



Committee for the Evaluation of Medical and Biomedical Engineering Study Programs

Afeka Academic College of Engineering

Evaluation Report

January 2017

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Chapter 1- Background

The Council for Higher Education (CHE) decided to evaluate study programs in the field of Medical and Biomedical Engineering during the academic year of 2016.

Following the decision of the CHE, Vice Chair of the Council of Higher Education on behalf of the Minister of Education, appointed a Committee consisting of:

- Prof. C. Ross Ethier- Department of Biomedical Engineering at Georgia Institute of Technology & Emory University School of Medicine, USA committee Chair
- Prof. James Moore- Faculty of Engineering, Department of Bioengineering, London Imperial College, UK
- Prof. Milica Radisic- Faculty of Applied Sciences and Engineering, University of Toronto, Canada
- Prof. Amit Gefen- Department of Biomedical Engineering, Tel Aviv University, Israel

Ms. Alex Buslovich Bilik was the coordinator of the Committee on behalf of the CHE.

Within the framework of its activity, the Committee was requested to:¹

1. Examine the self-evaluation reports, submitted by the institutions that provide study programs in Medical and Biomedical Engineering 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 2015).

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

Chapter 2-Committee Procedures

The Committee held its first meetings on November 27th 2016, during which it discussed fundamental issues concerning higher education in Israel, the quality assessment activity, as well as Medical and Biomedical programs in Israel.

During Novemebr and December 2016, the Committee held its visits of evaluation, and visited, Tel Aviv University, Ben Gurion University, the Technion and Afeka academic college. During the visits, the Committee met with various stakeholders at the institutions, including management, faculty, staff, and students.

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

The Committee thanks the management of Afeka Academic College and the Department of Biomedical Engineering for their self-evaluation report and for their hospitality towards the committee during its visit at the institution.

Chapter 3: Evaluation of Medical and Biomedical Engineering Study

Programs at Afeka Academic 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.

1. Executive Summary

The Committee was impressed overall with the Department of Medical Engineering at Afeka College. To support the continuing emergence of this department, several essential steps need to be taken, as follows.

- The Department should undertake, in conjunction with senior leadership, a detailed discussion of future student enrolment targets as part of an overall strategic planning exercise. This should be accompanied by an effective internal evaluation process that will benchmark progress toward specific milestones.
- The courses on regulatory issues (FDA, clinical trials and ethics) should be required for all students.

Increasing in numbers of students should be done after recruiting additional faculty, and securing the necessary infrastructure. Importantly, increasing student numbers should not come at the cost of diminishing the student experience. The Department should make efforts to protect some faculty time blocks for research so that they can stay current in their field. One example would be to set aside a common morning or afternoon during which faculty can interact collaboratively on research. Future recruiting efforts should target emerging areas of biomedical engineering, for example in drug delivery and biomaterials.

In closure, the leadership of the College and the Department should be commended for developing and managing this successful undergraduate Medical Engineering Program that fulfills an important need within Israel.

2. Mission and Goals

Observations and findings

The Departmental mission was simply stated in the report as being aligned with the College mission, and was not specific to the Department. The report articulated several goals as part of the strategic plan of the Department, and steps that needed to be taken to achieve these goals (pp. 14-15 of report). However, the rationale for these goals and the details of how the steps would be taken were unclear. More specifically, although the goals provided on page 14 were all very good, it was not clear how the Department will prioritize them, what the timelines to achieve the goals are, and if the action plans for achieving these goals are already in place. During the visit, the President and Head of Department expanded on these

points, and this was further supplemented by a subsequent slide deck that described the Departmental strategic plan.

It is clear that the special features of the Department of Medical Engineering at Afeka College include the relatively small and intimate nature of the program, which allows students ready access to their lecturers, and the strong industry focus of the program. These points were consistently articulated by students, alumni and faculty as strong positive attributes and in fact were the deciding factor for some students to attend the College. It is important that the Department maintain these features.

It is also clear that the College President is a dynamic individual who supports the Head of Department in achieving goals, and who understands the special features of the Department. It is also clear that the Head of Department is providing effective leadership and is contributing in a significant way to the special environment.

