December 2011

האוניברסיטה העברית בירושלים
The Hebrew University of Jerusalem

The Hebrew University of Jerusalem

Inter-Faculty Biotechnology Program

Self-evaluation report

Executive Summary

This report describes the results of the self evaluation process of the Inter-faculty M.Sc. Biotechnology Program of the Hebrew University of Jerusalem.

This program is different from most Hebrew University programs in that it spans three of its faculties: Sciences, Agriculture and Medicine. As such, it has no teaching staff of its own, and no research is conducted within its framework. Some of the self-evaluation criteria listed in the Council for Higher Education guidelines were thus irrelevant and were not addressed in this document.

Possibly the most important strengths and weaknesses of the program both stem from its inter-faculty nature. On the strengths side, this exposes the students to diverse aspects of biotechnology, as well as to a variety of research disciplines. This is a unique advantage rarely allowed by other teaching programs. On the other side, none of the faculties sees the program as an integral part of its core curricula; this leaves the program dependent upon the Rector's office. In leaner years, this has direct financial consequences with regard to students' fellowships.

Two additional weaknesses of the program:

a. It did not manage to gain sufficient visibility among the teaching programs offered by the Hebrew University, thus not attracting a sufficiently large number of first class students (currently 13 per year, on average)

b. Its director did not succeed in convincing the University leadership in the exponentially increasing importance of biotechnology in all aspects of human life, and thus of the necessity to support an excellence biotechnology graduate program

These weaknesses are at least partially offset by the most important strengths of the program:

a. A rich, diverse and interdisciplinary teaching program
b. High student satisfaction
c. A cadre of excellent graduates occupying important positions in the biotechnology industry

We believe that the Hebrew University Biotechnology Program can be developed into an attractant for excellent students, including from other universities, were no similar M.Sc. programs are offered. This, however, calls for a modest investment in students' fellowships as well as for an effort at increasing the program's visibility.

Chapter 1

THE INSTITUTION

1.1 A brief summary describing the institution and its development since its establishment

The proposal to establish a Jewish institution for higher education was raised as far back as 1882, yet the cornerstone of the Hebrew University was only laid in Jerusalem in 1918. The Department of Parasitology, the fledgling Medical Faculty, was established by the Hebrew University of Jerusalem with the help of the Jewish Physicians' Committee of New York in 1924, a year before the official opening of the University. On April 1, 1925, the university was officially opened on Mount Scopus. The academic life of the university (courses and research) took place on Mount Scopus until 1948, the year of the establishment of the State of Israel. During the War of Independence, the road to Mount Scopus was blocked and the university was forced into exile; it continued its activities thereafter in rented facilities scattered throughout various parts of Jerusalem. In 1955, the government of Israel allocated land in the Givat Ram neighborhood and also in Ein Kerem for new Hebrew University campuses. In 1967, the road to Mount Scopus was reopened, and in the early 1970s, academic activities were restored on the Mount Scopus campus.

The Hebrew University in Jerusalem was accredited as an institution of higher education by the President of Israel, Mr. Yitzhak Ben-Zvi, in accordance with the Law of the Council of Higher Education, 1958, on the 23rd of August 1962.

The Hebrew University operates on five campuses:

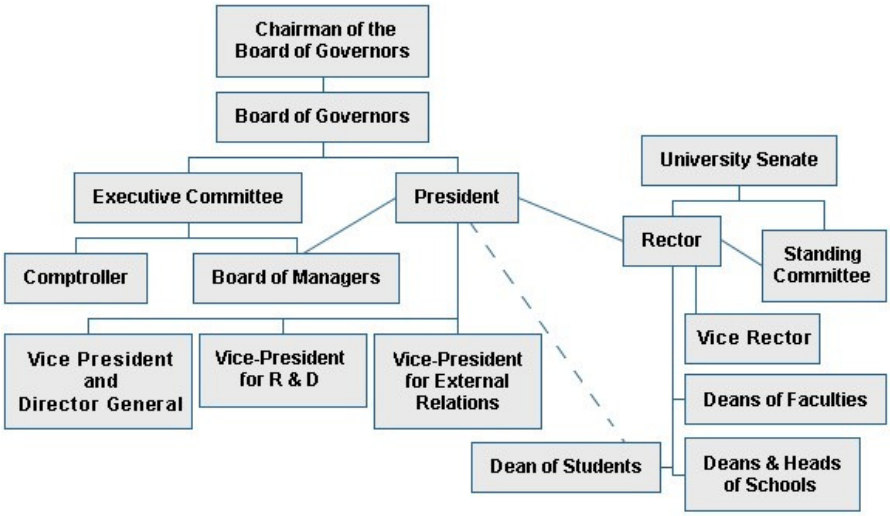
- Mount Scopus campus, site of the Faculty of Humanities and the School of Education, the Faculty of Social Sciences, the School of Business Administration, the Faculty of Law and the Institute of Criminology, the School of Occupational Therapy, the School of Social Work, the Truman Institute for the Advancement of Peace, the Center for Pre-Academic Studies, the Rothberg International School, and the Buber Center for Adult Education.

- Edmund J. Safra campus in Givat Ram, site of the Faculty of Mathematics and Natural Sciences, the School of Engineering and Computer Sciences, the Center for the Study of Rationality, the Edmond and Lili Safra Center for Brain Research, the Institute for Advanced Studies, and the Jewish National and University Library.

- Ein Kerem campus, site of the Faculty of Medicine (Medical School, School of Public Health and Community Medicine, School of Pharmacy, the School of Nursing, with the School of Occupational Therapy ensconced on Mt. Scopus) and the Faculty of Dental Medicine.

- Rehovot campus, site of the Faculty of Agricultural, Food and Environmental Quality Sciences and the School of Nutritional and Home Sciences.
- Beit Dagan campus, site of the Koret School of Veterinary Medicine.
- An additional site is the Inter-university Institute for Marine Science in Eilat, operated by the Hebrew University for the benefit of all institutions of higher learning in Israel.

1.2 Flow chart of the University's Organizational Structure



Chapter 2

THE PARENT UNITS

The Graduate Program of Biotechnology is an inter-faculty teaching program - run jointly by the Faculty of Science, the Faculty of Agriculture and the Faculty of Medicine. It is directed in turns by each of those Faculties; the current program head is Prof. S. Belkin of the Faculty of Science.

In view of the program's interfaculty nature, Chapter 2 is divided into three parts, describing each of the three "parent" faculties.

Chapter 2A - The Faculty of Mathematics and Sciences

2A.1 The name of the parent unit and a brief summary of its "history", its activities and development in the period of its existence.

The Faculty of Mathematics and Sciences was founded initially as the Faculty of Mathematics. Its first Dean, Prof. Abraham Halevi Fraenkel, joined the university in 1929, four years after the foundation of the Hebrew University. In the two following years the Microbiology, Chemistry and Physics Departments were established and were later joined together to form the Faculty of Science. The War of Independence in 1948 left the University's campus cut off from Israeli west Jerusalem, and alternative facilities were located throughout the city. In 1953, construction began on a new main campus on Givat Ram in the heart of Jerusalem (currently the Edmond J. Safra Campus). During the Sixties and Seventies the research and teaching activities were all transferred to this campus.

2A.2 Mission Statement of the Institute, its Aims and Goals

The two major missions of the Faculty of Science and Mathematics are as follows:

Learning, Teaching and Educating – The Faculty of Science attracts some of the best students in Israel. The Faculty's aim is to offer them a high level of teaching and training at both the undergraduate and graduate levels, which is based on front-of-the-line academic and scientific expertise and advanced research facilities, aiming at generating highly professional graduates, prepared to cope with any future scientific and professional challenges.

Research – The level of research carried out in the Faculty of Science is one of the highest in the world. The average ranking for 2011 of this Faculty by the Shanghai Academic Ranking of World Universities is 36. In their work, spanning many varied disciplines, our scientists and research students contribute to the store of knowledge worldwide. The Faculty's aim is to maintain top class scientific research in all of its varied disciplines by providing its faculty

members, both junior and senior, with advanced facilities and means and by monitoring strictly their academic achievement record.

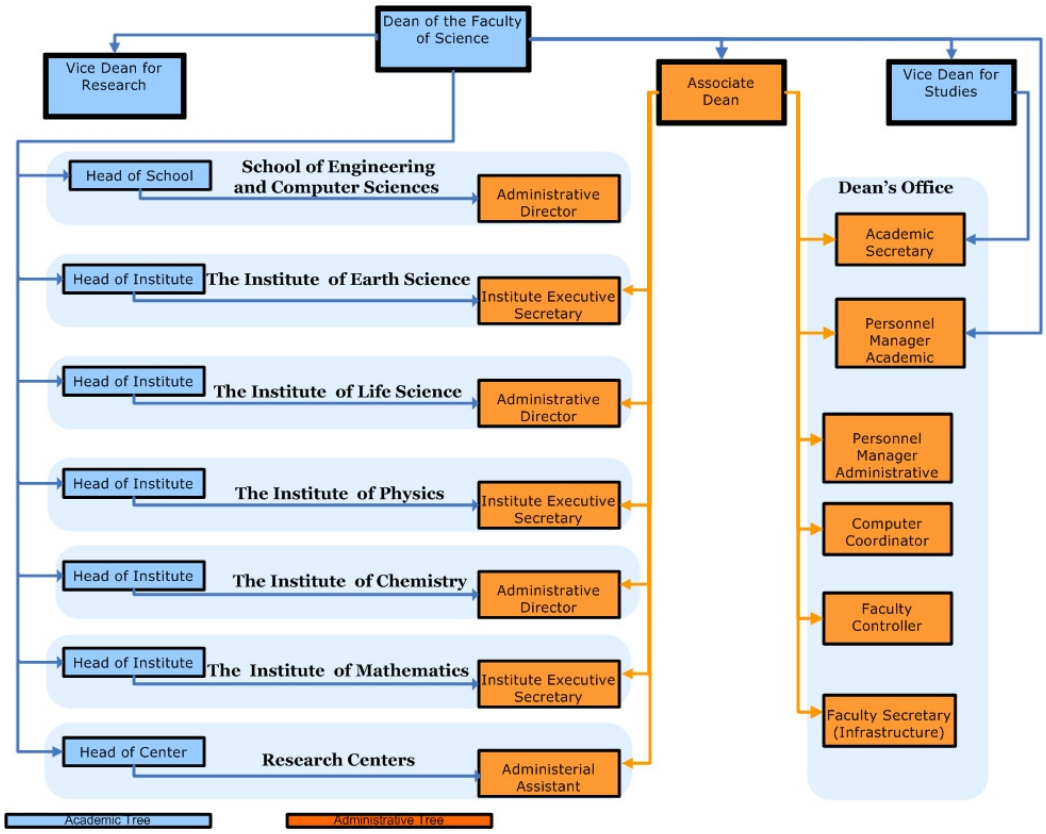
2A.3 Description and chart of the unit's academic and administrative organizational structure (including relevant committees).

The Faculty of Science consists of five research institutes: *Mathematics, Physics, Life Sciences, Chemistry* and *Earth Sciences*, as well as of *the School of Engineering and Computer Science.* They are all located on the Edmond J. Safra Campus in close proximity to one another, which enables bridging various scientific and technological fields and creating new versatile research directions. In that regard, the presence on the same campus of additional institutes such as Advanced Studies, Rationality and Brain Research is also extremely beneficial. Various combinations of such different basic fields are expressed in the development of multidisciplinary teaching and research centers such as: *The Amos de-Shalit Science Teaching Center, The Interdisciplinary Center for Neural Computation, The Center for the Study of Rationality, The Institute for Advanced Studies, The Center for Nanoscience and Nanotechnology and The Sudarsky Center for Computational Biology*. The Faculty comprises some 240 faculty members, around 2,000 undergraduates and some 1,500 MSc and PhD research students.

Many members of the Faculty of Science have been internationally acclaimed, and this renown has brought them copious awards and honors in their specific fields of expertise. A short list of just some of the recent prizes includes: **The Nobel Prize** (Prof. R. Aumann, Game Theory, 2006); **The Fields Medal in Mathematics** (Prof. E. Lindenstrauss, 2010); **The Israel Prize** (Prof. Y. Bekenstein, Physics, 2005; Prof. Z. Rapaport, Chemistry, 2006); Prof. Z. Selinger [ז"ל], Biology, 2007); **The Wolf Prize** (Prof. A. Levitzki, Life Sciences, 2005; Prof. H. Furstenberg, Mathematics, 2007; **The EMET Prize** (Prof. H. Furstenberg, Mathematics, 2004; Prof. M.O. Rabin, Computer Science, 2004; Prof. Z. Selinger [ז"ל] , Biological Chemistry, 2005; Prof. Z. Garfunkel, Geology, 2006; Prof. Batsheva Kerem, Life Sciences, 2008; Prof. I. Willner, Chemistry, 2008) and Prof. Saharon Shelah, mathematics, 2011; **The Fermat Prize** for Mathematical Research (Prof. E. Lindenstrauss, 2009); **The Rothschild Prize** (Prof. D. Kazhdan, 2010); **The Weizmann Prize** (Prof. J.D. Bekenstein, Astrophysics, 2011); **The Dan David Prize** (M.O. Rabin, Computer Science, 2010).

The Faculty is headed by the Dean of the Faculty. Two Vice Deans assist the Dean to coordinate the research and teaching activities. The Associate Dean is the Administrative director of the Dean's Office and the Faculty. Each of the Faculty institutes is headed by the institute's Chairperson who is assisted by an administrative director. The teaching activities

of each institute are coordinated by the Head the Teaching Program who is an ex-officio member of the Faculty's Teaching Committee under the Vice Dean for Teaching.



2A.4 Names of holders of senior positions at the Faculty of Science:

Dean of Faculty: **Prof. Gad Marom**

Associate Dean: **Dr. Jacob Nissenbaum**

Vice-Dean for Studies: **Prof. Nathan Paldor**

Vice-Dean for Research: **Prof. Yosef Yarom**

Assistant to the Dean for Scholarships/Fellowships: Prof. Alan Matthews

2A.5 The number of study programs (departments, etc) operating in its framework; the names of the academic degrees (in English and Hebrew) granted to the graduates of these programs (the phrasing that appears in the diploma).

The Faculty of Science hosts **18** departments and programs of study towards the first degree (**Bachelor of Science**) and **23** departments and programs of study towards the second degree (**Master of Science**) and the **PhD** degree. The studies towards the PhD degree are administered within the framework of the Authority for Research Students.

The Faculty of Science confers the following degrees; the list of Departments and Programs of Study in which the degrees are conferred is given below.

