty of Biology and recognizes both its achievements in research and education, and its unique situation as a Faculty of Biology in an institution with unparalleled strengths in technology and in multiple aspects of life sciences. Nonetheless, actions outside the Faculty are effectively marginalizing the Faculty of Biology. The Life Sciences Evaluation Committee is concerned the Faculty of Biology will be further undermined, unless specific structural issues within Technion, at the institutional level, are addressed.

The two most critical structural issues are: 1) the five units of math entry requirement to the BSc program; and, 2) the siloing of the Faculty of Biology within Technion, which impacts the degrees in biology, research, and resource allocation. These points are elaborated on below, but the recommendations of the Committee to address these issues include: 1) reducing the math requirement for the BSc program (while providing supplementary math courses within the curriculum for those who need them). The Biology faculty, and the Committee support this position, wish to uphold the current high standards, but recognize that for many potential outstanding students, it is not possible to take these five units of math prior to matriculating at the university; 2) creating a single door to all biology-related degrees (instead of the current situation, where there are competing biological degrees across differing Faculty within Technion); and, 3) allowing students, postdocs and all trainees to work in any relevant lab, irrespective of the specific Faculty affiliation of the laboratory or of the trainee.

The Committee was pleased to see that both the President of Technion and the faculty members within the Faculty of Biology agreed with our assessment and recommendations; this was explicit both from all we learned during our visit to the Technion, and the vision that was *clearly* reflected in the Self-Evaluation Report (SER).² In fact, it was made clear to us that the President has been trying to implement such changes. Specific initiatives from the President included 1) attempts to integrate biology across Faculties, where the Faculty of Biology was very supportive but the President faced resistance from other Faculties; and, 2) the creation of the Technion Human Health Initiative (THHI; also referred to as the “Council for the science and engineering of life”), which is still facing resistance from key Faculties, and is nonetheless strongly endorsed by the Faculty of Biology and by this Committee.

Hence, here is where the CHE can use its position to move Technion in a direction that is guaranteed to enhance translational and integrative biology — which is the future of biology. In the alternative, imagine, for a moment, if the Faculty of Biology continues to lose students and resources to other programs in Technion and elsewhere: how would competing programs

² From the SER: “Many challenges to our study programs could be addressed within the framework of the new Technion’s president’s strategic plan for the life sciences (2021) and the formation of a “Council for the science and engineering of life” responsible for coordinating the development of all life science faculties on campus. Planned actions include sharing resources between faculties, adding electives, providing multi-disciplinary options, offering dual degrees (especially with engineering departments), and increased marketing and visibility. Within the Faculty of Biology, we will create exciting, pertinent, new undergraduate study tracks and promote joint degrees with adjacent faculties. Although this report is mainly concerned with education, teaching is inseparable from research because the same faculty members do both, not to mention the integration of contemporary scientific findings at both undergraduate and graduate levels.” (pg. 5)

at Technion that rely on a strong biology program fare; how would the value of a degree in, for example, biotechnology be reduced if the 'biology' component were anemic? We strongly encourage CHE to use its position to help implement the recommended structural changes at Technion, in order to support the Faculty of Biology and ensure its place in the leadership of biology-related programs at Technion.

The Committee further notes that Technion faces some challenges that are similar to other institutions in Israel. Some of these issues can be addressed with national initiatives.

Section 3: Observations

3.1 The institution and the parent unit

The vision of the Technion as a science and technology research university is stated to be "among the world's top ten universities, dedicated to the creation of knowledge and the development of human capital and leaders for the advancement of the State of Israel and all humanity." The mission is not well detailed in the SER, but three domains of focus are noted; specifically, 1) knowledge ("the creation and teaching of knowledge"); 2) research (research in science and technology "met with support, guidance, and the intention of excellence"); and, 3) progress (which is most vague, because the document focuses on "human capital and leadership").

Technion is comprised of 18 academic units across Faculties and one department. The Committee is focused on the Faculty of Biology but multiple other Faculty units are of direct relevance to the mission of the Faculty of Biology (e.g., Chemical Engineering, Biotechnology and Food Engineering, Biomedical Engineering, Chemistry, Computer Science, Medicine). The integration of the Faculty of Biology and the Faculty of Medicine, which would strongly enhance the mission of both Faculties, is complicated because of the separation of the two campuses (Neve Sha'anun for the Faculty of Biology, and Bat-Galim for the Rappaport Faculty of Medicine).

The faculty members made it clear that there are no real interactions with two affiliated institutes, The Jacobs Technion-Cornell Institute in New York City and Guangdong-Technion Israel Institute of Technology. This is a missed opportunity for the Faculty of Biology.