The Department has stated a desire to increase undergraduate student enrolment over the next several years, reaching 100 students enrolled per year by 2021. The committee has concerns about this plan, inasmuch as this could damage the attributes that students uniformly valued, such as the quality interaction they have with the faculty. More generally, the rationale and business plan underlying this growth were not clearly articulated. We strongly believe that this matter needs to be examined in more detail before a growth plan is agreed.

Other components of the strategic plan appeared reasonable but would benefit from more details being added, optimally through discussion within the Department and between the Head of Department and the President.

For future hiring, emerging areas that would be of interest to industry but are not currently well-represented in the Department should be considered (e.g., drug delivery and biomaterials).

The balance between research and teaching: A complex matter is the role of research and how it relates to the teaching mission of Afeka. It was stated that Afeka College does not want to be a University; however, it is also recognized that research has benefits. For example, allowing students to participate in open-ended exploration that advances the student's knowledge (e.g. through final year projects) is an important aspect of the student's education and can be beneficial in some workplaces. Further, the teaching mission benefits from having the teaching staff remain current in their fields through research and participation in conferences. Finally, the administration also recognizes that the opportunity to carry out research is an important component of attracting high quality faculty.

Important issues arise from the struggle to dedicate resources to research, namely the career progression of the faculty. Faculty expressed the firm opinion that the only way to advance professionally was through research.

This is of course challenging in view of the heavy teaching load and the small amount of lab space available for research. This matter as it relates to faculty promotion is discussed more directly in Section 5; here we focus on the implications for the College mission.

We feel that it is appropriate to encourage research within the Department, but that there are practical limitations to achieving more research activity. Further, this aspect of the College needs to be very clearly understood by faculty and also even by students. We feel that the Department has established an important and successful niche in the Israeli Biomedical Engineering “ecosystem”, and that this must not be jeopardized by trying to emulate all aspects of a University department.

Degree programs: In the initial phase of the Department, the focus has been exclusively on the undergraduate B.Sc. program. While there is not yet a second degree in Biomedical Engineering at Afeka, the Department indicated that they would like to establish a second degree with thesis. Its implementation should be integrated within an overall Departmental strategic planning framework.

The field of Biomedical Engineering: Indicators all point to the continued growth of this discipline, both within the educational sector and also within the industrial sector. This growth is being driven by the ever-increasing role of technology in health care, as well as the desire of patients to have access to these advances. There is a clear long-term opportunity for the Department to capitalize on this trend.

Recommendations

Essential:

- The Department undertake, in conjunction with senior College leadership, a detailed discussion of future student enrolment targets, including consideration of: (i) the special environment arising from the intimate nature of the department; (ii) the business plan for the Department that would be driven by increased enrolments; and (iii) the ability of Israeli industry and other institutions to absorb an increased number of graduates.
- Senior leadership within the College continue to support appropriate growth of the Medical Engineering Department, with particular cognizance of the expected growth of the discipline and recognition of the particular space needs (e.g. wet labs) of the Medical Engineering discipline.

Important/advisable:

- If/when additional faculty hiring is carried out, the Department explicitly consider hiring into newer areas, with consideration of: (i) importance to industry; (ii) strengthening the biological expertise in

the program and faculty which is somewhat under-represented. An example hiring area is drug delivery and biomaterials.

Desirable:

- More aggressively brand and communicate the unique and valuable niche that the Department of Medical Engineering at Afeka occupies.
- Continue to work to ensure that research within the Department is possible and encouraged, realizing the limitations imposed by space, faculty time and student access.

3. Organizational Structure

Observations and findings

There appears to be a good relationship between the President and the Head of Department. For example, there are regular meetings between the President and the Heads for planning purposes, and the President is supportive of the Head. Similarly, there was an excellent relationship between the Departmental faculty and the Head, with strong faculty support for her leadership. Students and alumni also commented on the good relationship and accessibility that they had with the Head.