- B achelor of Science
- B achelor of Science with a specific specialization
- M aster of Science
- M aster of Science with a specific specialization
- M aster of Science in the framework of the direct track towards a PhD

Mathematics	מתמטיקה	BSc	MSc	PhD

Table 2.5: List of Departments and Programs of Study

Physics	פיסיקה	BSc	MSc	PhD
Chemistry	כימיה	BSc	MSc	PhD
Life Sciences	מדעי החיים	BSc		
Computer Sciences	מדעי המחשב	BSc	MSc	PhD
Earth Sciences	מדעי כדור הארץ	BSc		
Environmental science	מדעי הסביבה	BSc	MSc	PhD
Mathematics and Math Teaching	מתמטיקה במגמת הוראה	BSc		
Computer Sciences and Computational Biology	מדעי המחשב וביולוגיה חישובית	BSc	MSc	PhD
Computer Engineering	מדעי המחשב	BSc		
Computer Engineering with Specialization in Applied Physics	מדעי המחשב בהתמחות פיסיקה יישומית	BSc		
Applied Physics	פיסיקה יישומית			PhD
Brain Sciences: Computation and Information Processing	מדעי המח: חישוב ועיבוד מידע		MSc	PhD
Specialization in Rationality	התמחות ברציונאליות		MSc	PhD
Amirim: Program for Outstanding Students	אמירים: תוכנית מצטיינים	BSc		
Talpiot: IDF Academic Program in Physics and Mathematics	תלפיות: תוכנית אקדמית צה"לית בפיסיקה-מתמטיקה	BSc		
Plant Sciences (Botanics)	מדעי הצמח (בוטניקה)		MSc	PhD
Cellular and Developmental Biology	ביולוגיה תאית והתפתחותית		MSc	PhD
Genetics	גנטיקה		MSc	PhD
Brain and Behavioral Sciences	מדעי המח וההתנהגות		MSc	PhD
Structural and Molecular Biochemistry	ביוכימיה מבנית ומולקולארית		MSc	PhD
Evolution, Systematics and Ecology	אבולוציה, סיסטמאטיקה ואקולוגיה		MSc	PhD
Specialization in Genomics and Bioinformatics	התמחות בגנומיקה		MSc	PhD
Biotechnology	ביוטכנולוגיה		MSc	
Bioengineering	ביו-הנדסה			PhD
Exact Sciences (Physics-Chemistry)	מדעים מדויקים (פיסיקה-כימיה)	BSc	MSc	PhD

Chemistry and Life Sciences	כימיה-ביולוגיה	BSc		
Geology	גיאולוגיה	BSc	MSc	PhD
Atmospheric Sciences	מדעי האטמוספרה	BSc	MSc	PhD
Climate, Atmosphere and Oceanography	אקלים, אטמוספרה ואוקיאנוגרפיה	BSc		
Science Instruction	הוראת המדעים		MSc	PhD
Oceanography	אוקיאנוגרפיה		MSc	PhD
Management of Technology	ניהול טכנולוגיה		MSc	.

2A.6 The number of students who have studied (and are studying) within the parent unit in each of the last five years according to the level of degree (first degree, second degree with thesis, second degree without thesis, doctoral degree).

Table 2.6 Number of students in the Faculty of Science

Academic Year	BSc*	MSc with thesis	MSc without thesis	PhD
2006-07	2217	638	75	663
2007-08	2262	651	75	677
2008-09	2299	643	75	626
2009-10	2250	619	84	605
2010-11	1945	636	66	617

*The actual numbers can be around 15% lower accounting for BSc students who are enrolled in joint study programs

2A.7 The number of graduates of the unit in each of the last five years according the level of degree (first degree, second degree with thesis, second degree without thesis, doctoral degree).

Table 2.7 Number of graduates of the Faculty of Science

Graduation Year	BSc	MSc with thesis	MSc without thesis	MSc in direct studies to PhD	PhD
2007	480	144	10	22	68
2008	476	154	17	26	89
2009	505	129	23	16	78

2010	542	175	19	17	92
2011	513	167	36	19	105

2A.8 What bodies (internal/external) decide on rationale, mission and goals of the parent unit and of the study programs, how they are decided upon, examined and, if deemed necessary, changed? Have they been discussed within the last five years? If so, please specify when these discussions have taken place and what were their outcomes? If not, when were changes made (if at all)? How are the mission, goals and changes brought to the attention of the teaching staff, the students and the institution's authorities?

The body that is academically responsible for the teaching programs is the Faculty's Teaching Committee. It is headed by the Vice Dean for Teaching and it comprises the heads of all the Faculty's teaching programs (including the Head of the Biotechnology Graduate Program) and students' representatives (the Dean is an *ex-officio* member). The main responsibilities of the Faculty's Teaching Committee are to propose, discuss, approve and monitor all the Faculty's teaching programs including interfaculty as well as interuniversity programs. Depending on the issue at hand, new programs are submitted for ratification by the University's Standing Committee and – if required – by the Council for Higher Education.

Chapter 2B - The Faculty of Medicine

2B.1 The name of the parent unit and a brief summary of its "history", its activities and development in the period of its existence.

From unraveling the genetic mysteries of life to waging battle against the scourges of old age, researchers at the Hebrew University of Jerusalem's Faculty of Medicine are in the forefront of medical science, seeking the causes and cures of human affliction. Since its inception in 1946 by the Hebrew University of Jerusalem and the Hadassah Women's Zionist Organization, the Faculty of Medicine has ensured the training of highly skilled professionals well-versed in the latest developments in clinical medicine and biomedical research.

Today's Faculty encompasses five schools which offer comprehensive curricula to serve tomorrow's medical needs. Besides the Medical School, the Schools of Pharmacy, Nursing, Occupational Therapy, and Public Health and Community Medicine provide the education and skills which have enabled the Faculty's graduates to play a major role in establishing and maintaining the highest standards of research and treatment in Israel. The Faculty has earned an international reputation as a leading research institution through its pioneering efforts and scope of scientific inquiry. It has created an environment where preclinical and clinical medicines interact to facilitate innovative approaches in research, education and health care.

2B.2 Mission Statement of the Institute, its Aims and Goals The Hebrew University Faculty of Medicine's 'Raison D'etre':

BIO-MEDICAL RESEARCH; MEDICAL EDUCATION; SERVICE TO THE COMMUNITY

While research is conducted independently within each department, a broad approach has been established in the creation of interdisciplinary research centers which focus on such critical areas as cancer, cardiovascular, drug delivery and design, and bioinformatics. The innovative research conducted at these centers has received international recognition and has opened new vistas in the world of medical science. The Medical Faculty staff – some 500 clinical and preclinical academics and researchers – embody a wealth of knowledge, expertise and commitment. Many faculty members receive annually competitive research grants from the most prestigious foundations including NIH, ISF, EU etc. They collaborate in research projects with colleagues from the major medical institutions around the world and have been highly successful in competing for research grants. Their work is frequently published in prestigious international journals. A sign that the Faculty of Medicine of the Hebrew University is an outstanding excellent internationally acclaimed research institution is the fact that 12 of the Faculty members received the prestigious Israel Prize, the most

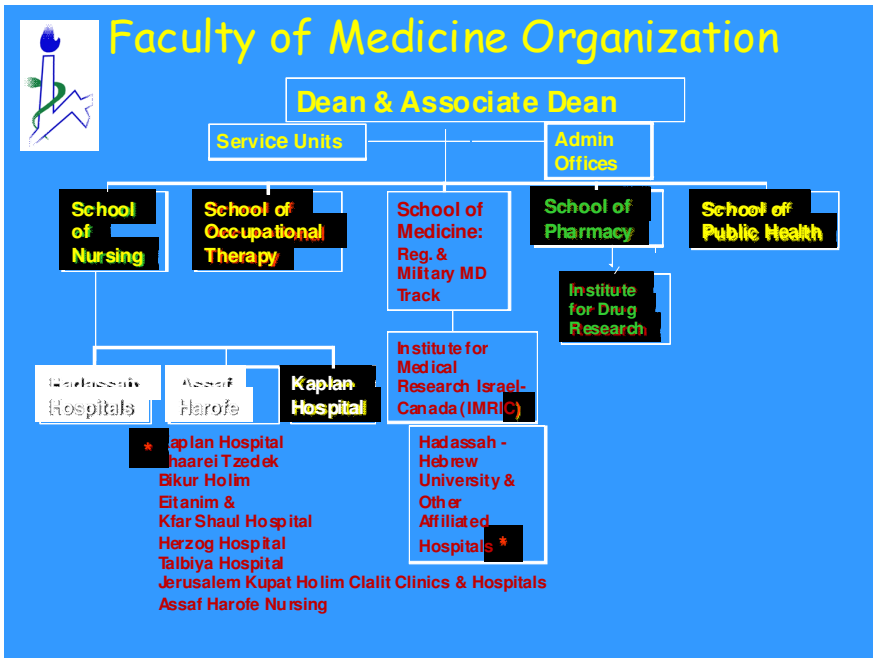
from any one research institution in Israel, two Faculty members received the Wolf Prize, two received the EMET prize and two alumni received the Nobel Prize.

The Faculty boasts the most state-of-the-art tools for education that includes a computerized anatomy classroom, as well as a center for multimedia that adapts course work and lectures online. Thus this hallmark of excellence, the Hebrew University Faculty of Medicine, attracts the brightest and most promising students. The current student body, more than 3,000 altogether - about 2024 undergraduates, over 1064 graduate students, and approximately 70 postdoctoral fellows per year - follows in the footsteps of the 3,700 physicians and 6,500 medical professionals who have trained at the Faculty to date.

Graduates of the Hebrew University Faculty of Medicine can be found in every area of health care and comprise the bulk of faculty members at Israel's four medical schools. They staff hospitals, clinics and pharmacies throughout the country, conduct research in Israeli institutions and industry, and hold key positions in the Israeli Government, the Israel Medical Association and the Medical Corps of the Israel Defense Forces.

2B.3 Description and chart of the unit's academic and administrative organizational structure.

With the exception of the Hadassah-Hebrew University School of Occupational Therapy on Mount Scopus, the Faculty's four other schools are located at the Ein Kerem medical campus. In addition to its clinical departments in the Ein Kerem and Mount Scopus Hadassah-Hebrew University Hospitals, the Faculty is affiliated with three general hospitals - Kaplan in Rehovot and Shaare Zedek and Bikur Cholim in Jerusalem , with three psychiatric hospitals, with all Jerusalem Kupat H Clinics & Hospitals and Assaf Harofe Nursing.



Intra Faculty Research and/or Service Units

Pain Research Center

Diabetes Research Center

Bioinformatics & Proteomics Units

Core Research Facility

Medical Education Center

History of Medicine Department

Pathology Department

DNA Micro-array

Gene Therapy Center

P3 Standard Secure Laboratory of highly infectious agents (i.e. HIV, TB, Hepatitis)

Prion Research Laboratory

SPF Animal Facility

Transgenic Mice Unit

Vaccine Facility

Committees in the Faculty of Medicine

The following is a list of the committees in the Faculty of Medicine and their chairs. Chairs and members of the committees are chosen by the Dean pending approval of the Faculty Council:

- Pre-Clinical Curriculum Committee (Degrees in all of Faculty's schools include first 3 years MD) – Faculty of Medicine, Chair Prof. Shosh Altuvia
- Clinical Curriculum Committee (years 4, 5 and 6 of MD studies) – Faculty of Medicine, Chair Prof. Dror Mevorach
- Curriculum Committee – School of Pharmacy, Chair Prof. Dan Gibson
- Curriculum Committee – School of Public Health, Chair Prof. Amir Shmueli
- Curriculum Committee – School of Nursing, Chair Dr. Anna W. Ruble
- Curriculum Committee – School of Occupational Therapy, Chair, Prof. Asher Ornoy
- Curriculum Committee for Advanced Degrees sub-committee for M.D./Ph.D., Chair Prof. Shosh Ravid
- Committee for Planning and Development, Chair Prof. Yoel Yaari
- Admissions Committee , Chair Dr. Udi Rudis
- Research Committee, Chair Prof. Ze'ev Paroush
- Selection Committee, Chair Prof. Shulamit Katzav-Shapira
- Computer Committee, Chair Prof. Aharon Lev-Tov

- M.D. - Thesis Committee, Chair, Prof. Avi Rivkind
- Faculty Awards Committee, Prof. Ora Paltiel
- Scholarships Committee, Chair Prof. Haya Lorborbaum-Galski
- Student Exchange Programs Committee, Chair Dr. Hezi Landau
- Animal House Committee, Chair, Prof. Stella Mitrani-Rosenbaum
- Committee for Core Research Facility, Chair Prof. Ophry Pines
- Committee for Scientific Lectures, Chair Prof. David Varon
- Internship Committee, Chair Prof. Uriel Elhalal
- Safety Committee, Chair Prof. Sigal Ben-Yehuda
- Ethics Committee, Chair Prof. Esther Shohami
- Center for Medical Education, Chair Prof. Arye Ben-Yehuda
- Affiliated Hospitals, Vice-Dean Prof. Drorit Hochner
- Pre Clinical Appointments & Advancement Committee, Chair Prof. Yoel Yaari
- Clinical Lecturer Appointments & Advancement, Chair Prof. Chaim Lotan
- Clinical Senior Lecturer & Up Appointments & Advancement, Chair Prof. Jacob Peer

2B.4 Names of holders of senior positions at the Faculty of Medicine

Academic positions:	
Prof. Eran Leitersdorf	**Dean**
Vice Deans:	
Prof. Oded Meyuhas	Pre-Clinical Appointments/Promotions and Academic Evaluation
Prof. Dan Gillon	Clinical Appointments/Promotions
Prof. Tamar Peretz	Teaching
Prof. Meir Shalit	Student Affairs
Assistant Deans:	
Prof. Drorit Hochner	Affiliated Hospitals
Prof. Yoel Yaari	Chair of the Committee Planning & Development
Prof. Jacob Peer	School of Medicine
Prof. Ze'ev Paroush	Research
Administrative Positions:	
Dr. Ronit Harel	Associate Dean
Ms. Vardit Erez	Teaching Services Department

The number of study programs (departments, etc) operating in its framework; the names of the academic degrees (in English and Hebrew) granted to the graduates of these programs (the phrasing that appears in the diploma).

Faculty Structure (Data 2011)	**The Hebrew University-Hadassah School of Medicine (1949)**	MD Reg Track (Est.1949) (6+1 years program)	M.D.:	691
		MD Military Track Discipline (Est. 2009*) (6+1 years program)	M.D.:	168
		Medical Sciences (Institute for Medical Research Israel-Canada –IMRIC)	B.Med.Sc:	162
			M.Sc	178
			Ph.D.	307
	The Hebrew University School of Pharmacy (Institute for Drug Research – IDR)		B.Pharm	465
			MSc	47
			Clinical D. Pharm:	41
			Ph.D	83
	The Hebrew University-Hadassah Braun School of Public Health & Community Medicine		MPH:	86
			IMPH:	40
			MHA	15
			MSc.	17
			Ph.D.:	31
	The Hebrew University- Hadassah Henrietta Szold School of Nursing		B.S.N.:	619
			M.S.N:	46
	The Hebrew University-Hadassah School of Occupational Therapy		B.O.T.:	181
			M.A.:	52
			Ph.D:	17
	TOTAL 2011/12 Registered School Year beg. November 2011		**3246**	

2B.6 The number of students who have studied (and are studying) within the parent unit in each of the last five years according to the level of degree (first degree, second degree with thesis, second degree without thesis, doctoral degree).