It is to the credit of the Faculty of Biology and of Technion that key activities, (i.e. research, academic staff, undergraduate teaching, graduate teaching, safety, maintenance, infrastructure, budget, etc.) have defined and responsible individuals who in turn are coordinated under the relevant senior executives. Overall, the sense of the Committee was that there was clear recognition of major and minor issues, and effective programs and policies in place for most issues. The largest issue confronting the Faculty of Biology, as it relates to the larger institution/parent units, are noted in detail in the Executive Summary and in the following sections below.

3.2 Internal Quality Assurance

The Committee is impressed by the fact the Faculty of Biology have used the CHE SER as an opportunity to conduct a comprehensive evaluation assessment. The Faculty utilized a systematic process, which included a retreat day to discuss with Faculty of Biology members. The report is well written and clear; the issues were discussed carefully and in depth.

The Committee sees as a weakness the apparent challenges with collecting the required information from several Technion offices. Data gathering exposed technical problems and emphasized the need to centralize the different kinds of data and make them easily accessible for future assessment (both external and internal). As an example, the Committee notes the difficulties with accurate information, when comparing Tables 1 and 2 which include inconsistent numbers of undergraduate students in the Faculty of Biology.

The Committee recommends allocating a specific institutional person to assist the SER process of all Technion Faculties (Technion-CHE-SER designate). It should ease the burden and provide an opportunity for ongoing data collection, simplifying tracking of progress, while reducing the time required from several faculty members in dealing with gathering the information and writing the report.

Most recommendations and points of the previous reports were met or are still in progress. For example, the Faculty did an outstanding job by hiring excellent young faculty members. The Faculty also provides a good justification as to why some recommendations could not be implemented.

When the new multidisciplinary Technion Human Health Initiative (THHI) is in place, some pre-identified problems could be easily resolved. One example is the prioritization of student registration in courses offered by other departments, as detailed below.

The Committee is hopeful that the plans articulated for THHI will be successful. This, together with the new Technion CHE-SER designate, will greatly improve upon the Faculty's Internal Quality Assurance capabilities.

The Faculty evaluated its overall performance in Internal Quality Assurance:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
				X	

The Evaluation Committee evaluated the Faculty's overall performance in Internal Quality Assurance:

	1	2	3	4	5
				X	

The Committee concurs with the Faculty's overall performance in "Internal Quality Assurance".

3.3 The Department/Study Program

The Faculty of Biology currently offers four undergraduate degrees: 1) A three-year Bachelor of Science (BSc) in Biology; 2) a three-year BSc in Molecular Biochemistry, managed jointly by the Faculties of Biology and Chemistry; 3) a four-year BSc in Biochemical Engineering, managed jointly by the Faculties of Chemical Engineering and Biology; and, 4) a four-and-a-half-year BSc in Materials Engineering and Biology, managed jointly by the Faculties of Materials Engineering and Biology.

Until 2020, there was also a four-year BSc in Computer Science, managed jointly by the Faculties of Computer Science and Biology, which is now a track within the Computer Science degree. This is one example of the impact of siloing of the Faculty - a program that was, and should be, a joint program, is now housed in another Faculty, to the detriment of the Faculty of Biology and to the relevant students. The implementation of the recommendations detailed at the end of this report using, for example, the THHI or other mechanisms, would provide an important opportunity to remove cross-Faculty barriers of these types of academic programs, where currently a specific program resides within a single Faculty (see §3.8).

The Faculty also offers both Master's and PhD degrees: 1) The Master of Science (MSc) in Biology is a Master's program with a research thesis, open to graduates of any of the degrees offered by the Faculty (listed above), or any graduate of a Biology-related track from an internationally recognized institute of higher learning in Israel or abroad; and, 2) Entry into the Doctor of Philosophy program, which usually requires an MSc or equivalent degree and a hosting mentor.

As an aside, the Committee supports the use of English as the language for teaching biology and life sciences at the graduate level and for graduate level theses. We expressed concerns when we learned that the main Technion graduate school website indicates that "By default, classes at the Technion are conducted in Hebrew"³. This text should be altered to reflect the fact that biology is taught in English. Prospective international or Israeli students whose first language is not Hebrew, and even students fluent in Hebrew who see the value of being fluent in English for biology-related careers, may be put off by this misrepresentation. In addition, this Committee recommends the inclusion of 1-2 courses in English in the undergraduate program. For example, usage of specific EDEX/Coursera courses for this purpose will provide an effective exposure and at the same time increase the options for elective courses on topics of disciplines that are missing in the Faculty.