In general, we had the impression that there was not a significant amount of bureaucracy nor a feeling of hierarchy with a lot of formality within the College. The Department seems to work collegially on major issues, with standing committees to consider teaching matters and strategic planning issues. During our meeting with faculty, some members were more vocal than others and we would have appreciated hearing more from everyone, but understand that this may also be related to the complexities of English language facility.

We had the sense that the administration was generally responsive to student concerns. The President clearly stated that maintenance of teaching quality was the primary goal, but that the administration was willing to be flexible for the benefit of students so long as this primary goal was met.

We enjoyed meeting alumni. There does not seem to be a formal Departmental alumni network; instead, links are informal and seem to be centered around the current Head of Department. Alumni appeared to be excellent ambassadors for the Department, for example through hiring of recent graduates. At some future date, when the number of alumni increases, the Department may wish to set up a more formal alumni network.

Recommendations

Essential:

- The organizational environment not be significantly changed (although we have no indication to suggest that change is in the works).

Desirable:

- A more formal alumni network be established at the Departmental level.

4. Study Programs

Observations and findings

The curriculum is well designed to serve its main goal of preparing students for industry. Indeed, only 10% of past students have continued for advanced studies. The department is successful in placing students in industry (see below).

The department offers three courses in regulatory issues (Clinical Engineering and Health Technology Management, Clinical Trials, Medical Ethics) that appear to have high value to the curriculum and the students. Nearly all students take these courses, but they are not required.

Design is incorporated into the curriculum only in the 4th year. There is at least one other course with potentially a design component in the 3rd year (Mechanical Design for Medical Engineering) but its content appears to be largely mechanical design without a medical component.

The medical information systems stream is largely led by one faculty member, who is currently on sabbatical. Many of the remaining courses in this stream are taught by other departments. Also, this stream borrows significantly from the Mechanics of Physiological Systems stream in specialization courses (Solid Mechanics and its Medical Applications, Waves Theory for Medical Engineering).

Afeka College has a separate department that deals with final projects, with a coordinator from each "regular" department. This is intended to encourage interdisciplinary projects amongst students, a strategy that appears to be successful. There are about 400 final projects in Afeka, out of which about 160 projects are from industry. In Medical Engineering, about 20% of the projects are from industry. Students can choose from a list of projects or propose their own. Bonus points are awarded for final projects written in English.

The second year (particularly second semester) is very heavy. Students commented that they often spent over 10 hours per day in lectures and labs during this period.

Recommendations

Essential:

- The courses on regulatory issues (FDA, clinical trials and ethics) be required for all students. While it is noted that nearly all students take these courses anyway, requiring the courses would be a powerful selling point for the department in marketing itself to prospective students and industry.

Important/advisable:

- Design be incorporated as early as possible in the curriculum. Students and alumni felt that it was only present in the final year project.
- The curriculum be expanded into areas that align with worldwide trends on medical engineering research and technology development. For example, drug delivery is already an important area, and overlaps with medical device development in several applications (e.g., drug-eluting stents). The additional infrastructure required would not be extensive. In the longer-term, the Department should consider expansion into regenerative medicine (requiring significant expansion of infrastructure).

Desirable:

- The Medical Information Systems stream should either be appropriately resourced within the department, or folded back into a general stream.
- While we recognize the difficulties in sequencing pre-requisite courses, the department should make an effort to distribute the student workload more evenly. The second semester of the second year appears to be particularly heavy.

5. Human Resources / Faculty

Observations and findings

Generally, the faculty and staff appear happy, engaged and highly committed to the success of the Department and their graduates. We specifically got a sense of a real *esprit de corps* that is sometimes lacking in academic institutions. This is partly a function of the small size of the Department, but also reflects positively on the Head of Department and the collaborative nature of decision making in the Department.

We were also very pleased to see a high fraction of female faculty members, reflective of the composition of the students and alumni.

We heard very clearly that there is significant tension related to the fact that faculty are hired for teaching and have a very heavy teaching load (many hours per week), yet their promotion is largely based on publications/research. It is challenging for faculty to carry out research due to the absence of graduate students and the heavy teaching burden.