The number of students in the Faculty of Medicine in the last SIX years is listed in **Tables 2.6 a-f:**

2.6a Number of students who studied in the Faculty in 2006, by Schools and degrees

PhD	MSc MPH Total	MSc non thesis	MSc thesis	MD	BSc	Program
				665		**Medicine MD (Reg Tract)** [1]
391	318		318		149	**Medical Sciences**[1]
133	103		103		513	**Pharmacy**
	60		60		698	**Nursing**
30	126	83	43		-	**Public Health**
12	89		89		137	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.6b Number of students who studied in the Faculty in 2007, by Schools and degrees

PhD	MSc MPH Total	MSc non thesis	MSc thesis	MD	BSc	Program
				670		**Medicine MD (Reg Tract)** [1]
407	292		292		142	**Medical Sciences**[1]
134	86		86		532	**Pharmacy**
	53		53		676	**Nursing**
27	117	27	90			**Public Health**
9	65	0	65		166	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.6c Number of students who studied in the Faculty in 2008, by Schools and degrees

PhD	MSc MPH Total	MSc non thesis	MSc thesis	MD	BSc	Program
				669		**Medicine MD (Reg Tract)** [1]
400	327		327		123	**Medical Sciences**[1]
138	90	0	90		519	**Pharmacy**
	51		60		638	**Nursing**
27	107	73	34			**Public Health**
13	65	12	53		170	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.6d Number of students who studied in the Faculty in 2009, by Schools and degrees

PhD	MSc MPH Total	MSc non thesis	MSc thesis	MD	BSc	Program
				661		**Medicine MD (Reg Tract)**[1]
401	249		249		126	**Medical Sciences**[1]
125	78		78		501	**Pharmacy**
	41		41		599	**Nursing**
26	118	57	64			**Public Health**
14	55	6	55		176	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.6e Number of students who studied in the Faculty in 2010, by Schools and degrees

PhD	MSc MPH Total	MSc non thesis	MSc thesis	MD	BSc	Program
				744		**Medicine MD (Reg & Military Tracts)** [1]
396	221		221		147	**Medical Sciences**[1]
120	89		89		487	**Pharmacy**
	30		26		574	**Nursing**
30	104	82	22			**Public Health**
12	50	10	40		179	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.6f Number of students who are presently enrolled in Nov 27 2011, by Schools and degrees

PhD	MSc MPH Total	MSc non thesis	MSc thesis	MD	BSc	Program
				859		**Medicine MD (Reg & Military Tracts)** [1]
307	178		178		162	**Medical Sciences**[1]
83	88		88		470	**Pharmacy**
	35		35		579	**Nursing**
31	158					**Public Health**
17	52				183	**Occupational Therapy**

[1] Both are part of the School of Medicine

2B.7 The number of graduates of the unit in each of the last five years according the level of degree (first degree, second degree with thesis, second degree without thesis, doctoral degree).

Tables 2.7 a-e list the Faculty's numbers of graduates:

Table 2.7a Number of students who graduated from the Faculty in 2006, by Schools and degrees

MD	PhD	MSc MPH Total	MSc non thesis	MSc thesis	BSc	Program
145	0	0	0	0	106	**Medicine MD (Reg Tract)** [1]
-	39	144	30	114	39	**Medical Sciences**[1]
-	10	50	0	50	80	**Pharmacy**
-	0	1	0	1	152	**Nursing**
-	2	41	22	19	-	**Public Health**
-	5	10	4	6	52	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.7b Number of students who graduated from the Faculty in 2007, by Schools and degrees

MD	PhD	MSc MPH Total	MSc non thesis	MSc thesis	BSc	Program
138	0	0	0	0	99	**Medicine MD (Reg Tract)** [1]
-	50	211	57	154	33	**Medical Sciences**[1]
-	15	47	0	47	122	**Pharmacy**
-	0	22	0	22	169	**Nursing**
-	3	62	44	18	-	**Public Health**
-	0	32	10	20	39	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.7c Number of students who graduated from the Faculty in 2008, by Schools and degrees

MD	PhD	MSc Total	MSc non thesis	MSc thesis	BSc	Program
134	0	0	0	0	108	**Medicine MD (Tract)** [1]
-	51	210	55	155	33	**Medical Sciences**[1]
-	10	21	0	21	121	**Pharmacy**
-	0	12	0	12	161	**Nursing**
-	2	58	40	18	-	**Public Health**
-	1	33	14	19	36	**Occupational Theray**

[1] Both are part of the School of Medicine

Table 2.7d Number of students who graduated from the Faculty in 2009, by Schools and degrees

MD	PhD	MSc Total	MSc non thesis	MSc thesis	BSc	Program
60	0	0	0	0	114	**Medicine MD (Reg Tract)** [1]
-	0	19	5	14	48	**Medical Sciences**[1]
-	16	35	0	35	129	**PharMacy**
-	0	20	0	20	121	**Nursing**
-	3	54	39	15	-	**Public Health**
-	1	19	5	14	48	**Occupational Therapy**

[1] Both are part of the School of Medicine

Table 2.7e Number of students who graduated from the Faculty in 2010, by Schools and degrees

MD	PhD	MSc MPH Total	MSc non thesis	MSc thesis	BSc	Program
80	0	0	0	0	97	**Medicine MD (Reg Tract)** [1]
-	52	156	28	128	23	**Medical Sciences**[1]
-	18	34	0	34	133	**PharMacy**
-	0	11	0	11	141	**Nursing**
-	0	44	25	19	-	**Public Health**
-	1	16	2	14	43	**Occupational Therapy**

[1] Both are part of the School of Medicine

2B.8 What bodies (internal/external) decide on rationale, mission and goals of the parent unit and of the study programs, how they are decided upon, examined and, if deemed necessary, changed? Have they been discussed within the last five years? If so, please specify when these discussions have taken place and what were their outcomes? If not, when were changes made (if at all)? How are the mission, goals and changes brought to the attention of the teaching staff, the students and the institution's authorities?

The body that is academically responsible for the teaching programs is the Faculty's Teaching Committee. It is headed by the Vice Dean for Teaching and it comprises the heads of all the Faculty's teaching programs (including the Head of the Biotechnology Graduate Program) and students' representatives (the Dean is an *ex-officio* member). The main responsibilities of the Faculty's Teaching Committee are to propose, discuss, approve and monitor all the Faculty's teaching programs including interfaculty as well as interuniversity programs. Depending on the issue at hand, new programs are submitted for ratification by the University's Standing Committee and – if required – by the Council for Higher Education. The Faculty of Medicine encompasses 27 committees that are appointed by the Dean. These committees are in service to the Dean to manage and to operate the Faculty's teaching, research and administration. These committees are also a vehicle for examining and discussing principle changes and conceptual aspects of the curriculum, research programs and development of the Faculty, as well as, to deliberate on advance initiatives for developing new programs. These initiatives and/or material changes are then raised in the appropriate Committee where they are discussed in depth and modified if needed, until they are approved or rejected by the Committee. These principle decisions are then

transferred to the Faculty's Planning and Development Committee, and frequently to the Faculty Council, for final approval. Major decisions that will also affect the University must also get approval from the University's Standing and/or Regulations Committees as well as the Rector's office. It should be noted that the entire above process begins first by establishing work and thinking teams to research the topic thoroughly before it is presented in the first Committee.

An example of such a process which took place in recent years is the Merging of the two largest Faculty research institutes into one. About five years ago the Dean appointed a special Steering Committee to examine, discuss and finally forge a plan for merging the Institutes of Microbiology and Medical Sciences into one large cutting edge, leading, Biomedical Research Institute. The Committee's recommendation was discussed and affirmed by the faculty members of the then two institutes, discussed and affirmed in the Development and Planning Committee of the Faculty and affirmed as well in the Faculty Council. As this program was important on the University level it was affirmed also by the appropriate University authorities.

Chapter 2C - The Robert H. Smith Faculty of Agriculture, Food and Environment

The Robert H. Smith Faculty of Agriculture, Food and Environment is the only institute of higher education in Israel offering university degrees in agriculture, and is also home to the School of Nutritional Sciences (the only school of nutrition in Israel that confers graduate degrees in biochemistry and nutrition) and the School of Veterinary Medicine. Established in 1942 as the Institute for Agricultural Sciences with 21 Master's students, the Faculty today has a student body of 2,200.

The Faculty offers academic programs leading to B.Sc., M.Sc. and Ph.D. degrees in Agriculture, B.Sc. and M.Sc. degrees in Nutrition, and a Doctor of Veterinary Medicine degree. Through its Division for External Studies, the Faculty also offers short-term international postgraduate courses on various agricultural subjects, a non-thesis Master of Science in Agriculture program and a Post-Graduate Diploma in Plant Sciences, all of which are conducted in English for foreign students.

The Faculty's teaching and research activities continue to play a central role in advancing agriculture to strengthen the Israeli economy, while training tomorrow's scientists and agriculturists; protecting and rehabilitating the environment, while increasing food production and reducing world hunger; mobilizing agriculture to meet human health needs and improving the quality and purity of agricultural products; and sharing the benefits of Israeli research and innovation with other nations.

Faculty graduates have widespread occupational functions as well as key roles in Israeli institutions. Our graduates:

- Are active in farming communities - kibbutzim, moshavim and private farms - using their know-how to compete in world food markets;
- Comprise a large part of the staff of the Agricultural Research Organization and the Extension Service of the Ministry of Agriculture;
- Occupy most of the leading positions within the Ministry of Environmental Quality;
- Constitute a significant professional segment of many Israeli high-tech industries involved in production relevant to local and international agriculture (drip irrigation, seeds, fertilizers, and biocontrol methods, as well as recycling of agricultural waste and water remediation);
- Are teachers of biology, nutrition and agriculture at universities, high schools and junior high schools throughout the country;
- Serve abroad on Israeli projects of technical aid, cooperation and R&D;

- Serve as dieticians in hospitals, clinics, and outreach programs.;
- Serve as food engineers in the food industry;
- Assume important roles as economic advisors to government ministries, companies and the agricultural sector; and
- Are sought after in the hotel management industry.

Some of the Faculty research achievements and innovations include:

- Methods of drip irrigation and fertigation.
- Breeding fruits and vegetables selected for industrial harvesting and with long shelf life as well as improved taste and disease resistance and returning fragrance to flowers.
- Development of intensive arid-zone agriculture.
- Soil solarization - a nonchemical method of controlling soilborne plant diseases.
- Green-farming techniques - use of natural biofertilizers and biocontrol by biofungicides and parasitic insects - to reduce the use of chemical fertilizers, fungicides and pesticides.
- Recycling technologies for waste-water reclamation and composting of solid municipal and agricultural wastes; using plants to purify water polluted by heavy metals.

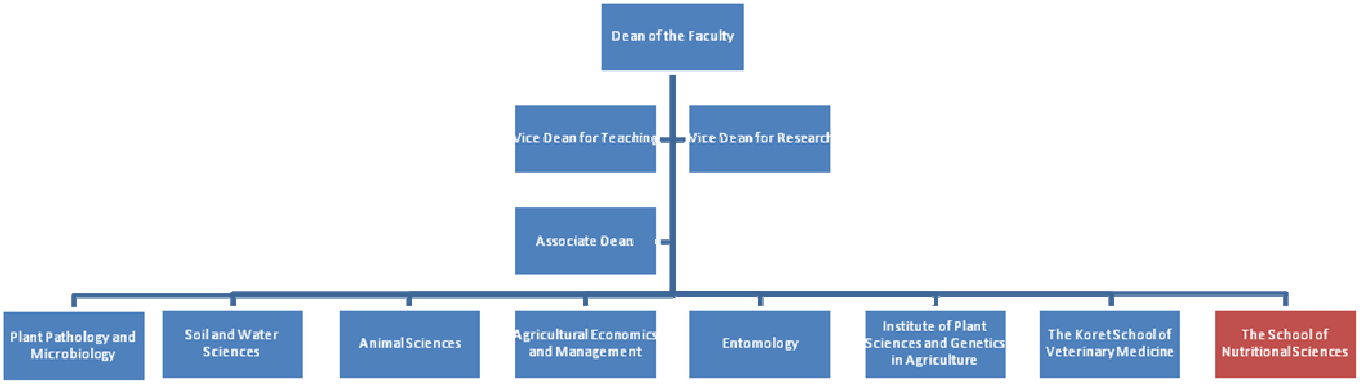
Research at the Faculty has improved and increased yields of fruits, vegetables, grain crops, flowers and cotton; helped overcome problems of pest damage and soil contamination; led to the most efficient use of water for agriculture; produced ground-breaking innovations in irrigation techniques; helped develop Israel's flower export industry from almost nil in the 1960's, to its current status as one of the largest exporters of flowers in the world; produced novel food ingredients having positive metabolic and physiologic effects in various metabolic disorders; revealed mechanisms controlling production and efficiency of ruminants, poultry and fish species; improved the understanding of the pathogenesis of veterinary diseases, and the health of companion and production animals and much more.

The specific achievements and innovations of the School of Nutritional Sciences include elucidation of the role of Omega-3 fatty acids in bone development, the role of clock genes in obesity, characterization of fatty liver and the role of oxygen radicals, and of iron metabolism and the involvement of intestinal genes. Research by the School has also enhanced our understanding of transcription factors that bind fatty acids in intestinal morphogenesis of cancer, the role of nutritional education in diverse Israeli populations, and the importance of nutritional factors in the development and progress of Alzheimer's disease.