Both the undergraduate and graduate programs are very successful, but there are some issues that potentially resulted in the significantly reduced numbers of students enrolled in the BSc programs, and the high attrition of undergraduate students before graduation. It is important

³ See https://graduate.technion.ac.il/en/prospective-students/language_of_studies/

for the Faculty of Biology to determine the reason(s) for the attrition and to intervene so that fewer students leave before completing their degree. These phenomena should serve as a clear bellwether of real risks to the Faculty of Biology. Unless these issues are addressed, there is a risk of marginalization of a Department that is scientifically exemplary and uniquely situated in a technical university (see §3.5 and §3.8).

Specifically, the President and Dean expressed strong support for training opportunities across Faculties/Departments, and this is an approach that is endorsed by the Committee in the strongest possible terms. This includes the potential for additional BSc degrees across Faculties/Departments; allowing the possibility of obtaining dual degrees (e.g. Biology plus other sciences or engineering); opportunities for Biology students to carry out research in biology-oriented labs across all Faculties/Departments; incentives for cross-Department studies; and the option for students to enroll as first year “Technion biology students,” without committing to a specific Faculty, declaring a major at the end of the first year, etc. See further elaboration in §3.8.

The Faculty evaluated its overall performance in Study Program:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
					X

The Evaluation Committee evaluated the Faculty's overall performance in Study Program:

	1	2	3	4	5
				X	

The decrease in undergraduate student matriculation is a concern which we believe can be addressed by institutional activities as the Committee has discussed below.

3.4 Teaching and Learning Outcomes

The institutional Center for Promotion of Teaching and Learning provides excellent instructor training for newly recruited faculty members before they start teaching. Participation in these training workshops is mandatory. The Unit also provides various non-mandatory workshops to professors at all levels to improve and advance their teaching, on a regular basis. The Life Science Evaluation Committee suggests that the Institutional Teaching Committee encourage all faculty members to attend pedagogical workshops. It would enrich the faculty’s teaching

expertise, and they would gain knowledge about various modern teaching tools. The teaching committee should keep track of the faculty attendance, with each faculty attending one workshop every 2-3 years.

The Committee agrees with the faculty members' view about the benefit of the presence of students in class and limiting remote teaching in order to increase the possibility of informal interactions. In addition, we are satisfied with the open mindedness of the institution to continue providing recorded courses and "hybrid classes" to support those who cannot attend physically in class.

It is important that the curricula and syllabi are updated and approved regularly. Although the Committee was impressed by the dedication of the professors to update their syllabi from time to time, we got the impression that the assessment of syllabi is in the hands of the different lecturers and is being performed at a range of frequencies. Also, Students noted that credit awarded for some time-intensive lab courses was disproportionately low. The Committee recommends the Curriculum and Teaching Committee handle curricula and syllabi evaluation and approval on a more regular basis (every 2-3 years), and work with the course instructors using a more structured approach.

The student surveys could be very informative as they contain questions addressing many aspects of teaching, including lecturing abilities and course quality. While the questionnaire provides a comprehensive assessment, we wonder if the question related to the ability of the lecturer "to develop a good rapport with the students" pushes professors to fit students' expectations by giving 'easy accredited courses'. We suggest removing this question while keeping the section of invited comments. The Committee recommends lowering the impact the student surveys provide in the process of faculty evaluation. The Faculty should bear in mind the volume of peer reviewed publications stating the limitations of student class evaluations; among the findings is that there are documented lower scores given to female faculty members. The Faculty might also consider peer evaluations of instruction, especially for more junior teaching personnel, for constructive criticism.

The methods of examination and student assessment are seen positively by the Committee, as it includes various ways to evaluate the students' learning outcomes (including multiple choice exams, open questions, and combination of both). Overall, the Committee appreciates the commitment of the professors to excellent teaching and high-quality evaluation process of the student's achievements. The Committee recommends the faculty members to keep close contact with the Center for Promotion of Teaching and Learning in order to get updated information about alternative assessment tools that emerge from time to time.

The Faculty evaluated its overall performance in Teaching and Learning Outcomes:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
					X

The Evaluation Committee evaluated the Faculty's overall performance in Teaching and Learning Outcomes:

	1	2	3	4	5
				X	

The offered courses are strong and effective in satisfying the needs for student training. But there seems to be a lack of routine, structure of evaluation/updating of syllabi and teaching methodology.