This is a structural issue that goes beyond Afeka College and relates to promotions structure for Professorial ranks established by CHE. Given that there is a difference in missions between the colleges and universities, this seems out of balance. Specifically, in an engineering department with close ties to industry, and where a major set of outputs can be devices for health care, the “under-weighting” of patents and industrial activity seems inappropriate. Promotions should be based on impact, and patents should not be ignored. We are aware that there is a parallel promotions track but it is seen as less desirable.

As discussed in the General Report, this is a systemic tension and problem that needs to be addressed locally and globally in the system. The Committee will be making recommendations directly to CHE regarding promotion metrics related to non-standard outputs, e.g. patents and industrial impact.

Recommendations

Essential:

- The College consider nominating faculty for promotion on the Parallel Track, as appropriate. It is not unusual to promote industry-associated faculty on similar tracks at other leading institutes (typically known as “Professor of the Practice”), and these people are not viewed as “second class citizens.” Their promotion is typically based on patents, industrial engagement and design outputs.

Important/advisable:

None.

Desirable:

- Faculty be proactively made aware of IP transfer and protection services offered by the College so that if/when patentable discoveries are made, they can be protected in a suitable manner.

6. Students

Observations and findings

The primary focus of Afeka College is to educate and train engineers for industry. In the medical engineering program, the main goal of the Department is to prepare students for the medical device and clinical engineering fields. While the senior management and some of the faculty have expressed interest in also being able to prepare their students for research in academia, this is not an immediate priority and is not the current focus. The President and Department Head have emphasized their Problem-Based-Learning (PBL) approach which is being applied throughout the program, where they encourage students to be creative and solve problems such as design of processes, algorithms and medical

devices, through team work. This team work promotes (positive, constructive) competition among students, and pushes them to excel. In addition, soft skills such as leadership and management of team work, technical report writing, presentations and communication are practiced in such PBL training sessions, which are repeated in multiple courses.

It was emphasized to the committee that the curricula and levels of the basic science and fundamental engineering courses are equivalent to those in Israeli research universities. About 1/4 of their students drop out, and most of those leave in the first year. Calculus is the course where most of these students fail. Afeka has added more courses and aid for students in math to reduce this dropout rate. About 19% of the students continue to a master's degree with thesis. The majority of those select Tel Aviv University for graduate studies. The President feels that one of the major reasons for dropout is that students work during the first and second year, which is a well-known issue in Israel, in universities as well.

About 60 students are currently enrolled per year. This number has grown steadily from 2012 when the program started with about 20 students. The overall number of students (cumulative over the 4 year program) is about 200. The program offers two main tracks for specialization: Mechanics of Physiological Systems and Medical Information Systems. About 90% of their graduates find employment in the medical device industry.

The Department would like to increase the number of students, initially with the same number of faculty. Their goal is to have 100 students per year. However, they believe that, at present, industry does not have enough positions to absorb 100 students graduating each year, and some students might end up unemployed.

The President, Department Chair, Faculty, students and alumni all emphasized and elaborated about how important it is that the learning atmosphere is intimate, that an important benefit of studying in Afeka is that a student can directly approach the faculty, and that faculty typically know students by their names. Students and alumni have described close and family-like relationships with the faculty. The majority of the students stay in touch with the faculty after graduation. Overall, students were very happy with this atmosphere. This is indeed a benefit of a small institute. Despite the size of the Department and College, there appears to be a large diversity in the population of students, gender-wise and reflecting the different streams in Israeli society. All students and alumni were enthusiastic about their studies in Afeka, and made very positive comments regarding the level of teaching, the atmosphere, the way they are treated and the overall impression that they had from their period of study.

Recommendations

Essential:

- Increase numbers of students only after completion of the strategic plan described above. This may require recruiting additional faculty, and securing the necessary infrastructure (office/lab space etc.).

Important/advisable:

- Adjust the workload for students, so that it is more uniform across the semesters.