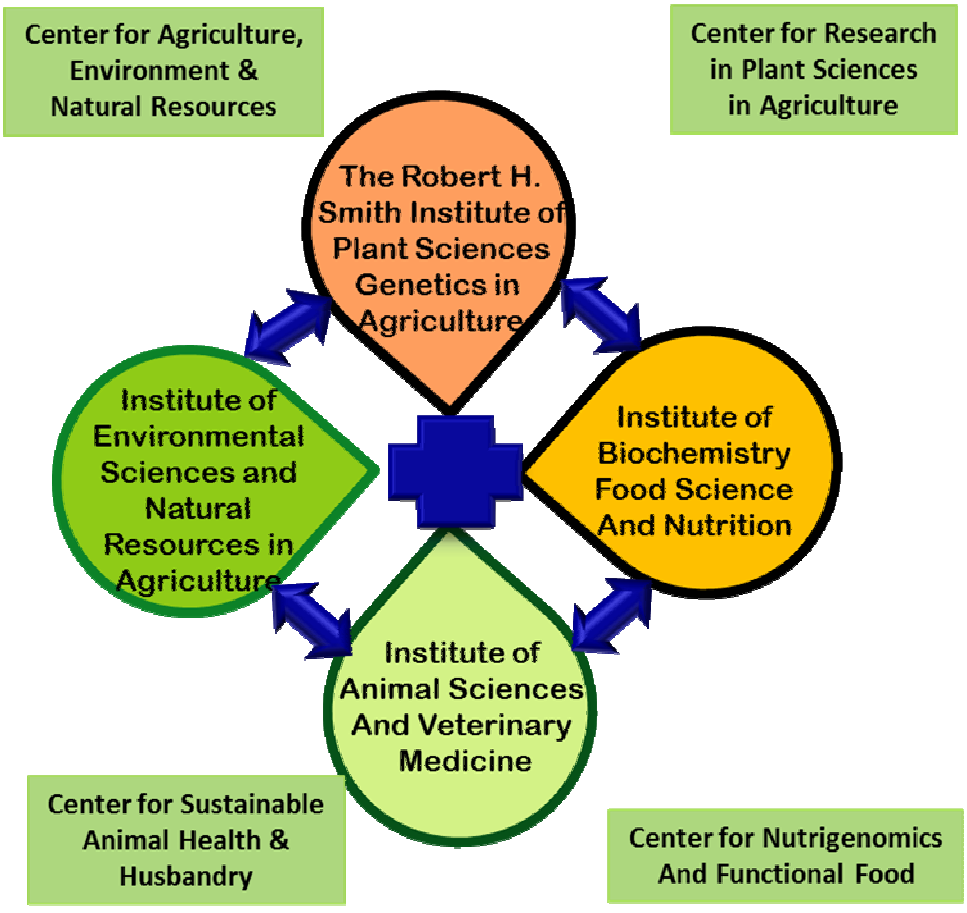
Our vision and future plans are based on the unique qualities of the Faculty, among them an outstanding core of scientists and students striving to develop novel concepts and ways to

address the challenge before us, that of providing food for the future and alleviating world hunger. Our goals include the development of long range research, teaching and training programs that will promote the advancement and application of modern agriculture.

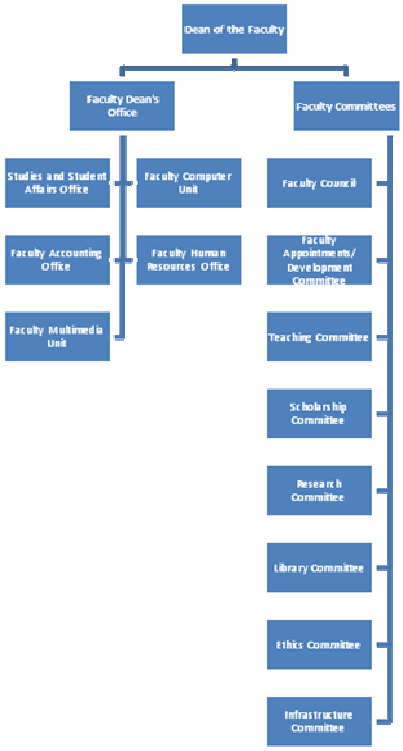
The Smith Faculty has undergone a paradigm shift in the framework of four pillar institutes and four new interdisciplinary research centers.



Academic and Administrative Organizational Structure



Committees:



2C.3a Names of holders of senior academic and administrative positions

- Dean: Professor Aharon (Ronnie) Friedman; aharonf@savion.huji.ac.il
- Vice Dean for Research: Professor Shmuel Wolf; swolf@agri.huji.ac.il
- Vice Dean for Curriculum and Academic Affairs: Professor Moshe Coll; coll@agri.huji.ac.il
- Associate Dean: Mr. Dotan Zaidel; dotanz@savion.huji.ac.il

2C.4 The number of study programs (departments, etc) operating in its framework; the names of the academic degrees (in English and Hebrew) granted to the graduates of these programs (the phrasing that appears in the diploma); the number of students who have studied (and are studying) within the parent unit in each of the last five years according to the level of degree (first degree, second degree with thesis, second degree without thesis, doctoral degree).

DVM	PhD	MSc Agr.	BSc Agr.	Department
	X	X	X	**Plant Sciences in Agriculture**
	X	X	X	**Plant Protection**
	X	X	X	**Soil & Water Sciences**

	X	X	X	**Agr. Economics & Management**
	X	X	X	**Animal Sciences**
	X	X	X	**Biochemistry and Food Science**
	X	X		**Field & Vegetable Crops**
	X	X		**Horticulture**
	X	X		**Genetics and breeding**
		X		**Environmental Quality and Natural Resources in Agriculture**
	X	X		**Animal & Veterinary Sciences**
X	X			**Veterinary Medicine**
	X	X	X	**Nutritional Sciences**
			X	**Hotel, Food Resources & Tourism Management**

Names of degrees:

Bachelor of Sciences

Master of Sciences

Doctor of Veterinary Medicine

Doctor of Philosophy

2C.5 The number of graduates of the unit in each of the last five years according the level of degree (first degree, second degree with thesis, second degree without thesis, doctoral degree).

Year	Degree		Students	Graduates
2006	**B.Sc.**		1350	520
	M.Sc.	with thesis	513	119
	M.Sc.	without thesis	69	24
	Ph.D.		289	40

2007	**B.Sc.**		1279	548
	M.Sc.	with thesis	444	148
	M.Sc.	without thesis	116	22
	Ph.D.		295	43
2008	**B.Sc.**		1216	550
	M.Sc.	with thesis	475	148
	M.Sc.	without thesis	54	22
	Ph.D.		309	28
2009	**B.Sc.**		1343	316
	M.Sc.	with thesis	443	120
	M.Sc.	without thesis	40	16
	Ph.D.		302	27
2010	**B.Sc.**		1328	353
	M.Sc.	with thesis	389	107
	M.Sc.	without thesis	46	13
	Ph.D.		326	33
2011	**B.Sc.**		1369	
	M.Sc.	with thesis	354	
	M.Sc.	without thesis	47	
	Ph.D.		299	

2C.6 What bodies (internal/external) decide on rationale, mission and goals of the parent unit and of the study programs, how they are decided upon, examined and, if deemed necessary, changed? Have they been discussed within the last five years? If so, please specify when these discussions have taken place and what were their outcomes? If not, when were changes made (if at all)? How are the mission, goals and changes brought to the attention of the teaching staff, the students and the institution's authorities?

The Faculty Council, consisting of all the Professors, Associate Professors, Senior Lecturers and the Lecturers, is the major constitutional body of the Faculty of Agriculture, Food and Environment. This body makes decisions on the rationale, mission and goals of the Faculty and its departments, and is the electoral body of the three managing committees. The three committees are as follows:

- The Development Committee under the chairmanship of the Dean. Additional members include the two vice deans, the associate dean, the pro-dean and three members elected by the council. Membership in this committee is for a period of 4 years. This committee makes decisions on all issues of development, such as scientist recruitment, development of research disciplines and more.
- The Curriculum Committee under the chairmanship of the Vice-Dean for Curriculum Affairs. The Dean and representatives of all academic units, as elected by the council, also serve on this committee. Membership in the committee is for a period of 3 years. This committee deals with all matters related to curricular issues, including course approval and structure of course hierarchy.
- The Research Committee under the chairmanship of the Vice Dean for Research Affairs. Four additional members are elected by the council, and a representative of the students' elective body also sits on the committee. Membership is for a period of 3 years. This committee deals with all aspects of research, with emphasis on grant resources as well as application of scientific innovations.

The committees submit their recommendations to the plenum of the Faculty Council for discussion and ratification. All decisions are distributed to staff, student elective body and University authorities by electronic minutes.

In addition to the centralized authorities, each department as a unit sets its general goals and vision for development and recruitment. Departmental Steering Committees pursue the means to put these goals into practice. The committees prioritize fields in the departments that need to be strengthened through the addition of new academic staff and discuss major changes in the curriculum. The departments submit their recommendations to the Faculty's three major committees.

In addition to local Faculty committees, the University has a Teaching Regulations Committee, which consists of all the chairpersons of the Curriculum Committees of the various faculties of the University. This committee is in charge of University regulations concerning instruction and studying. The President and the Rector of the University frequently convene special committees to evaluate specific faculties or departments.

The Faculty's undergraduate study program was recently revised, with the number of credit points reduced from 164 to 150. This major alteration was made following recognition that the undergraduate degree in Agriculture was more intensive by far than that of other life sciences. Each academic unit was requested to revise its undergraduate program with the aim of reducing the number of credit points while maintaining the excellence of our study record. Intensive discussion, at all levels, led us to conclude that it would be possible to reduce the learning load to 150 credit points without affecting the quality of undergraduate studies. This decision was approved by University authorities, and is currently undergoing implementation.

2C.7 What is the Parent Unit's perception of the evaluated Study Program/Department within its greater framework? Is the study program represented in the Parent unit's decision making bodies?

Within the above context, it is clear that the School of Nutritional Sciences is central to our vision for alleviating world hunger. Alleviation of hunger, thereby realizing our main mission, will be achieved by increasing production, protecting natural resources, developing new and nutritious food supplies and by developing new strategies to meet human nutritional requirements. The two latter objectives are central to the activities and function of our School of Nutrition. Furthermore, the school is committed and dedicated not only to the professional training of dieticians, as are other schools of nutrition which have recently opened in Israel, but also to the far broader vision embraced by the Faculty of Agriculture, Food and Environment as a whole;, this commitment, evident in our research and social endeavors, is a unique and essential advantage of the Smith Faculty's School of Nutritional Sciences.

All decision making bodies in the Robert H. Smith Faculty of Agriculture, Food and Environment, as detailed above, include representatives of the Institute of Biochemistry, Nutrition and Food Sciences, the research institute that administers the School of Nutrition.

An appendix to the description of the Faculty of Agriculture: a B.Sc. "Biotechnology of Agriculture" specialization program

1. Mission

Biotechnology combines a wide range of subjects from life sciences to computer sciences, and deals with the development and application of biological technologies for the production of pharmaceuticals, diagnostic systems, food and more. Although medical biotechnology is popular, agricultural biotechnology may soon overshadow it, as more people die from hunger and malnutrition than from diseases. World population has been forecast to grow to ten billion people by the year 2050, almost 1.5 times its size today. This would put incredible pressure on an already strained agriculturally based food supply. There is little doubt that biotechnology in conjunction with agriculture can meet the challenge together.

The main purpose of the Program of Specialization in Biotechnology in the Faculty of Agriculture is to train students in biotechnology which would allow them to either work in industry and/or prepare them for graduate studies (MSc and PhD) in the field. The study program is linked to studies in the fields of plant sciences, plant protection, biochemistry and food or animal sciences, so that the students acquire the basic knowledge both in the specific field and in the various areas related to biotechnology.

The study program includes courses dealing with molecular genetics, genetic engineering, genomics, bioinformatics, immunology, cell and tissue culture, biotechnology of food, separation and identification of macro- and micro- molecules, etc. In addition, in the course of their studies, students will be exposed to related subjects such as commercial initiatives in the field of biotechnology, quality control in the biotechnology industry, and legal and ethical issues involved. The program includes a number of laboratory courses. Most of the courses are constructed so that they have aspects related to animals, plants, microorganisms, and technologies for production of food.

The admission requirements for this program are rigorous, so that only the very best students are accepted. The unit is interested in limiting the number of students in the program in order to provide these students with the very best and also because of the high cost of the laboratories.

2. Academic program

The students will be required to take a total of 165[1] credits. Of these, 104-122 credits are requirements of the field of study, and 30.5 credits are program requirements fulfilled by fifteen courses of which eleven (see bolded course number in table 2.1) are designed, and are open only, for the students of the program. These "program specific courses" include 4 laboratories that enable the students to acquire basic and advanced tools in biotechnology in various fields. The laboratories are designed to teach the students basic research skills, keep them up-to-date with the latest advancements in the field, expose in general, and to increase their interest in biotechnology science. For their remaining credits (i.e. 12-31 credits depends on the specific field), the student will choose from a given list of courses in their field. Below is a list of the program obligatory courses (Table 2.1) and an example of obligatory courses in one of the study fields of the program (Table 2.2).

[1] Note that from 2011 students will be required to take a total of 150 credits

2.1. List of obligatory courses in the program (30.5 credits)

Course name	**Course #**
Introduction to biotechnology	71029
Basic techniques in molecular biology	71204
Pharmaceutical quality assurance and quality control	71206
Chromatography of micro and macromolecules	71211
Cell and tissue culture	71213
Proseminar in biotechnology	71212
Seminar in biotechnology	71214
Fermentation in biopharmaceutical industry	71215
Applied microbiology laboratory	71219
Immunology laboratory	71209
Bioinformatics and structural biochemistry	71437
Entrepreneurship and management in biotechnology	73552
Molecular genetics	71034
Genetic engineering	71184
General immunology	71811

2.2. List of the obligatory courses for students in the field of animal sciences with specialization in Biotechnology (111 credits)

Course name	**Course#**
Introduction to zoology	71004
Introduction to calculus	71022
Organic chemistry (a)	71066
Calculus	71071
Chemical principles - lab	71073
Chemical principles	71074
Cell biology	71078
English - level 1	71051
English - level 2	71052
Physics for life sciences	71060
Organic chemistry (b)	71067
Biochemistry	71080
Biochemistry - lab. Course	71081
Introduction to entomology	71501
Histology	71817
English - level 1	71051
Fundamental genetics	71012
Fundamental statistics	71013
Introduction to economics a (non-majors)	71019
Plant biology	71044
Introduction to molecular biology	71065
Animal physiology and anatomy	71801

Statistical principles in experimental design	71026
General microbiology	71056
Animal genetics and breeding of farm animals	71091
Introduction to history and philosophy of science	71251
Introduction to endocrinology	71810
Principles of farm animals nutrition	71839
Elements of pathology	71844
Comparative reproduction	71803
Bioclimatology of farm animals	71833
Molecular aspects in food biotechnology	71476
Introduction to embryology	71804

3. Instructors

3.1 Course instructors of the obligatory courses in the program

Institute/department	**Academic staff**
Plant Sciences	Prof. Alexander Vainstein
Plant Sciences	Dr. Alon Samach,
Animal Sciences	Prof. Berta Sivan
Plant Sciences	Prof. David Weiss
Biochemistry, Food Science and Nutrition	Dr. Hagai Abeliovich
Plant Sciences	Prof. Hanokh Czosnek
Biochemistry, Food Science and Nutrition	Dr. Masha Niv
Plant Sciences	Prof. Naomi Ori
Animal Sciences	Prof. Orna Halevy
Animal Sciences	Prof. Rina Meidan
Animal Sciences	Prof. Ronnie Friedman
Biochemistry, Food Science and Nutrition	Dr. Zohar Kerem
Plant Protection	Dr. Yael Heifetz
Plant Protection	Prof. Yitzhak Hadar
	External staff
	Dr. Eli Khayat
	Dr. Ilana Harlev
	Mr. Moshe Landsberg

4. Student statistics

4.1 Number of students for each field over the last five years

2010	**2009**	**2008**	**2007**	**2006**	**Field**
12	8	4	1	6	Plant Sciences
8	12	7	4	4	Biochemistry, Food Science and Nutrition
7	13	3	7	5	Animal Sciences
3	2	2	4	1	Plant Protection
3	7	4			Agricultural Economics and Management
33	**42**	**20**	**16**	**16**	**Total:**

4.2 Number of graduates of each field over the last five years

2010	2009	2008	2007	2006	Field
2	4	2	9	4	Plant Sciences
7	2	2	3	8	Biochemistry, Food Science and Nutrition
2	6	2	8	9	Animal Sciences
1	1	3	3	1	Plant Protection
					Agricultural Economics and Management
12	**13**	**9**	**23**	**10**	**Total:**

Chapter 3

The Inter-Faculty Biotechnology Program

3.1 The Goals and Structure of the Study Program

3.1.1 A brief summary of the program's development

The Hebrew University Inter-Faculty Biotechnology Program was founded in the late 1980's, at an attempt to provide M.Sc. students with an opportunity to become acquainted with the diverse aspects characterizing modern biotechnological sciences, while at the same time carrying out a thesis project on a specific subject at one of the program's three member faculties. The first batch of M.Sc. graduates graduated in 1991; since then, **315** students have graduated from the program; since 2005, **17** students have continued towards a Ph.D. degree without having to graduate (the "direct Ph.D. track"), and **27** students are currently (Dec. 2011) enrolled as full time students.