3.5 Students

The Committee noted the academic strength of undergraduate students in the Faculty of Biology. Students are well prepared, take a range of appropriate courses, and are engaged in high quality research with Faculty mentors. Students appear happy with the program and are well supported.

Many undergraduate students dropout or do not graduate (Table 6). The Committee recommends that the Faculty take measures to address the issue by tracking the numbers of 'dropouts', and develop strategies to identify potential problems early on, and work with at-risk students to find appropriate solutions.

As it currently stands, only students taking 5 units of mathematics in high school (representing only 5% of graduating high school students) are eligible for admission to the Faculty of Biology. The Committee believes that the high standards for mathematics proficiency should be maintained. However, the Committee also believes that strong students in the life sciences, who have not had opportunities for full exposure to the highest level mathematics studies, would be excluded by these admission criteria. We recommend, therefore, that students taking 4 units of high school mathematics be allowed admission, on the condition that they then make up any gaps in their knowledge; the Technion can work with admitted students to overcome the one-unit deficit.

The Committee also suggests that the Technion reconsider admission of students to specific programs. Since the initial year of study includes required courses taken by virtually every Technion first year student, we recommend that a single portal for undergraduates to the program will easily facilitate decisions about major and also potentially dual majors or minor study programs. At present, the Committee was told that such dual majors are very difficult to undertake; we recognize that the Engineering students study for one year additional to the three years of Biology undergraduate students, and that CHE oversees this requirement. The Committee learned that this difference is a barrier to joint programs of study; we ask Technion and CHE to reconsider this historical policy in order to facilitate multidisciplinary approaches to study and research. It would be advantageous to the THHI program to have this flexibility.

From the interviews with students and alumni, the Committee was informed that mentoring with respect to non-academic careers was not well developed. We recommend instituting a formal program of engagement with local biotech companies, alumni, and representatives of other professions that value life-sciences training (journalism, patents, policy, teaching, etc.). Such programs are effective in securing relevant job placements for those interested in alternate careers. Another recommendation is that the Faculty of Biology consider allowing/enabling undergraduate students to be permitted to do their research at local biotechnology companies. This will expose students to a non-academic environment while gaining meaningful research experience.

The Committee was impressed with the high quality of current graduate students in the Faculty of Biology. Students are exposed to rigorous coursework, and are mentored successfully by the faculty. Furthermore, the Committee noted that availability of student travel funds for conferences was a strength.

About 70-80% of incoming MSc matriculated as undergraduates at the Technion. The committee encourages developing mechanisms for increasing the number of applicants from other institutions in Israel and abroad. This includes developing a program of optional rotations over the first-year, to afford incoming MSc and PhD students a chance to explore multiple labs before selecting a lab for their research project; this option can also be afforded to internal students who desire it.

The Committee observed the increased period of time necessary to complete graduate degrees (direct PhD - ~7 years, PhD >5 years, MSc ~3 years; pg. 48 of the SER) compared to CHE definitions (PhD - 4 years and MSc - 2 years). The labs in which these students are pursuing their research are responsible for compensating the graduate students once the CHE-Technion fellowships have been timed out.

Since this situation is similar to other institutions of Higher Education in Israel, the Committee strongly recommends CHE's reevaluation of this issue. Additional time should be provided based on the nature of the work performed, and the recommendation of the student's advisory committee. In any case, the financial support for students should be continuous and of the same financial source throughout their degree program. Therefore, the Committee suggests the Faculty take measures to secure Funds to provide additional time to complete a degree. Further, if a student matriculates from outside Technion, and takes the opportunity to do lab rotations before deciding on a dissertation project, it will be essential to provide additional time to degree. Funds for such rotations could, for example, be provided by multidisciplinary programs such as the THHI.

Another issue the Committee learned of was that graduate students reported that they do not receive formal training as teaching assistants. We recommend that such a training program be implemented.

The Committee further recommends that Technion and the Faculty of Biology develop a strong outreach program to publicize their programs to potential student groups throughout Israel and abroad. This will increase applicants to both undergraduate and graduate programs, and to postdoctoral fellows.

The Faculty evaluated its overall performance in Students:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
				X	

The Evaluation Committee evaluated the Faculty's overall performance in Students:

	1	2	3	4	5
			X		

The students are strong. The small (and shrinking) size of the undergraduate program is a concern of the Life Sciences Evaluation Committee. Further, we encourage the CHE and the Technion at large to facilitate breaking down of barriers to interdisciplinary studies such as supporting the THHI initiative. Mentoring of students about potential post-graduation careers and of TAs in pedagogy are also areas in need of attention.