7. Teaching and Learning Outcomes

Observations and findings

The Departmental teaching committee involves nearly all faculty in the department, and is very active in maintaining and updating the curriculum. The Department head does all peer teaching evaluations annually. Student survey data are used as one of multiple inputs to curriculum review. None of the syllabi include learning outcomes. Assessment of students is largely based on exams in lecture-based courses. The students develop and demonstrate communication skills in laboratory reports and the final year project. It was stated that the department makes use of problem-based learning approaches, but it was not clear which courses incorporate that.

The department as a whole undergoes an annual review process with the College leadership.

The College has created a teaching center to evaluate and improve teaching quality, and runs teaching evaluation surveys regularly. Student surveys are completed before the final exam, and do not affect the grading of the students.

Recommendations

Essential:

- Within 8 months, add learning outcomes for each course, making sure that a uniform template for syllabi is used.
- Within 8 months, the Department faculty adopt processes for continually updating learning outcomes in the syllabi for each course. Courses that employ problem-based learning should clearly indicate this in the syllabus, and opportunities to do this should be exploited in all years. Communication of these outcomes to students will enhance the educational process.

Desirable:

- Consider the use of flipped classroom and other techniques that offer efficient alternatives to lectures.

8. Research

Observations and findings

The review of the CVs submitted with the self-evaluation report demonstrates that the Afeka faculty are highly qualified and have appropriate skills for both teaching and research in biomedical engineering. The background and research areas of the faculty span the areas of: cardiovascular hemodynamics, computational fluid dynamics, finite element modeling, digital signal processing, medical imaging, image processing, mathematical modelling of physiological systems and biomaterials.

The program does not have a Master's degree; thus the lecturers rely on students performing 4th year final projects to conduct research. Another critical limitation is the fact that the faculty have a very high teaching load, with each faculty teaching 4-6 courses per year. In addition, there are no dedicated research labs. Teaching labs serve as research infrastructure for the final project students.

The committee toured the laboratory space and was impressed with the efficient space utilization and the excellent condition of all laboratory equipment. The students clearly had access to the latest models of equipment (e.g. a brand new ultrasound system) and essential software (e.g. Matlab, LabView etc). It is clear that the Department is doing its best to efficiently use its resources for both research and teaching.

The Committee was pleased to hear the presentations of some of the final projects and found that they are targeting really important practical problems. Some projects were highly innovative, suitable for IP protection, and resulted in conference and paper publications.

Although there are only 3 grants held in the Department at present, the faculty should be commended on their increased research efforts and increasing numbers of submitted grants (pp. 51 and 52 of self-evaluation report). The faculty are clearly aiming to increase research intensity and bring in more grants that would enable them to hire research assistants.

Some faculty have shared research projects, for example with Rabin Medical Center, Sheba Medical Center and Tel Aviv University, and it would be advisable to enhance these collaboration activities and expand such networks further.

The committee understands fully the constraints against which the faculty are working in terms of time for research, space and student time. The committee noted that most of the projects and most of the research infrastructure are dedicated to classical medical engineering with focus on medical devices. This is certainly appropriate for the current stage of the Department, but in the intermediate and long term it might be necessary to further modernize the research agenda.

Among new research areas, it appears that the least resource-intensive area for expansion would be in the area of drug delivery. Further, this area

may have good opportunities for collaboration (e.g. TEVA), as well as regulatory and quality control/quality assurance topics that could be explored and that would also ensure that the students working on the drug-delivery projects ultimately find jobs in industry.

In terms of publications, most faculty publish in the journals of impact factor 1-2. This is consistent with the research field, as most medical device journals have impact factors in that range. However, if the Department is able to expand to the emerging areas as stated above, they might be able to reach journals of a higher impact factor.

The data in Appendix 7.3 indicate that six out of 11 faculty have published papers or supervised research students in the past 3 years. The lion's share of this productivity is carried by two faculty members. Together, the faculty members in the entire Department have published a total of 25 papers or conference proceedings, averaging ~8 per year. It is highly recommended to create an environment where each of the 11 faculty can participate in the supervision of the research students and publish conference or journal papers.