3.1.2 Mission Statement

The Hebrew University Inter-Faculty Biotechnology Program was founded based on the understanding that present and future advances in biotechnology will revolutionize numerous aspects affecting human life, and that there is a place for a broad-spectrum education program that will highlight for the students at least some of these aspects. The program thus aims to generate M.Sc.-level students that on the one hand are trained in high-quality research in an academic research laboratory, and on the other hand are acquainted with several of the diverse disciplines that make up modern biotechnology. It is envisaged that the program graduates will either continue with advanced studies towards a Ph.D. degree, or find employment in the increasingly expanding biotechnology industries.

3.1.3 Organizational structure

Due to its inter-faculty nature, the program is academically and administratively controlled by the University's office of the Rector. In practice, however, this responsibility is delegated to the faculty the program director is a member of (currently the Faculty of Science). The budget is shared by the Rector's office and the host faculty.

The program director is nominated by the Rector for a period of three years, based upon recommendations from the faculties' deans. The director is helped by a part time (50%) secretary, which is the only member of the University staff assigned to the program.

Academic aspects of the program are decided by the Teaching Committee, composed of representatives of all member faculties.

3.1.4 Holders of academic and administrative positions

Program director – **Prof. S. Belkin**, Faculty of Science

Program Secretary – **Ms. M. Fingerhut**, Faculty of Science

Teaching committee 2011-2012:

Prof. Itamar Simon, Faculty of Medicine

Prof. Doron Steinberg, Faculty of Dental Medicine

Prof. Berta Sivan, Faculty of Agriculture

Prof. Y. Hirschberg, Faculty of Science

3.1.5. The number of students who have studied in the program over the last five years

The Biotechnology Program awards only one degree, a second degree (M.Sc.) with thesis. The number of new students enrolling in the program has remained relatively constant over the last few years, averaging ca. 13 per year, as is shown in the Table below.

Number of new students in the Biotechnology Program

	2006	2007	2008	2009	2010	2011
No. of new students enrolled - second degree with thesis	14	17	12	12	14	13

3.1.6. The number of graduates who have studied in the program over the last five years

The Table below lists the number of students who graduated from the program in each of the last 6 academic years.

Number of graduates of the Biotechnology Program

	2006	2007	2008	2009	2010	2011
No. of new graduates - second degree with thesis	21	15	20	15	9	9

3.2 The Study Program – Contents, Structure and Scope

3.2.1 Name, tracks, campuses

The Hebrew University Inter-Faculty Biotechnology Program is taught in a single track, with no designated specializations. The students' education combines a broad interdisciplinary exposure on the one hand and an in-depth research into a specific topic on the other hand. Thus, while the students carry out their specific M.Sc. research projects in one of the faculties, they take courses in three faculties on three campuses.

The University's campuses in which the program is taught are the Jerusalem Givat Ram Edmond J. Safra Campus (home of the Faculty of Science), the Jerusalem Ein Kerem Campus (Faculty of Medicine) and the Rehovot Campus (Faculty of Agriculture). The students, by

design, have to take courses in all three campuses and are thus exposed to different disciplines much more than "regular" M.Sc. students. The compulsory courses of the program are planned so that one day a week (Wednesday) in the first semester all students spend a day in Jerusalem and one day a week (Monday) in the second semester all students spend in Rehovot. The program provides transportation for the students between Rehovot and Jerusalem on the relevant days. The students mostly spend the rest of their time in their parent campus, where they carry out their M.Sc. research project under the guidance of one of the program's faculty members on that campus. They normally also take the rest of their academic credit points by attending elective courses on that campus. These credit points are taken from a selected list of courses, all of biotechnological relevance, and of suitable academic levels. Selection of alternative elective courses is allowed, but requires approval of the program director.

3.2.2 Structure, content, and scope of the study program

The program is built out of three classes of courses:

a. Compulsory courses – taken by all students (13 credit points)
b. Elective/compulsory courses – groups of courses, out of each the student has to select one (usually the one provided in his campus; 9-11 credit points)
c. Elective courses – from among which the students select courses, based upon their personal interest and/or their relevance to their thesis topic, to a cumulative total of at least 34 credit points. Alternative courses not on the original list are allowed, but require specific approval of the program director.

The students can distribute the course load over the standard 2 year program according to their personal preferences, but are strongly encouraged to concentrate most of the credit points in the first year so that the second year can be mostly dedicated to completion of the thesis project.

A point which should probably be re-emphasized is that the Biotechnology Program does not have "its own" faculty and its own teachers; all teachers in the program belong to a parent faculty, and their primary teaching obligation is to that faculty and to the institute of which they are members within that faculty. As a consequence, all of the elective courses and some of the compulsory courses are selected from among other teaching programs. A small number of courses (designated with an asterisk in Table 1 below) were specifically constructed for the Biotechnology Program. Some of these courses are given by "external" teachers, either paid or volunteers. All of these courses are open to students of other teaching programs, but there are no "service courses" to other units.

The structure of the program is described in detail in Table 1.

Table 1: courses in the Hebrew University Biotechnology Program,

Academic Year 2011

Framework of study: single track, M.Sc. with thesis

Teaching Staff		No. of Students	Weekly Laboratory Hours	Weekly Exercise Hours	Weekly Teaching Hours	Prerequisites for Admission	No. of Credits	Course Type (oblig./elective/ seminar/other)	Course Title	Course No.	Semester	Year in Program
Employment Degree	Name of staff member											
Full Prof.	Shimshon Belkin	36			2		2	Obligatory	BIOTECHNOLOGY IN ISRAEL*	76052	1	1 or 2
Full Prof.	Shimshon Belkin	15					2	Obligatory	BIOTECHNOLOGY SEMINAR*	94707	1	
Full Prof.	Stefan Rokem	34			4		4	Obligatory	INDUSTRIAL MICROBIOLOGY	81854	1	
Full Prof.	Ophry Pines	33			2		2	Obligatory /Elective**	PHYSIOLOGY OF MICROORGANISMS*	81829	1	
Full Prof.	Charles Yaffe	72			2		2	Obligatory /Elective**	THE IMMUNOLOGICAL BASIS OF VACCINES	81807	1	
Ph.D. Outside Teacher	Ilana Harlev	38			2		2	Obligatory /Elective**	ENTREPRENEURSHIP IN LIFE SCIENCES*	73552	1	
Full Prof.	Avraham Domb	90			2		2	Elective	MACROMOLECULAR DRUGS & BIO POLYMERS	64642	1	
Full Prof.	Amiram Goldblum	2			3		3	Elective	MOLECULAR MODELING FOR DRUG DESIGN	64751	1	

Full Prof.	David Weiss	-			2		2	Elective	SIGNAL TRANSDUCTION IN PLANTS	71101	1	
	Saul Bordman	-			4		4	Elective	PHYTOBACTERIOLOGY	71125	1	
Full Prof.	Elisha Telor	29			2	71081 BIOCHEMISTRY - LAB. COURSE	2	Elective	PLANT NATURAL PRODUCTS & PHYTO-REMEDIATION	71186	1	
Dr.	Hagai Abeliovich	-			2		2	Elective	BIOCHEMISTRY OF PROTEINS AND ENZYMES	71901	1	
Dr.	Hagai Abeliovich	-			3		3	Elective	BIOCHEMISTRY OF CARBONATES	71902	1	
Full Prof.	Yitzhak Hadar	-			2		2	Elective	ENVIRONMENTAL MICROBIOLOGY	71977	1	
Full Prof.	Joseph Hirschberg	14			4		4	Elective	BIOCHEMISTRY AND PHYSIOLOGY OF PHOTOSYNTHESIS	72600	1	
Full Prof.	Alex Levin	11			3		3	Elective	PLANT ENVIRONMENT: PHYSIOLOGY AND MOLECULAR BIOL	72637	1	
Full Prof.	Hanna Margalit	68			5		5	Elective	BIOINFORMATICS-COMPUTERIZED ANALYSIS OF BIO. SEQ	72677	1	
Dr.	Stefan Rokem	12			5		5	Elective	APPLIED MICROBIOLOGY	72679	1	
Dr.	Tsafi Danieli	27			3		3	Elective	PURIFICATION & EXPRESSION OF RECOMBINANT PROTEIN	72681	1	
Full Prof.	Oded Shoseyov	43			3	71184 GENETIC ENGINEERING	3	Elective	PROTEIN ENGINEERING & NANO BIOTECHNOLOGY	73501	1	

Full Prof.	Alexander Vainstein	22			3	71065 INTRODUCTION TO MOLECULAR BIOLOGY	3	Elective	DNA SEQUENCES: VARIATION & APPLICATIONS	73527	1	
Full Prof.	Ilan Rosenshine	7			4		4	Elective	MEDICAL MICROBIOLOGY	81801	1	
	Ora Furman	23			4		4	Elective	STRUCTURE AND FUNCTION OF PROTEINS	81817	1	
Full Prof.	Itamar Simon	33			4		4	Elective	MOLECULAR BIOLOGY	81850	1	
Full Prof.	Joseph Hirschberg	12			3		3	Elective	MOLECULAR BIOLOGY & BIOTECHNOLOGY OF HIGHER PLAN	88843	1	
Full Prof.	Shimshon Belkin	7			2	72361 INT. TO PLANT SCIENCE - HONOR'S PROG. /72335 INTRODUCTION TO MICROBIOLOGY /89305 BACTERIA IN THEIR NATURAL ENVIRONMENT	2	Elective	ENVIRONMENTAL MICROBIOLOGY	89777	1	
Ph.D. (volunteer) Ph.D (volunteer)	Yechiam Salts Rivka Berg	18			3		3	Obligatory	BIOTECHNOLOGY IN AGRICULTURE*	73534	2	1 or 2
Ph.D. Outside Teacher	Hedva Shikler	16			2		2	obligation	BIOTECHNOLOGY AND INTELLECTUAL PROPERTY*	73547	2	
Ph.D. Outside Teacher	Ilana Harlev	15			2		2	Obligatory /Elective**	ENTREPRENEURSHIP IN LIFE SCIENCES*	76050	2	

Ph.D. volunteer	Shterm Yehuda	-			3		3	Obligatory /Elective**	COMPUTERIZED ANALYSIS OF NUCLEIC ACIDS & PROTEINS	73548	2	
Full Prof.	Edouard Jurkevitch	-			2		2	Obligatory /Elective**	PHYSIOLOGY & MOLECULAR BIOLOGY OF BACTERIA	73540	2	
Full Prof.	Ronnie Friedman	-			3		3	Obligatory /Elective**	ADVANCED IMMUNOLOGY	71914	2	
Dr.	Masha Niv	19			3	71081 BIOCHEMISTRY - LAB. COURSE /71080 BIOCHEMISTRY	3	Obligatory /Elective**	BIOINFORMATICS AND STRUCTURAL BIOCHEMISTRY	71437	2	
Full Prof.	Michal Linial	24			4	72332 INTRODUCTION TO MOLECULAR BIOLOGY /72155 GENERAL GENETICS A	4	Obligatory /Elective**	WORKSHOP IN BIOINFORMATICS	72351	2	
Dr.	Eilon Yavin	-			3		3	Elective	PEPTIDES & OLIGONUCLEOTIDES: CHEMICAL & BIOLOGICAL ASPECTS	64813	2	
Full Prof.	Yoel Sason	18			3		3	Elective	INTRODUCTION TO REACTORS AND BIOREACTORS THEORY	69684	2	
Full Prof.	Hanokh Czosnek	67			3	71012 FUNDAMENTAL GENETICS	3	Elective	MOLECULAR GENETICS	71034	2	
Full Prof.	V. Soroker	16			2	71501 INTRODUCTION TO ENTOMOLOGY	2	Elective	CHEMICAL ECOLOGY IN PLANT PROTECTION	71126	2	
	A. Adelboim	17			3	71034 MOLECULAR GENETICS	3	Elective	LABORATORY IN MOLECULAR BIOLOGY	71177	2	

Full Prof.	Hanokh Czosnek	46			3	71034 MOLECULAR GENETICS	3	Elective	GENETIC ENGINEERING	71184	2	
Full Prof.	Baruch Kanner	37			3	71080 BIOCHEMISTRY	3	Elective	CHEMISTRY AND BIOCHEMISTRY OF FOOD	71430	2	
	Alex Levin	25			3		3	Elective	PLANT - PATHOGEN RELATIONSHIPS	72587	2	
Dr.	Rachel Green	48			2	72334 INTRODUCTION TO PLANT SCIENCE	2	Elective	AN INSIGHT INTO PLANT DEVELOPMENT	72653	2	
Full Prof.	Oded Shoseyov	-			3		3	Elective	PROTEIN ENGINEERING & NANO BIOTECHNOLOGY	72682	2	
Full Prof.	Yaacov Okon	-			2		2	Elective	FIXATION AND METABOLISM OF NITROGEN IN BACTERIA	73531	2	
Full Prof.	Aharon Oren	9					7	Elective	MARINE MICROBIOLOGY	76716	2	
Full Prof.	Ofer Mandelboim	15			4		4	Elective	CELLULAR, MOLECULAR IMMUNOLOGY: SELECTED ISSUES	81803	2	
Full Prof.	Ophry Pines	39			4		4	Elective	MOLECULAR CELL BIOLOGY	81812	2	
Full Prof.	Stefan Rokem	36			2		2	Elective	BIOTECHNOLOGY & ENVIRONMENT SCIENCES	81864	2	
Full Prof.	Jacob Rachmilewitz	59			2		2	Elective	MOLEC. & CELL BIOL OF GROWTH FACTORS & CYTOKINES	81891	2	
Dr.	Amir Eden	10			2		2	Elective	EPIGENETICS AND CHROMATIN	88849	2	
Dr.	Julia Shifman	8			3		3	Elective	PROTEIN DESIGN AND EVOLUTION	92623	2	

Full Prof.	Shimon Schuldiner	-			3		3	Elective	CHANNELS AND TRANSPORTERS: FROM GENE TO MECHANISM	94305	2	
Full Prof.	Yechezkel Barenholz	22			4		4	Elective	LIPOSOMES: THEORY AND APPLICATION	94704	2	
Full Prof.	Eithan Galun	22			4	75304 HUMAN GENETICS /72350 HUMAN GENETICS	4	Elective	GENE THERAPY	94905	2	

***** Course designed specifically for the Biotechnology Program

******Obligatory/Elective – an obligatory selection from a limited number of courses

3.2.3 Planning and managing of the study program

Planning the study program is the responsibility of the program director, who consults with the Teaching Committee. The committee's approval is required for establishment of new courses and for significant changes in the requirements from the students. New courses need also to be approved by the current parent faculty so that they can be entered into the University's course list.