3.6 Academic Faculty and Human Resources

The process for hiring new faculty (i.e., PIs) was clearly described and there seems to be a strong correlation between policy and its implementation to attract high quality and productive appointees. The newest PIs (at all levels of academic ranks) serve as clear evidence that the Faculty of Biology has been exceptionally successful and assertive in attracting the best and most promising PIs. There is clear evidence of having a policy for promotion and making positive vs. negative decisions.

Regardless, for the Life Sciences Evaluation Committee and for some faculty, it remained unclear how transparent the promotion process is and how candidates are updated throughout their progress and the process' stages. While PIs are open to mentoring and receiving mentoring to and by other PIs at all levels, it is the Committee's recommendation that a much more structured faculty promotion mentorship program is developed to accompany PIs at all levels towards promotion (especially untenured PIs).

A common view expressed by faculty members is that the research start-up funding was insufficient to support early career researchers in establishing their labs and recruiting personnel. This is a challenge for new faculty as, in addition to purchasing consumable supplies, they find themselves using these funds to pay for new equipment, to support lab personnel salaries, and pay service fees for core facilities, which apparently due to using start-up funds end up being more expensive for junior PIs. It was noted that within the start-up package there is funding allocated for a fixed amount of years per subsidized student. In the

current policy “the clock starts ticking” from the moment the PI starts their appointment. It is this Committee’s recommendation that the subsidy initiates when the student arrives in the lab, as it may take some time before students are needed.

Competitive start-up funding is critical for maintaining a strong track record of recruiting, retaining, and supporting outstanding faculty. A correlate of this is that any newly recruited faculty member must have the essential equipment needed to pursue his or her research. We learned of one example where key equipment was not purchased for a recruit, who is now going elsewhere. It is this Committee's recommendation that the Faculty increase the start-up package and reduce the fees needed for core facility services.

The Committee learned that the Institutional Technology transfer office is engineering-focused, because of the greater numbers of engineering departments. The Committee recommends the hiring of a Life Sciences specialist. This would align with the Technion plan to realize the vision of the THHI. We also recommend that when a PI has a temporary short-fall in external grant support, the Technion should supply bridge funding that will, at a minimum, cover the essential expenses of the laboratory including the Lab Manager’s compensation.

This is a small Faculty with relatively small numbers of administrative support staff. To the Committee’s surprise, many positions within the administrative support staff were not fully funded by the institution. These staff are critical for the Faculty of Biology, for the PIs, and for the undergraduate and graduate programs. Relatively modest investment in support staff will provide large dividends to the Technion. Here, too, integration across the different Faculties provides a means of eliminating some redundancies and reducing total costs to Technion, while providing expert support for biology and biology-affiliated fields across the various Faculties.

Lab managers are a critical support to labs. They are employed with 50% institutional appointments, with the remaining salary support is the responsibility of individual laboratories. This brings some uncertainty to these positions and threatens continuity. The lab managers are essential to ongoing research in any lab because they master the lab’s techniques which they pass on to graduate students, solve technical barriers, guide undergraduate project students, take care of orders, lab equipment maintenance and paper-work. Since lab manager positions are fundamental to research, the Committee recommends an increase of the percentage of institutional salary support for lab managers to assure long-term job certainty prospects, continuity, and research expertise and contributions. The bridge funding to cover short-term dips in funding is also a means of adding security to these roles, which will benefit both the lab managers and the PIs.

One other recommendation of the Committee is that a new job category be created, Staff Scientists, which would be academic faculty on a research-support track (e.g., Research Assistant Professor etc.). The personnel essential to maintaining the high quality local/university-based Core Facilities should be in this category. We learned that a component of the price charged to users of the Core Facilities is for payment of the salaries of these professionals. This distortion greatly increases the price of Core Facilities usage, making it unaffordable to Faculty researchers on a routine basis. These Staff Scientists should be paid directly by the Technion, and not by the PI’s research grants. This would result in increased stability and higher quality personnel. The Committee also recommends to provide

opportunities for continuing education (conferences, etc.), and for academic advancement, which will further professionalize this group and reduce poaching by industry.

Another outcome of directly employing professional staff scientists would be reduced costs of use of the facility. Note that one complaint we heard was the excessive charges for using the Technion facilities compared to sending samples to either commercial or other Research Cores of local institutions as user-fees are currently compensating for the salaries of the Staff Scientists. It is the opinion of the Committee that these Core Facilities can and should be a great asset to the Technion members of THHI and also local biotechnology companies who collaborate.