Recommendations

Essential:

- Secure a dedicated amount of time for lecturers each week to devote to research so that they can stay current with the developments in their field and thus enhance their teaching efforts.
- All lecturers supervise final year projects and publish conference abstracts or research papers at least once every 3 years.
- Within 12 months, develop an implementation plan to enhance research capabilities (both faculty hiring and lab infrastructure) in emerging areas of biomedical engineering, for example in drug delivery and related biomaterial sciences & engineering.
- Expand high performance computing infrastructure to support computational solid mechanics and computational fluid dynamics (CFD) teaching and research.

Important/advisable:

- Expand collaboration with hospitals and consider writing joint grant applications.
- In the longer term, consider expanding the research expertise in more biologically-oriented areas of biomedical engineering and incorporate some emerging research areas such as: biomaterials, tissue engineering, stem cell bioengineering and medical robotics.

Desirable:

- Secure dedicated research lab space and infrastructure.

9. Infrastructure

Observations and findings

There are multiple laboratories that serve the program, including a Medical Engineering lab, a Medical Mechanics lab, a Medical Electronics lab etc. The laboratories are well maintained and nicely equipped with new systems and instrumentation – the specifics of which are detailed in the relevant chapter in the report from the institute. There are projection and other teaching facilities, WiFi infrastructure, meeting rooms for students to work in and a library. Only the Department Chair has her own office. Other faculty share space in cubicles and in an open space work environment, which includes a dedicated room for meeting students. This is all reasonable, given the constraints and practical considerations in terms of the cost and availability of space and the needs of faculty.

Overall, the College uses its space efficiently and wisely, and the only issue to consider is how to increase the available space further for future recruitment of faculty.

There is full accessibility for people with disabilities.

Recommendations

Essential:

- Since the space for offices, laboratories and other infrastructure appears to be fully used at present, recruitment of additional faculty must be accompanied by securing additional space.

10. Self-Evaluation Process and implementation of previous recommendations

Observations and findings

The Committee would like to thank the Department of Medical Engineering for preparing a thorough self-evaluation report that was well organized and a pleasure to read.

In addition to the self-evaluation report prepared for the Council for Higher Education, the Department has several other mechanisms in place that help continuously monitor the performance of lecturers as well as the performance of the Department as a whole.

Specifically, the performance of each faculty member is evaluated independently based on teaching evaluations and peer review of the lectures. Based on this information, the Head of the Department performs

an integrated evaluation, on an annual basis, for each lecturer, that is tied to the teaching staff bonus increase decision as well as consideration for promotion.

The College also has an internal mechanism for quality control. Each year, the Departments prepare an annual performance report for the President of the College that includes reports from each course coordinator as well as the report from the Department Head. This annual review does not include evaluations performed by persons outside the colleague (e.g. external advisory board, etc.). The President makes adjustments and recommendations to the Departments based on this report in collaboration with the Department Head. It would be advisable to also make the entire faculty complement fully aware of the tangible benefits coming out of the Departmental annual review process.

The committee is pleased to learn that there are effective mechanisms of self-evaluation in place. No points of concern were noted.

Recommendations

Essential:

- Once the Departmental Strategic plan is fully developed, develop an effective evaluation process that will benchmark Departmental progress against the Strategic plan. Perhaps this can be done as part of the annual Departmental performance review.

Desirable:

- Establish an External Advisory Board.

Chapter 4: Summary of Recommendations and Timetable

Essential recommendations:

- The Department undertake, in conjunction with senior College leadership, a detailed discussion of future student enrolment targets, including consideration of: (i) the special environment arising from the intimate nature of the department; (ii) the business plan for the Department that would be driven by increased enrolments; and (iii) the ability of Israeli industry and other institutions to absorb an increased number of graduates.