3.2.4 Coordination and examination of courses' contents

Upon the establishment of a new course, its proposed contents are examined in detail by the teaching committee as well as by the faculty Deputy Dean of Teaching. There is no established procedure for coordinating and checking the contents of courses that have been approved in the past. Nevertheless, each year, as a part of the process of planning next year's program, the program director examines the published syllabi of the program courses and, when necessary, discusses the contents with the relevant teachers.

3.2.5 Additional non-academic bodies

No non-academic bodies are involved with either the planning or the managing of the Biotechnology Program.

3.2.6 Future development plans

There are no major development plans that are currently under discussion for the Biotechnology Program. The only relevant issue that has been recently discussed has been to expand the program to accept also PhD students.

Additional issues that are on the board for discussion towards the next academic year:

- Increasing the program's visibility so as to attract its full complement of students (currently envisaged as 30 per year, 10 per faculty)
- Bringing in an external sponsor in order to be able to offer more fellowships to the program's students.

3.2.7 Goal achievements, strengths and weaknesses

The program continuously fulfills its original mission in that every year it graduates a cadre of high-quality M.Sc.-level students, with research experience as well as a broader understanding of the biotechnology arena.

Weaknesses

- Some biotechnological arenas are visited only cursorily or not at all
- Reliance on teachers whose main loyalty lies elsewhere
- Insufficient visibility of the program inside and outside the Hebrew University
- Number of students too small – full complement rarely reached
- Students spend time travelling between campuses and towns
- Insufficient support of HUJ management
- Incomplete understanding of HUJ management of the biotechnological future
- No TA positions associated with the program

Strengths

- A unique program allowing exposure to diverse biotechnological fields
- A combination of courses that is often impractical for "normal" students
- Constant interactions with students from other disciplines
- Early exposure to biotechnological industries
- Early exposure to IP and entrepreneurship issues
- Very high satisfaction among graduates

3.3. *Teaching, Learning and Learning Outcomes*

While we have tried our best to respond to all questions in this section, it should be borne in mind that many of them are not fully relevant to the Hebrew University Biotechnology Program; it is a very small program with a limited scope, most courses of which are actually part of other programs and thus we have a very little say regarding their quality.

3.3.1 Teaching evaluation and improvement

Teaching is evaluated based upon (a) regular students' evaluation reports and (b) formal and informal discussions with students regarding specific issues that have come up. The program director discusses negative students' evaluations with the relevant teacher(s).

No guidance programs are offered to teachers, though some are available in other frameworks.

3.3.2 Rankings of the courses as a result of the teaching surveys of the last 5 years

Table 3 lists average scores of student teaching surveys in the Last 3 Years, displaying a range of scores of 14 to 18.3 in teacher evaluation and 13.5 to 17.2 in overall course evaluation. Data for the two previous years was scant and did not allow calculation of averages.

As the number of courses evaluated was small, we did not distinguish between the two semesters in the calculation of the average scores. We provide the summary evaluation values for both the courses and their teachers.

Table 3: Average Score of Teaching Surveys in the Last 5 Years, the Biotechnology Program

Seminars	Electives	Obligatory	
	16.16	14.08	Mean lecturer
	15.34	13.69	Mean course
	5	3	N. of courses

Academic year 2009

Seminars	Electives	Obligatory	

Academic year 2010

18.89	15.60	18.34	Mean lecturer
Seminars	**Electives**	**Obligatory**	
1	4	3	N. of courses
	14.98	18.18	Mean lecturer
	13.55	16.60	Mean course
	6	2	N. of courses

Academic year 2011

3.3.3 Information technology in teaching and learning

Two years ago we have introduced a compulsory selection of at least one bioinformatics-related course; these courses involve the intensive use of computers, data analysis and a variety of programs for diverse applications including protein/crystal structure, genomic and metagenomic analyses. Other than that, the use of IT is limited to the employment of course sites (now true for all courses) which host downloadable lecture presentations, instructions and information for students, exercises, required reading materials etc.

3.3.4 Learning Outcomes

It is expected that graduates of the Biotechnology Program will be able to:

- Demonstrate knowledge of biological processes from molecular, cellular , and organismal perspectives.
- Understand the possible implications of such processes for biotechnology applications.
- Demonstrate ability to employ molecular, cellular, and biochemical techniques of biotechnological relevance.
- Engage in the scientific process to form hypotheses, synthesize scientific information, gather and analyze data, apply statistical techniques and draw conclusions.
- Engage in effective scientific communication as individuals and as team members by listening, speaking, and writing and presenting in written, oral and poster formats.

- Approach and solve biological problems critically with scientific literacy in individual and group settings.
- Understand the basic principles and stages involved in transferring a scientific idea from an academic laboratory to a commercial setting
- Apply ethical practices and behavior in all aspects of biotechnological scientific endeavors.

It is expected that these capabilities will be learned in the course of the M.Sc. studies from both individual courses and as an integral part of the thesis research project.

As the Biotechnology Program "uses" many courses from at least three faculties on three campuses, it has no control over the examination process and/or individual student grading in most of its courses. The following information in this section will thus be limited to M.Sc. dissertations only.

Each graduating student has to submit a written dissertation on his thesis research project. The dissertation is prepared according to the guidelines of the faculty where the research work is carried out, and links to the guidelines are provided in the program's website. The thesis is read and graded by at least one examiner in addition to the thesis supervisor.

The final graduating grade (out of 100) is composed of course grades (40%), thesis grade (30%) and final exam grade (30%).

Average thesis grade over the last 3 years:

92.91 (n= 32)

Average final graduation grade over the last 3 years:

92.47 (n= 32)

Number of graduates who graduated with honors:

In the period 2006-2011, over 38% of the graduates graduated with honors; out of **94** students, **29** graduated cum laude and **7** summa cum laude.

3.4. Students

3.4.1 *The number of students enrolled in the program over the past 5 years:* **82**

3.4.2 *The entry requirements/criteria for the program and the actual admission data (first degree and advanced degrees), including the "on probation" status.*

Acceptance criteria:

- A B.Sc. (or equivalent) degree from a recognized institute of higher learning in Israel or abroad, in a relevant field of study

- A minimum grade average of 85

a. Over the last 5 years:

Number of students who applied to the program – **86**

Number of admitted students – **62**

Number of students who began their studies - **56**

Number of students who completed their studies – **77** (including 9 students who continued towards a "direct track" PhD program)

b. T

he de-facto admission criteria are the same as those outlined above. Occasionally (ca. 1-2 cases per year) students are accepted the average grade of whom is below the required 85, based upon a personal interview and after being vouched for by a faculty member who has agreed to act as his thesis supervisor.

c. O

ver the last 5 years, average B.Sc. grade of students accepted to the program was ca. 89.5; the average acceptance grade for each of the last 5 years is listed in the table below.

Average B.Sc. grades of students accepted to the Biotechnology Program

	2007	**2008**	**2009**	**2010**	**2011**
Average B.Sc. grades of accepted students	90.66	88.79	90.43	87.25	90.05

3.4.3 Selection and admission process

Students apply via the Faculty of Science M.Sc. secretariat, where a file is assembled and delivered to the program director, who then decides on one of the following options:

a. Acceptance with no preconditions
b. Acceptance with make-up course requirements
c. Acceptance to a "make-up year"
d. Rejection

In the first two cases, students are notified that their acceptance is dependent upon their finding a thesis advisor within a pre-defined period of time.

3.4.4 The de facto criteria for advancing to the next year in the program as well as the criteria for completion of the degree, including the graduation requirements:

There are no criteria set by the Biotechnology Program for advancing from year I to year II.

For completing the degree, the student has to accumulate 34 credit points (1 credit point = 1 weekly hour per semester); In addition, the students are required to deliver a lecture describing their thesis highlights, in the form of either a department/institute seminar or in a scientific meeting. The following minimal grade criteria apply:

Minimum course grade - **60**

Minimum M.S. exam score - **65**

Minimum thesis grade - **65**

Minimum final M.Sc. degree grade - **65**

In practice, the graduates' grades are of course much higher. Average M.Sc. grades of the program's graduates are presented in the Table below.

Average final M.Sc. grades of Biotechnology Program graduates

	2007	2008	2009	2010	2011
Average final M.Sc. grades	91.38	90.85	92.03	92.09	93.30

3.4.5 Yearly drop-out rate of students from the program over the last five years:

Drop-out rates over the last 5 years have been very low: 5 students out of a total of 68 students accepted to the program in that period. Three of the dropouts have moved to a different Hebrew University M.Sc. program, and 2 (as far as we know) have stopped their studies altogether.

We find this number acceptable and currently no active steps are taken to attempt to prevent students from leaving the program.

3.4.6 Involvement in research projects

Since this is a Masters program with a research thesis, all students are obviously involved in research projects.

3.4.7 Counseling

There are no specific counseling hours or regulations. Individual study programs are approved for each of the students by the program director; personal discussions are held if deemed necessary by one of the sides. In addition, at least two of the courses ("Biotechnology in Israel" and "Entrepreneurship in Life Sciences") provide the students with opportunities to meet biotechnology professionals from both start-up and established companies, as well as from "biotechnology users" such as medical diagnostics or forensic science laboratories. The students are encouraged to interact with these professionals, and many of them do so.

All year 1 students have an orientation meeting with the program director at the beginning of the year, and are encouraged to approach him with any problem; a second meeting is held towards the end of year, normally in the framework of the compulsory seminar.

At the end of year 1, the program students are required to submit an abstract of their research proposal, which is then read and approved (or not) by two Teaching Committee members. In cases when the proposal is not approved, the student is required to submit a revised version, following a personal meeting in which the document's problems are discussed.

3.4.8 Complaints

Complaints, if any, are usually brought to attention of the program director by the students, either directly or via the program's secretary. In the course of the present director's tenure, such complaints have been very few and always trivial.

3.4.9 Financial assistance

According to an agreement between the relevant faculty deans, Biotechnology Program students are eligible for financial assistance by the faculty they carry out their research thesis in, according to the prevailing regulations in that faculty.

In addition, the Rector's office has been traditionally helpful in allocating additional fellowships for the program's students, based upon their grade average. This aid was deemed essential in view of the extra demands put upon the students by the nature of the program. By having to commute between two cities and three campuses, the students spend less time in their "home lab" in comparison to their fellow students from the same lab who belong to one of the "local" M.Sc. programs. Thus, from the viewpoint of their thesis supervisor, the program becomes less attractive and he/she would prefer that the student register to an M.Sc. program in the same campus/faculty, with none of the associated logistic problems.

This extra funding, rather generous in the earlier days of the program, has dwindled in recent years and is now at an all time minimum (no decision yet on 2011/2012), as displayed in the Table below. Please note that as students usually receive support for 2 years, the number of new students per year receiving a fellowship is approximately half of the values in the Table. As is obvious from the data provided above, the change in recent

years is not due to changes in the quality of the accepted students but rather a result of a policy shift.

Number of Biotechnology Program receiving university fellowships from the Rector's office*

	2004	2005	2006	2007	2008	2009	2010	2011
Students receiving Rector's assistance	17	20	21	20	16	8	5	4

* Support per student is between 50% - 150% yearly M.Sc. fellowship (ca. 10,000 to 25,000 NIS per year); tuition is not covered by this source.

3.4.10 Contact with alumni

Over the last two years we have conducted a mail survey among our graduates; in addition to updating their contact details in our records, the questionnaires served to survey the graduates' opinions on the Biotechnology Program following their post-academic experiences, as well as collect information concerning their current occupation. Out of ca. 300 questionnaires, 62 were returned and analyzed.

Possibly the two most important questions in the context of the present evaluation process were as follows:

A. If you had the opportunity to decide again on the course of your M.Sc. studies, which of the following decisions would you have taken:

   a. Make the same decision: the Inter-Faculty Biotechnology Program

   b. Select another M.Sc. program (name which one)

   c. Not study at all towards a second degree

As clearly indicated in the Table below, the results of the survey were very decisive, with 74% opting for option 'a'. The majority of the 'b' group would have chosen Business Administration (or a related field) as the direction to go for. No graduate opted for 'c'.

B. Are you employed in the biotechnology arena?

Once again the answers were clear, with 69 % employed in a biotechnology-related occupation.

As the graduates who answered the questionnaires spanned a broad range of graduation years, some of them are employed in rather junior position whereas others are much more senior (e.g. R&D Director for a hospital complex; Director of Business Development in a big pharmaceutical company).