The Faculty evaluated its own overall performance in Academic Faculty and Human Resources:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
				X	

The Evaluation Committee evaluated the Faculty's overall performance in Academic Faculty and Human Resources:

	1	2	3	4	5
			X		

The Committee considered the percentage of salary and status of Laboratory Managers an important issue to be resolved for long-term employment prospects of research-active staff within PIs' laboratories. The Committee also wants to underscore the national need for instituting a "staff scientist" position. Further, creating a structured mentoring system for all junior scientists throughout their entire career at Technion, is imperative.

3.7 Diversity

The Committee was very impressed with the representation of women and Arab students in the undergraduate and graduate programs. Data for other minorities was not provided. Representation in the graduate program of students who trained as undergraduates at institutions other than the Technion, including internationally, was limited (~20%), and the Committee recommends instituting policies that would increase such representation. However, the faculty does not reflect the diversity of the student body; it would be desirable to recruit Arab scientists to the Faculty of Biology.

The Faculty evaluated its overall performance in Diversity:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
				X	

The Evaluation Committee evaluated the Faculty's overall performance in Diversity:

	1	2	3	4	5
			X		

The Committee commends Technion on their efforts to maintain a diversified community, and recommends that this effort be maintained in recruitment of students at every level, faculty recruitment, and administrative support personnel. Granular data that incorporates “other” minorities should be maintained.

3.8 Research

The Faculty of Biology has 31 full-time active Principal investigators (PIs) and four professor emeriti. Faculty are productive and engaged in cutting-edge research using state-of-the-art experimental and computational approaches. Research at the Faculty of Biology is diverse, spanning a wide range of disciplines, including biophysics, cell and developmental biology, molecular neuroscience, protein biochemistry, microbial ecology and evolution, and regulation of gene expression. Many faculty take advantage of collaborations with members of Technion in diverse science and engineering faculties, and this is also a key area for growth, as described further below. Also, while research is impressive, methods of evaluating research areas and themes, as well as its impact were not clearly specified. This point is important to facilitate mentoring, promotions, marketing, PR, retention, and more.

The Evaluation Committee recognizes that the hoped for multidisciplinary research, translational and integrative research under the THHI initiative, would certainly benefit from breaking down silos and providing very strong incentives for intra- and inter-Faculty collaborations. This needs to happen at all levels, from Biology students taking on research projects across Faculties/Departments, to seed funds for cross-Faculty studies, etc. There have to be financial incentives to ‘kick start’ ‘pump prime’ these processes.

More broadly, with the excellent medical school and the exceptional technical departments, the strong Faculty of Biology (known for its basic scientific discoveries, as well as its highly

translational ones) at the Technion can readily be a model for translational and integrative (e.g., multidisciplinary) biological research. The Committee heard of barriers to such translational and integrative biological research from the President, the Dean, and the faculty members.

The institutional THHI vision, where key stakeholders form an effective inter-Departmental program, is the key to maintaining Technion in a leadership role in translational and integrative biology. The key stakeholders are, most importantly, Biology, Medicine, Biological Engineering, Biotechnology, and Chemistry. The Faculty of Biology should be empowered by the institution to take a leadership role in this noteworthy effort.

Students in biology should be encouraged to consider research across laboratories, take advantage of dual mentoring, rotate (if so they desire) across labs in these faculties, etc. Faculty (PIs) should be supported in efforts to develop studies across these faculties. In many institutions throughout the world, modest, competitive, internal pilot grants, that require PIs from at least 2 distinct departments, provide an effective means of stimulating cross-disciplinary research. Such research can often have commercial impact, which again would leverage the unique position of the Technion as a world-leader in technology development.

It would be advantageous to cultivate interactions with local biotech companies. Some of these collaborations could be joint research projects with members of the Faculty of Biology, and others could serve as potential placements for student research projects and internships.

As noted elsewhere, not all Core facilities are providing competitive pricing or state-of-the-art approaches, and this inhibits some cutting-edge research.

The Faculty evaluated its overall performance in Research:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
				X	

The Evaluation Committee evaluated the Faculty's overall performance in Research:

	1	2	3	4	5
				X	

The Committee concurs with the Faculty's overall performance in "Research".

3.9 Infrastructure

The Committee toured the Life Science and Engineering (LS&E) Core facilities in the Emerson building, and there was unanimous agreement that, overall, they provide high quality equipment to support the world-class research being performed by the Faculty of Biology. The facility serves the entire institution (and some including national needs) and provides all of the various specialized equipment and staff expertise to support training of faculty and students on the use of the equipment, as well as advice on experimental design.