- Senior leadership within the College continue to support appropriate growth of the Medical Engineering Department, with particular cognizance of the expected growth of the discipline and recognition of the particular space needs (e.g. wet labs) of the Medical Engineering discipline.
- The organizational environment not be significantly changed (although we have no indication to suggest that change is in the works).
- The courses on regulatory issues (FDA, clinical trials and ethics) be required for all students. While it is noted that nearly all students take these courses anyway, requiring the courses would be a powerful selling point for the department in marketing itself to prospective students and industry.
- The College consider nominating faculty for promotion on the Parallel Track, as appropriate. It is not unusual to promote industry-associated faculty on similar tracks at other leading institutes (typically known as “Professor of the Practice”), and these people are not viewed as “second class citizens.” Their promotion is typically based on patents, industrial engagement and design outputs.
- Increase numbers of students only after completion of the strategic plan described above. This may require recruiting additional faculty, and securing the necessary infrastructure (office/lab space etc.).
- Within 8 months, add learning outcomes for each course, making sure that a uniform template for syllabi is used.
- Within 8 months, the Department faculty adopt processes for continually updating learning outcomes in the syllabi for each course. Courses that employ problem-based learning should clearly indicate this in the syllabus, and opportunities to do this should be exploited in all years. Communication of these outcomes to students will enhance the educational process.
- Secure a dedicated amount of time for lecturers each week to devote to research so that they can stay current with the developments in their field and thus enhance their teaching efforts.
- All lecturers supervise final year projects and publish conference abstracts or research papers at least once every 3 years.
- Within 12 months, develop an implementation plan to enhance research capabilities (both faculty hiring and lab infrastructure) in emerging areas of biomedical engineering, for example in drug delivery and related biomaterial sciences & engineering.
- Expand high performance computing infrastructure to support computational solid mechanics and computational fluid dynamics (CFD) teaching and research.
- Since the space for offices, laboratories and other infrastructure appears to be fully used at present, recruitment of additional faculty must be accompanied by securing additional space.
- Once the Departmental Strategic plan is fully developed, develop an effective evaluation process that will benchmark Departmental progress against the Strategic plan. Perhaps this can be done as part of the annual Departmental performance review.

Important recommendations:

- Expand collaboration with hospitals and consider writing joint grant applications.
- In the longer term, consider expanding the research expertise in more biologically-oriented areas of biomedical engineering and incorporate some emerging research areas such as: biomaterials, tissue engineering, stem cell bioengineering and medical robotics.
- If/when additional faculty hiring is carried out, the Department explicitly consider hiring into newer areas, with consideration of: (i) importance to industry; (ii) strengthening the biological expertise in the program and faculty which is somewhat under-represented. An example hiring area is drug delivery and biomaterials.
- Design be incorporated as early as possible in the curriculum. Students and alumni felt that it was only present in the final year project.
- The curriculum be expanded into areas that align with worldwide trends on medical engineering research and technology development. For example, drug delivery is already an important area, and overlaps with medical device development in several applications (e.g., drug-eluting stents). The additional infrastructure required would not be extensive. In the longer-term, the Department should consider expansion into regenerative medicine (requiring significant expansion of infrastructure).
- Adjust the workload for students, so that it is more uniform across the semesters.

Desirable recommendations:

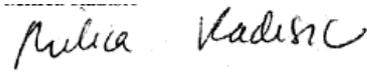
- More aggressively brand and communicate the unique and valuable niche that the Department of Medical Engineering at Afeka occupies.
- Continue to work to ensure that research within the Department is possible and encouraged, realizing the limitations imposed by space, faculty time and student access.
- A more formal alumni network be established at the Departmental level.
- The Medical Information Systems stream should either be appropriately resourced within the department, or folded back into a general stream.
- While we recognize the difficulties in sequencing pre-requisite courses, the department should make an effort to distribute the student workload more evenly. The second semester of the second year appears to be particularly heavy.
- Faculty be proactively made aware of IP transfer and protection services offered by the College so that if/when patentable discoveries are made, they can be protected in a suitable manner.
- Consider the use of flipped classroom and other techniques that offer efficient alternatives to lectures.
- Secure dedicated research lab space and infrastructure.

- Establish an External Advisory Board.