3.4.11 Strengths and weaknesses

Strengths

- Usually a very good group of dedicated students
- Program attracts a significant number (over 50%) of students from other institutions
- Many of the students are aware of the "real" biotechnology in the outside world, and are eager to experience it
- Very high satisfaction among graduates

Weaknesses

- Number of students too small – full complement rarely reached
- Insufficient support of HUJ management

	Yes (%)	No (%)
Given the opportunity to decide again on your M.Sc. program, would you have selected the Biotechnology Program again?	74	26
Is your current employment biotechnology-related?	69	31

3.5 Human Resources

3.5.1 Teaching Staff

The Biotechnology program does not really have "teaching stuff", since its teaching program, as noted earlier, is mostly dependent on courses provided by teachers of other programs. In fact, the only teachers that may be considered as "ours" are those "imported" specifically from outside the University for teaching in the program:

- Dr. Yechiam Zalts (Agricultural Research Organization) - Agricultural biotechnology
- Dr. Rivka berg (Agricultural Research Organization) - Agricultural biotechnology
- Dr. Hedva Shickler (Private law firm) – Biotechnology and intellectual property
- Dr. Ilana Harlev (Consultant; entrepreneur) – Entrepreneurship in life sciences

To this list may be added Shimshon Belkin, the Biotechnology Program director, who is in charge of two additional courses ("Biotechnology in Israel" and "Biotechnology Seminar"), and Prof. Ophri Pines from the medical school ("Physiology of Microorganisms"). Between them these teachers are in charge of all courses that were designed specifically for the Biotechnology Program; these are the courses highlighted by an asterisk in Table 1. With this in mind, the relevance of sections 3.5.1.1 – 3.5.1.4 and 3.5.1.7-3.5.1.9 is limited, and they were not addressed in this report.

3.5.1.5 Appointment of the head of the program

The director of the Biotechnology Program is appointed by the University Rector following consultation with the relevant Dean, according to the natural rotation. For example, as the previous director was from the Faculty of Agriculture, and the current one is from the Faculty of Science, it is expected that the next director will be appointed from the Faculty of Medicine. Standard appointments are for three years.

3.5.1.6 Job definition and credentials

As far as we are aware, no official description has been published that defines the position of the program director. The position involves the academic and administrative tasks involved in the routine management of the program; at the same time it is expected that each director will update and upgrade the program so as to avoid the risks involved in getting stuck in established routines.

Similarly, we are not aware that the required credentials for the job have been officially posted. It is understood that the director will be a full time university professor; to date all directors have been full professors, but clearly associate professors are just as eligible. It also

stands to reason that the person's research and teaching interests will be of biotechnological relevance, and that he will express his commitment to the job.

3.5.2 Technical and administrative staff

The program employs a part time (50%) secretary that comprises its entire administrative stuff. The secretary serves as a focal point of reference for both students and teachers, with whom she maintains continuous contacts. She organizes the course schedule, takes care of transportation of the students to the different campuses, and coordinates administrative issues between the different faculties. She takes care that all scheduled milestones will be met by both faculty and students (such as submitting research programs at the end of year I), assembles the final exam committees, and organizes their meetings.

3.5.3 Strengths and weaknesses

<u>Weaknesses</u>

- Teachers' first loyalty is to parent institute and not to the program
- Dependence upon external teachers
- Limited funding prevents expansion of external teacher offerings

<u>Strengths</u>

- A group of teachers allowing exposure to diverse biotechnological fields
- The teachers who do get involved are committed to the program

3.6 Infrastructure

For reasons already outlined above, the Biotechnology Program is not served by any specific infrastructure as it employs the facilities provided by the parent faculties. Classes, laboratories and computer facilities are those assigned to the specific courses by the relevant faculty with very little input from us. The students use the libraries in each of the three campuses.

Chapter 4

RESEARCH

As indicated several times in previous chapters, the Biotechnology Program does not have its own scientific staff; furthermore, as it is a limited teaching program only, there are no research activities that are associated with this program.

Nevertheless, we have decided to provide the committee with an opportunity to become acquainted with some of the research activities with which our teachers are involved, each in the framework of his/her own parent unit. For this purpose we have assembled information on research activities conducted by Hebrew University teachers that either (a) teach courses that are a part of the Biotechnology Program or (b) have supervised Biotechnology Program students in their M.Sc. thesis over the last decade. In view of these limitations, only some of the points listed in the self evaluation instructions for this chapter will be addressed.

Below is a list of Hebrew University faculty who are members of the biotechnology program; marked by an asterisk are teachers that have been active in the program over the last decade, either by supervising M.Sc. research theses or by teaching in the program's courses. Researchers marked with a double asterisk are those the research activities of whom are outlined below, and the CV's of whom are provided in a separate file.

Manifestations of research activities covered in this chapter include research interests, publications and research grants. Additional activities are listed in the CVs provided separately.

List of members, the Biotechnology Program teachers (by faculty)

* Active members
** Members the research activities of whom are outlined in this section

Faculty of Medicine	Faculty of Agriculture	Faculty of Science
Prof. Eithan Galun**	Prof. Nor Chejanovsky**	Prof. Shimshon Belkin**
Prof. Ofer Mandelboim**	Dr. Nir Dai**	Prof. Guy Bloch**
Prof. Stella Mitrani-Rosenbaum**	Dr. Dani Eshel**	Dr. Uri Gat**
Prof. Ariella Oppenheim**	Dr. Yoram Eyal**	Prof. Gidi Gross**
Dr. Jacob Rachmilewitz**	Prof. Edouard Jurkevitch**	Dr. Sebastian Kadener**
Dr. Stefan Rokem**	Prof. Rina Meidan**	Prof. Aaron Kaplan**
Prof. Reuven Or	Prof. Naomi Ori**	Prof. Michal Linial **
Prof. Dan Eilat*	Prof. Dov Prusky**	Prof. Aharon Oren **
Prof. Shoshana Altuvia	Dr. Eyal Seroussi **	Prof. Etana Padan**
Prof. Hanna Engelberg-Kulka*	Prof. Alexander Vainstein **	Prof. Hermona Soreq**
Prof. Hanna Ben-Basat*	Prof. David Weiss**	Prof. Itamar Willner**
Prof. Yinon Ben-Neria	Prof. Oded Yarden**	Prof. Daphna Atlas

Prof. Michal Baniash	Dr. Hagai Abeliovich	Prof. David Engelberg*
Prof. Yechiel Becker	Prof. Zach Adam*	Dr. Benjamin Aroeti
Prof. Raphael Breuer	Prof. Yaakov Okon	Prof. Sergei Braun*
Dr. Stephan Brocke	Prof. Arie Altman*	Prof. Michael Brandeis*
Prof. Yehezkel Berenholz*	Dr. Jonathan Elkind*	Prof. Chaim Gilon
Prof. Herve Bercovier	Prof. Shalom Apelboim	Prof. Hagai Ginzburg
Prof. Alberto Gabizon*	Dr. Saul Bordman	Prof. Yosef Greunbaum
Prof. Amiram Goldblum*	Prof. Eliezer Goldsmith*	Dr. Uri Gat
Prof. Israel Goldberg	Prof. Arie Gertler*	Prof. Ariel Darvasi*
Prof. Gershon Golomb	Dr. Saul Bordman	Prof. Josef Hirschberg*
Dr. Yaakov Golzner*	Prof. Itzhak Hadar*	Prof. Danny Cohen*
Prof. Ruth Galili	Dr. Amir Heiman*	Prof. Avraham Loyter
Prof. Chuck Grinblat*	Prof. Orna Halevi*	Prof. Alex Levin*
Prof. Avi Domb*	Prof. Yosi Hillel*	Prof. Alex Levitzki
Dr. Rivka Drezner-Polak	Prof. Shmuel Wolf*	Prof. Michal Linial*
Prof. Alex Honigman*	Prof. Alexander Vainstein*	Prof. Eduardo Miterani*
Prof. Israel Volovdavski	Prof. David Weiss*	Prof. Eran Meshorer
Prof. Zecharia Zacai	Prof. Hanich Zosnek*	Prof. Rachel Nechushtai*
Prof. Eitan Yefe-Nof	Prof. Daniel Zamir	Dr. Yaakov Nahmias
Prof. Amikam Cohen	Dr. Yael Heifetz	Prof. Ioav Kabachik
Prof. Ron Cohen	Prof. Ephraim Cohen	Prof. Shimon Schuldiner*
Prof. Ehud Katz*	Prof. Zohar Kerem*	Prof. Ruth Sperling*
Dr. Chaia Lorberbaum*	Dr. Zvi Ludmir	
Prof. Oded Meyuhas	Dr. Efrat Monsango-Ornan	
Prof. Reuven Laskov*	Dr. Marganit Levy	
Prof. yael Stern-Bach*	Dr. Menachem Moshalion	
Dr. Daniel Malul*	Prof. Rina Meidan*	
Dr. Hanna Margalit	Prof. Amos Nosinovich	
Prof. David Naor	Dr. Masha Niv	
Dr. Tali Naveh	Prof. Bertha Sivan	
Prof. Justin Silver*	Prof. Ilan Sela*	
Prof. Itzhak Polachek*	Dr. Alon Semech*	
Prof. Eitan Fibach	Prof. Aharon freidman	
Prof. Ofri Pines	Dr. Eyal Friedman*	
Prof. Amos Panet*	Prof. Ram Raifen*	
Prof. Michael Friedman	Prof. Oded Shosayov*	
Prof. Tamar Peretz*	Prof. Avraham Steinberg	
Prof. Moshe Kotler	Prof. Roni Shapira*	
Prof. Eli Keidar	Dr. Elisha Tel-Or*	
Prof. Raymond Kaempfer		
Prof. Baruch Kanner*		
Prof. Chaim Rosen		
Prof. Ilan Rosenshein		
Prof. Shlomo Rotem		
Prof. Aharon Razin		
Dr. Yaakov Rachmilevich*		
Dr. Eitan Shaulian		
Prof. Doron Steinberg*		
Prof. Michael Steinitz		

Research interests of selected Biotechnology Program teachers

A. Faculty of Science

Prof. Guy Bloch

Our research interests are focused on the evolution and mechanisms underlying social behavior and sociality. We study mainly honey bees and bumble bees as models. Bee social organization is astonishing; they live in well organized societies in which up to thousands of individuals coordinate their activities to achieve efficient division of labor, food gathering, colony protection, nest construction, and complex migratory (swarming) ventures. In spite of their relatively small and simple nervous system, bees exhibit complex social behavior, elaborate learning and memory capacities, sophisticated navigation skills, and in the case of the honey bee, also a symbolic (dance) communication system. Our research program integrates analyses at different levels, including genomics, molecular, cellular, neuronal networks, individual behavior, and social organization. We have been studying diverse behaviors including phototaxis (directional response to light), reproduction, dominance, and sleep. Our major line of inquiry, however, has been the interplay between social factors and the biological clock.

Research topics include: (1) neuroanatomical and molecular bases for socially-regulated plasticity in circadian rhythms (funded by the ISF); (2) annotation and genomics analyses of the newly sequenced genome of several bumble bees for studies on the evolution of social behavior (funded by BARD); (3) functional genomics of reproduction, dominance and division of labor in the bumble bee Bombus terrestris (funded by BARD); Juvenile hormone signaling in bumble bees (funded by BARD); (4) social and molecular regulation of size-based division of labor in bumble bees (funded by the BSF); (5) social and molecular regulation of sleep in bees (funded by the GIF).

Dr. Uri Gat

Hair Development and growth The hair follicle is a fascinating model for the study of organogenesis, cell growth, differentiation and stem cell function. We have several projects which explore the role of regulatory pathways and genes that govern this system's function. Thus we are interested in the Runx family of transcription factors who we have found to be active in several important facets of hair formation and cycle. The Hippo pathway is a more recent signaling pathway involved in tissue/organ growth control. We are investigating the mode of its activity in the hair follicle and have generated a unique transgenic mouse model for this goal.

Evolution of genes in metazoan (multicellular) animals In this project we are using a new animal model – the sea-anemone (שושנת-ים) *Nematostella*. This animal is our model for the basic structure and function of metazoans, the large group of organisms that we belong to. We are conducting evolutionary studies on key genes which are important for human development. Our aim is to understand their origin in the animal world and how they have undergone change in the very different animals. The work involves both the use of bioinformatics for analyzing the family trees of the genes and experimental work with the sea-anemones. We are checking the function of the genes using new genetic tools that are becoming available to researchers who are studying this new model animal.

Spider silk fibers – studying their properties and new ways for their production A very special biotechnological project in the lab is the study of a remarkable material, the spider silk. This is the material from which the spider weaves its web. We have established a new expression system for the production and analysis of the structure of this extremely strong and tough fiber. Our goal is to understand how these unique proteins assemble and polymerize to form the spider silk fibers. In addition, we are exploring new ways to synthesize spider silk fibers using genetic engineering and taking advantage of our gained insight about these proteins.

Prof. Gidi Gross

Membrane-anchored β2m and its uses We have created membrane-anchored derivatives of β_2m (mβ_2m), the invariable MHC-I light chain, as a potent genetic tool for MHC-I presentation of N-terminally linked antigenic peptides. Through the genetic engraftment of selected intracellular signaling domains onto the C-terminus of mβ_2m we convert the resulting MHC-I complexes into cellular activation receptors. We are exploiting this genetic platform and other related strategies for the development of novel approaches for immuno-gene therapy of human diseases.

Targeting autoreactive CD8 T cells in type 1 diabetes (T1D) We have generated transgenic NOD mice all T cells of which express a chimeric mβ_2m-CD3ζ chain, harboring a peptide from mouse insulin. This polypeptide pairs with the H-2K^d MHC-I heavy chain and is recognized by diabetogenic CD8 T cells that frequently dominate the early islet infiltrate. In-vitro, transgenic T cells specifically kill insulin-reactive cells, while in-vivo they reduce incidence of the disease and inhibit its progression following cell transfer. We are now examining the broader potential of this approach.

Cancer vaccines In a series of preclinical studies we are evaluating the efficacy of the mβ_2m platform in ex-vivo immunization experiments against human melanoma and in-vivo, using the B16 mouse melanoma model in mouse models for lymphoid malignancies.

Adoptive T cell therapy of cancer In this research we are examining novel genetic means for improving the clinical efficacy of anti-tumor T cells. We put special emphasis on the use of mRNA as a safe and highly efficient method for gene delivery into effector T cells and apply new categories of genetic adjuvants we have been developing.

Universal vaccines against allergy In this project we use our new vaccine platform to target physiological components associated with atopy, applying both an in-vitro experimental setting and an in-vivo model based on humanized transgenic mice.

Evaluating novel cellular sources for MHC-I binding peptides It is becoming increasingly clear that most peptides that are actually presented by the cell MHC-I makeup derive from different forms of short-lived polypeptide products, rather than from the native turnover of the 'old' cellular proteins. We are exploring protein products generated through several cellular processes as potential sources for MHC-I binding peptides.

Studying peptide trimming at the ER Whether MHC-I molecules play an active role in the final N-terminal trimming of MHC-I-binding peptides at the ER is still an unresolved issue. In this study we are exploiting unique N-terminally extended peptide substrates which allow us to address this fundamental issue in MHC-I antigen processing and presentation pathway.