Based on information provided in the SER and our discussions with faculty members and senior administrators, there is an unambiguous need to strengthen access to Core facilities for biology researchers. The user fees for these facilities are clearly too high and while there is a strong desire by the faculty members to take better advantage of the facilities; these prohibitive costs have, in some cases, led to labs using their start-up funding to purchase their own equipment, which already exists in the facility and creates an unnecessary redundancy. In other cases, the high fees have led to outsourcing for various services, including sequencing, because it is far cheaper on a per sample basis compared to using the in-house sequencing services provided. The Committee encourages the Technion leadership to find ways to better support access to these Core facilities for their researchers by lowering fees. One model used in many institutions is for the institution to provide base funding for 100% staff FTEs for the Core facilities, while user fees could be used to recover reagent costs, and help offset costs for service agreements, repairs, etc. Another suggestion is to consider participating in the national initiative to have cutting edge Core facilities available across multiple institutions, for example, OMICS.⁴

The Committee was pleased to learn that Technion funding has been allocated for the renovation of the Biology teaching labs. Although these are at some distance from the research and administrative facilities and in a mixed-use building, the delivery of these new teaching facilities will improve student learning and technical readiness for real world research and applications.

Regarding the two excellent research buildings allocated to the Faculty of Biology, select high profile research spaces were visited by the Committee, including some more or less recently renovated laboratories. The spaces were large, well equipped, productive, and functional. Some, however, contained equipment that were replicated in core facilities or only shared by a couple of collaborating faculty, implying the possibility of future efficiencies and use-savings. Older labs, if resources allow, would also benefit from renovations to bring facilities to state-of-the-art stages.

Though the Biology Faculty is relatively small, missing aspects of key infrastructure, such as a Cryo-Electron Microscope, would allow for the retention and recruitment of structural biologists in Biology, Medical, and in Bioengineering disciplines.

Though most biologists use digital library and database services, there is a physical resource of a limited-hour operation library in the neighboring Chemistry building. The digital resources are deemed sufficient and available upon the request of the Faculty. If the Technion were to

⁴ www.israel-cores.org/home

join a national consortium of institutions and access a shared wider range of electronic publications and databases, the institutional costs would be much less for more resources.

The Faculty evaluated its own overall performance in Infrastructure:

(1=unsatisfactory, 2=needs significant improvements, 3=needs minor improvements, 4=satisfactory, 5=highly satisfactory)

	1	2	3	4	5
			X		

The Evaluation Committee evaluated the Faculty's overall performance in Infrastructure:

	1	2	3	4	5
			X		

The Committee ranked the Faculty of Biology facilities as satisfactory as funding has been already allocated to renovate outdated teaching labs, whereas the other research and shared facilities are provided with sufficient space and, especially regarding recently renovated labs, with highly satisfactory structural renovations and equipment. Nevertheless, a potential increase in the number of faculty members should be taken into consideration - lab allocation and facility renovation should be done accordingly.

Recommendations include reducing the user fees for the core facilities, complete the renovations for the teaching laboratories, renovate the older existing research lab spaces when resources and swing lab space permit it, generate efficiencies between in-lab, intralab-shared, and core facility provided equipment and services, and continue to invest in the latest EM imaging resources (e.g. cryo-EM) to attract future structural biologists to this and other Bio- and Medical-focused faculties, including in Engineering, which field has been identified as an area of future growth by the Faculty.

Section 4: Conclusions and Recommendations

4.1 Conclusions

The Committee highly commends the Faculty of Biology for its superb level of scientific accomplishments and vision of interdisciplinary biology as the future of biology-related sciences and technologies. The biggest conclusion made by the Committee is that the Technion should recognize the Faculty of Biology as a leader for driving the commendable initiative of the Technion's President to break silos and integrate biology across Faculties in a

multidisciplinary way through the creation of the Technion Human Health Initiative (THHI; also referred to as the “Council for the science and engineering of life”). For this, some structural issues with regards to the level of students’ entry, as well as a global pull of students (and trainees at all levels) are recommended (see earlier and below).

4.2 Recommendations

Essential

The Technion should pursue the creation of the Technion Human Health Initiative (THHI) with a leading role for the Faculty of Biology.

The Technion Leadership should enable the Faculty to widen the pool of applicants and admit students who have had 4 (not only 5) math units in high school and facilitate the ability of those students to close the gap early in their Technion studies

The Technion Leadership should consider enabling student-entrants to Technion to decide on their major department after taking the core courses required for all first year BSc students.

The Technion Leadership should ensure the ability of students, postdocs, and all trainees affiliated with the Faculty of Biology to work in any and all relevant labs on campus. Research mentorship from a few Faculties should be encouraged. In addition, permitting students affiliated with the Faculty of Biology to perform research in Biotechnology laboratories should be encouraged.