Signed by:



Prof. Ross Either, Committee Chair



Prof. Milica Radisic



Prof. Jimmy Moore



Prof. Amit Gefen

November 2016

Prof. C. Ross Ethier
Department of Biomedical Engineering
Georgia Institute of Technology & Emory University School of Medicine
USA

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 the Chair of the Council for Higher Education's Committee for the Evaluation of the study programs in Medical and Bio-Medical Engineering. In addition to yourself, the composition of the Committee will be as follows: Prof. James Moore, Prof. Milica Radisic and Prof. Amit Gefen.

Ms. Alex Buslovich-Bilik will be the coordinator of the Committee.

Details regarding the operation of the committee and its mandate are provided in the enclosed appendix.

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

Sincerely,

Dr. Rivka Wadmany
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
Ms. Alex Buslovich-Bilik, committee coordinator



Medical Engineering - Schedule of Site Visit
Afeka College - Monday 28/11/16

Time	Subject	Participants
09:00-09:30	Opening session with the heads of the institution and the senior staff member appointed to deal with quality assessment	1. Prof. Ami Moyal 2. Dr. Anat Ratnovsky - Head of the Medical Engineering Department and Head of the B.Sc. Teaching College Committee
09:30-10:30	Meeting with the academic head of the Department of Medical Engineering	1. Dr. Anat Ratnovsky - Head of the Medical Engineering Department and Head of the B.Sc. Teaching College Committee
10:30-10:45	Coffee Break	
10:45-12:15	Meeting with senior academic staff with tenure (representatives of relevant committees)* and Junior (untenured) academic staff **	1. Dr. Zehava Blechman - Cardiovascular Hemodynamics 2. Dr. Sara Naftali - Computational Fluid Dynamics (CFD) Analysis of Transport Patterns, Finite Elements (FE) Analysis in Mechanical Physiology, Digital Signal Processing (DSP) of Physiological Signals 3. Dr. Yair Zimmer - Medical Imaging, Image Processing, Signal Processing 4. Dr. Nadav Shefer - Mathematical and Computational Models of Biologic and Physiologic Systems, Clinical Engineering 5. Dr. Aviram Meilin - Cell Biology and Microbiology 6. Dr. Zoya Gordon - Computational Fluid Dynamics (CFD) Analysis of Uterine Dynamics in Pathological States, Finite Elements (FE) Analysis of Cervical Incompetence and its Surgical Treatment (cerclage), Congenital Malformations and Fetal Therapy (TTTS) 7. Dr. Sarit Yaniv - Computational Fluid Dynamics (CFD) Analysis of Uterine Dynamics in Pathological States, Finite Elements (FE) 8. Dr. Ayelet Shvalb - Thermodynamics of Chiral Interaction on Surface 9. Dr. Moran Aviv - Biomaterials - Polymers

		<p>10. Mr. Ofer Schwartz - Adjunct academic staff - Language and Signal Processing</p> <p>11. Mrs. Yael Danai-Menuhin - Adjunct academic staff and projects' coordinator - Laboratory trials in various fields of medical mechanics</p>
12:15-13:15	Lunch	Closed-door working meeting of the committee

Time	Subject	Participants
13:15-14:15	Tour of facilities: labs, classrooms, library, offices	<p>1. Dr. Anat Ratnovsky - Head of the Medical Engineering Department and Head of the B.Sc. Teaching College Committee</p> <p>2. Mr. Itshak Kravchinski - Head of Lab and Research Infrastructure</p>
14:15-15:00	Meeting with B.Sc. Students **	Please include up to 10 B.Sc. students (only 2 nd and 3 rd year)
15:00-15:15	Coffee Break	
15:15-16:00	Meeting with Alumni**	Please include up to 10 Alumni that graduated in the last 3-7 years
16:00-16:30	Final Project presentation	
16:30-17:15	Closed-door working meeting of the committee	
17:15-17:35	Summation meeting with heads of institution, Dean of the faculty and head of department	<p>1. Prof. Ami Moyal - President</p> <p>2. Dr. Anat Ratnovsky - Head of the Medical Engineering Department and Head of the B.Sc. Teaching College Committee</p>

* The heads of the institution and academic unit or their representatives will not attend these meetings.

** The visit will be conducted in English with the exception of students who may speak in Hebrew and anyone else who feels unable to converse in English.