The Faculty should work to reduce the attrition of undergraduate students before graduating; determine the cause(s), and where possible, intervene to promote successful completion of the BSc degree.

Technion Leadership should take measures to financially support graduate students engaged with research-based MSc and PhD programs, beyond the arbitrary time length provided to complete MSc and PhD degrees, e.g., 2-years and 4-years, respectively. The realistic length of time required to complete will be determined by a Faculty Advisory committee, based on prior statistical reports.

The Technion should expand administrative and IT support to the Faculty. Administrative positions of staff in the office of the Faculty of Biology should be fully funded by the Technion.

The Technion support should cover 100% of the salaries of technical staff essential for the Core facilities (Staff Scientists).

Important

The Faculty should provide all students with information about the wide range of careers that they can pursue with their Technion degrees.

The Faculty should establish liaisons with local biotech and big pharma companies for internships and student research project opportunities, for faculty collaborations, and targeted financial support of the Faculty of Biology

Teaching Assistants should be provided pedagogical training/workshops by the Faculty or institution, like all other teaching faculty.

Adjust the “clock” on expending start-up funds to begin when research can commence, not the moment of hiring. This includes the support of students who will join the PI.

The Technion should increase the institutional contribution to the salaries of the Lab Managers.

The Technion should allocate funds for fellowships to foreign postdocs.

Recruit a staff member dedicated to the Faculty of Biology intellectual property in the institutional Tech Transfer office.

The Technion should complete the planned renovations of the old research labs, improve the physical state of the old buildings and take measures to increase the lab-space allocated to the Faculty.

The Technion should support the purchases of essential large (potentially shareable) equipment needed for newly recruited faculty members, as well as established faculty members.

The degree programs in Biology should be effectively publicized/marketed to high school students throughout Israel, college students in Israel, and to potential students abroad to attract more applicants. This will be much simpler and more effective with a unified Life Sciences program (as noted above).

It is important to revise the website of the Faculty of Biology to state explicitly that graduate education is conducted in English. This will attract an international pool of applicants.

Desirable

The Technion Leadership should advocate and participate in a nation-wide consortium for shared electronic subscriptions to journals and databases.

The Faculty of Biology should continue the diversification of students and faculty members.

The Faculty of Biology should develop a comprehensive plan for faculty mentoring and make this transparent.

The curriculum should be reevaluated on a regular basis, to avoid overlapping topics and to develop cutting edge courses as new fields open and existing ones evolve. Course credit assigned should reflect the effort required for lab classes.

Signed by:

Prof. Lynne Regan

Committee Chair



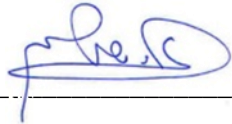
Prof. Joseph Buxbaum



Prof. Edna Cukierman




Prof. Orna Elroy-Stein



Prof. Mark Hauber



Prof. Bruno Lemaitre



Prof. Carol Shoshkes Reiss



Prof. Shai Shaham



Prof. Vincent Tropepe



Appendix I: Letter of Appointment



October 3, 2022

Prof. Lynne Regan,
Institute of Quantitative Biology, Biochemistry and Biotechnology,
Edinburgh University
UK

Dear Professor,

The Israeli Council for Higher Education (CHE) strives to ensure the continuing excellence and quality of Israeli higher education through a systematic evaluation process. By engaging upon this mission, the CHE seeks: 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.

As part of this important endeavor, we reach out to world renowned academicians to help us meet the challenges that confront the Israeli higher education by accepting our invitation to participate in our international evaluation committees. This process establishes a structure for an ongoing consultative process around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial enterprise.

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 Science and Biology** departments. Other members of the Committee will include: Prof. Joseph Buxbaum, Prof. Edna Cukierman, Prof. Orna Elroy-Stein, Prof. Mark Hauber, Prof. Bruno Lemaitre, Prof. Carol Shoshkes Reiss, Prof. Shai Shaham, and Prof. Vincent Tropepe.

Ms. Anat Haina will be the coordinator of the Committee.

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

Sincerely,

Prof. Edit Tshuva
Vice Chair,
The Council for Higher Education (CHE)

Enclosures: Appendix to the Appointment Letter of Evaluation Committees

cc: Dr. Varda Ben-Shaul, Deputy Director-General for QA, CHE
Dr. Liran Gordon, Senior Advisor for Evaluation and Quality Enhancement
Ms. Anat Haina, Committee Coordinator