Developing a rapid and simple approach for the purification of MHC-I-peptide complexes Pinpointing actual antigenic peptides that are bound by the cell's MHC-I products is of key

importance, particularly regarding the identification of potentially useful tumor-associated peptides. We have recently developed a novel mRNA-based methodology for facilitating the isolation of selected MHC-I molecules, which avoids the use of detergent, requires a relatively small number of cells and only a minimal culturing period and yields high quality results.

Dr. Sebastian Kadener

1) Molecular and neural bases of circadian rhythms in *Drosophila*.
2) Role of miRNAs in the regulation of behavior in *Drosophila*.
3) Study of neurodegeneration using *Drosophila* models.
4) Development of the circadian clock in mouse embryonic stem cells.

Prof. Aaron Kaplan

In general, research in my laboratory focus on the mechanisms which drive ecological processes with emphasize on photosynthetic microorganisms. During the last 5 years, topics of biotechnological importance include:

1. Biotic interactions that determine the composition of phytoplankton population in fresh-water lakes.
2. The mechanism and control of photorespiration in cyanobacteria.
3. Regulation between photoautotrophic and photomixotrophic growth in cyanobacteria.
4. Acclimation of diatoms to changing light intensity and carbon metabolism.
5. Structure and coordination within the cyanobacterial cell.
6. Resistance to photoinhibition in biological sand crust organisms.
7. The biological role of cyanobacterial toxins and control of toxic cyanobacterial blooms

Prof. Michal Linial

1. Cell biological aspects of secretion with a focus on neurotransmitter release and insulin release in the pancreas and molecular screening for coping with stress.
2. Experimental proteomics – limitation and benefit of mass spectrometry based analyses.
3. Proteomics and Genomics approaches in the study of diseases and behavior with a focus on ageing disease and translation regulation.
4. Bioinformatics –developing large-scale studies for biological sequences and their global organization, tool development.
5. Systems biology, specifically view of toxins and short peptides in modulation receptors in neuronal and immune systems.
6. Fat cells as a gate for the cellular events related to weight control - in vivo and in vitro physiology.

Prof. Aharon Oren

1. Adaptation of microorganisms to life at high salt concentrations.
2. Physiology, biochemistry, and taxonomy of halophilic microorganisms.
3. The microbial ecology of solar salterns.
4. The microbiology of the Dead Sea.
5. Prokaryote taxonomy and nomenclature.

Prof. Etana Padan

Molecular and structural biology of membrane proteins are for front subjects in modern biochemistry and biotechnology. Membrane proteins represent about 30 % of the proteome and have indispensable functions in all living cells; they are involved in energy storage and transduction, transport of solutes into the cell, export of toxic material from the cell and signal transduction across membranes, an essential process in cell communication and normal proliferation. Thus, about 60 % of the drug targets are membrane proteins and about half of these are transporters.

We study the membrane protein NhaA, Na^+/H^+ antiporter which plays primary role in pH and Na^+ homeostasis in enterobacteria and other bacteria and has human orthologues which have long been drug target. Our major recent breakthrough was the determination of the crystal structure of NhaA Na^+/H^+ antiporter providing novel insights into the mechanism of

activity and regulation of an antiporter and shedding new light on the general architecture of membrane proteins. In addition the structure opened new avenues of research that could not otherwise have been applied to transporters, namely crystal structure based experiments combined with computation. Using NhaA as a template we mopdeled model the human NHE1 and NHA2 antiporters. We are now studying the mechanism of antiport and its unique pH regulation, a property NhaA shares with many antiporters. Understanding how pH regulates membrane protein as well as other proteins is an important aim of biotechnology.

Prof. Hermona Soreq

Acetylcholine and cholinergic signaling control brain, muscle and blood cell functions, inflammation and aging. We develop and employ molecular-based approaches for exploring the mechanisms underlying this regulation.

We cloned, mapped, expressed and characterized the normal and mutated human cholinesterase genes and discovered their multiple alternative splicing products, protein partners and the micro-RNA genes which regulate their expression. We also discovered stress-induced changes in neuronal cholinergic gene expression, mRNA translocation into neuronal processes, cognitive deterioration and anxiety reactions, and demonstrated expression differences in the cholinesterase genes acetyl- and butyrylcholinesterase (AChE, BChE) which associate with risks for Parkinson's and Alzheimer's diseases, and both the BChE and AChE-R proteins suppress Alzheimer's disease pathologies, while the synaptic splice variant AChE-S promotes these pathologies.

Cholinergic stress responses change neuronal gene expression; disrupt the blood-brain barrier, translocate mRNA into neuronal processes and enhance cognitive deterioration, exacerbating anxiety reactions. Mutated and alternatively spliced cholinesterase variants associate with risks for disease and their protein partners and the micro-RNAs regulating their expression all affect these phenotypes, inducing hyper-proliferation or suppressing or enhancing amyloid pathologies.

Pre-mRNA processing (and especially alternative splicing) is vulnerable to changes under stress and both inherited and acquired nervous system defects. We employ High-throughput microarrays, power sequencing and advanced bioinformatics to construct gene networks and identify candidate regulator genes and microRNAs for these events. We validate the involvement of these genes in body-to-brain signaling and disease susceptibility using lentivirus- or oligonucleotide treated cells and live transgenic disease model mice.

Prof. Itamar Willner

Bioelectronics. Electrical contacting of redox proteins with electrodes. Electronic transduction of biological events, bioelectrocatalysis, biosensors related to enzyme sensors, immunosensors and DNA sensors. Transduction of recognition processes by means of amperometric, potentiometric, impedance, piezoelectric, field effect transistor and surface plasmon resonance signals. Application of the systems for the development of analytical, clinical, environmental and forensic diagnosis. Development of biofuel cells based on electrically-contacted enzyme electrodes.

Molecular electronics and molecular machinery. Integration of molecular assemblies with electronic transducers to yield unique electronic and sensoric functions such as molecular rectifiers, molecular diodes and specific recognition and binding functions. Design of

molecular shuttles, molecular beads and molecular rotors. Integration of chemical assemblies with mechanical micro-elements to tailor microdevices and micro-robots. Development of "smart" signal-triggered matrices exhibiting controlled wettabilities.

Nanoparticle superstructures on surfaces. Development of methodologies for the assembly of layered three-dimensional nanoparticle-molecular crosslinked arrays onto electrodes, and their use for the selective electrochemical sensing, photoelectrochemistry and electrocatalysis. Application of molecular receptors, oligonucleotide-DNA, donor-acceptors and host-guest complexes as crosslinking elements. Design of nanoparticle-polymer hybrid systems with tailored electronic properties and their application for selective sensing.

Nanobiotechnology. Biomolecule-nanoparticle (metal, semiconductor or magnetic) hybrid systems are synthesized. The effects of metal nanoparticles on the electronic properties of biomolecules, and the photonic activation of biomolecules are investigated. Metal nanoparticles and semiconductor quantum dots are used to follow bioprocesses such as biocatalytic transformations, DNA and immuno-recognition processes. Nanoparticles are used as electrical or optical amplifying labels for biorecognition events. Nanoparticle-biomolecule hybrids are used as templates for the preparation of metallic nanowires and the fabrication of nanodevices. Nanoparticle-enzyme hybrid systems are employed as "catalytic inks" for the synthesis of metallic, polymer, or semiconductor nanowires.

Nanotechnology. Nanoparticles or carbon nanotubes are integrated with polymer matrices to design hybrid materials of tailored electronic, optical and catalytic processes. The hybrid materials are employed as specific sensor matrices, artificial muscles, and "smart" signal-triggered materials.

Nanometric design and characterization of nanostructures on surfaces using atomic force microscopy (AFM). Nanopatterns are generated on surfaces by electrochemical, photochemical, or biocatalytic means using the chemically-modified AFM tips as the patterning tool. The generated patterns act as domains for the chemical assembly of nanostructures for electronic, sensor, and device applications. Besides the normal applications of AFM to characterize nanostructures, chemically-modified tips are used to follow inter-molecular interactions and recognition events.

DNA-Machines and Protein-Machines for biosensing. DNA-based systems that duplicate functions of machines (scission, replication, ligation) are designed. The machines are activated by a recognition event and fueled by biomolecular substrates. The autonomous operation of the machines yields waste products that provide a readout signal for the recognition events. The paradigm of DNA machines intends to substitute the PCR process. The DNA machines analyze nucleic acids, and aptamer-based machines detect proteins or low molecular weight substrates. Protein machines that involve the autonomous evolution of biocatalysts are employed as amplifying paths for the formation of antigen-antibody complexes.

Physical and chemical characterization of the structures and functions of monolayer and thin-film assemblies. Application of different techniques including electrochemical, impedance, microgravimetric quartz-crystal-microbalance, FTIR, ellipsometry, surface plasmon resonance, XPS, AFM/STM, etc., for the characterization of the structure, composition and function of thin-film interfaces.

Molecular optoelectronic and optobioelectronics. Designing of molecular photoswitches, electronic and photonic transduction of photoswitchable chemical functionalities.

Photoswitching of biological functions such as biocatalytic transformation of binding interactions. Photochemical switching of molecular redox functions and magnetic functions. Application of the systems for light-induced molecular and biomolecular patterning of surfaces. Use of the photoactive molecular or biomolecular assemblies as information storage systems, capable of photonic recording and electronic transduction.

DNA-based electronic and photonic systems. Photonic and electronic DNA-sensors. Electronic transduction and amplification of DNA-sensing by electrochemical means (amperometric, impedance, FET), microgravimetric quartz-crystal-microbalance. Photoelectrochemical transduction of oligonucleotide-DNA interactions. Photonic transduction of DNA-sensing using photoactive vesicle-fusion, surface plasmon resonance, fluorescence methods.

Nanoengineering of monolayers and thin-films with recognition functions. Molecular recognition sites are imprinted in monolayer and thin films associated with interfaces by novel chemical and photochemical means. The functionalized interfaces revealing stereoselectivity, chirospecificity and structural selectivities are employed for developing sensoric, photoelectrochemical, catalytic and photocatalytic processes.

Photoinduced electron transfer and artificial photosynthesis. Photochemistry in organized media and microheterogeneous environments. Photochemical transformations in supramolecular assemblies. Vectorial electron transfer and photochemical switches. Biomimetic photosynthetic transformations and artificial photosynthesis, CO_2-fixation, photolysis of water, nitrogen fixation. Semisynthetic photoenzymes, photoinduced electron transfer in proteins. Understanding fundamental processes of electron transfer.

Molecular and biomolecular engineering of surfaces. Microstructuring of surfaces with molecular or biomolecular micro- and nano-scale patterns using photolithography or contact-stamping techniques. Patterning of surfaces with photoactive or photoswitchable functions, catalytic elements or biocatalysts. Application of the molecular micropatterns as active elements for the three-dimensional structuring of surfaces with conductive wires or insulating wires. Imaging and characterization of the systems by scanning microscopy techniques.

Environmental photocatalysis. Photochemical degradation of organic and inorganic pollutants, surface modification of semiconductors for environmental photocatalysis. Mechanistic studies in the catalytic photooxidation of organic materials in the gas and solution phases.

Prof. Shimshon Belkin

- Molecular microbial ecology, with a focus on extreme environments
- Water quality and innovative approaches to water quality monitoring
- Whole cell biosensors: genetically engineered microorganisms as sensors of environmental stress and their incorporation into diverse hardware platforms

B. Faculty of Medicine

Prof. Eithan Galun

Unfolding the role of IL6 signaling and trans-signaling in tissue regeneration. This investigation is performed under the academic leadership of Dr. Jonathan Axelrod. We have shown that IL6 trans-signaling is essential for salivary gland and kidney regeneration. We are

currently investigating the role of IL6 trans-signaling in preventing cardiomyocyte apoptosis and inducing heart regeneration.

The role of inflammation in hepatocellular carcinoma (HCC) development. The groups of Prof. Amnon Peled and Dr. Daniel Goldenberg are investigating the roles of innate immune factors in HCC development. We have shown the importance of Galactin 1 and CCR5 in primary liver tumor development. This was done by generating new genetically manipulated mice. The role of IL6 in HCC was recently uncovered through a collaborative effort with Jonathan Axelrod. Ablating IL6 prevents tumor progression in an inflammation-mediated HCC (the MDR2 KO mice).

Novel gene therapy delivery systems. Having access to an efficient, simple and reproducible gene delivery system would be a major breakthrough to gene therapy researchers. At our institute, we have developed a novel gene delivery system using laser-based gene targeting/delivery. We have proved this in the muscle and skin. Recently we have shown that using this novel femtosecond ultrafast infrared laser system, we could deliver efficiently expression vector to the retina and reverse retinal blindness by transducing cells with expression plasmids of mutated and non-expressed proteins.

We also use the FIV lentivector for neonatal gene therapy. We have shown that we could reverse the glycogen storage disease type Ia phenotype with a FIV – lentivector expressing the G6Pase gene. We are currently further exploring the usage of this vector.

MicroRNA biology. We investigate the expression of microRNA122 in the liver and its biological significance in vitro and in animals. We also investigate the importance of microRNAs*. The H19 non-coding RNA is the precursor of mir675. We investigate this microRNA as part of our interest of the oncogenic role of H19 in HCC development.

Prof. Stella Mitrani-Rosenbaum

Muscle function: Characterization of the effects of the mutated GNE gene in the pathophysiology of muscle tissue. Hereditary Inclusion Body Myopathy (HIBM) or GNE myopathy, is a unique group of neuromuscular disorders characterized by adult-onset, slowly progressive distal and proximal muscle weakness, and typical muscle pathology, including rimmed vacuoles and filamentous inclusions. This disease is the most common form of ethnic-related familial degenerative myopathy, with a prevalence of 1:1500 in the Jewish Iranian community. The identification in our laboratory of GNE as the gene causing HIBM, a form of myopathy till then considered almost exclusively as a Middle Eastern Jewish disease, allowed the recognition of that same disorder worldwide and a new classification of this group of diseases. UDP-N-acetylglucosamine2-epimerase/ N-acetylmannosamine kinase (GNE) is a bifunctional enzyme which plays a key role in the biosynthetic pathway of sialic acid. Because of its terminal position on macromolecules and on cell membranes, sialic acid is an essential molecule involved in many biological and pathological processes. Our research is now aimed towards the understanding of the biochemistry and biology of GNE in non affected muscle, and subsequently in HIBM muscle tissue, by investigating different biochemical and biological aspects of the GNE activity in muscle tissue and cell cultures. Knock in mice carrying the most frequent mutation in GNE have been established and zebrafish models are being evaluated. Simultaneously we are investigating the potential partners of GNE in muscle cells by mass spectrometry, and microchip technology**.** We anticipate that these in vitro and in vivo systems specifically designed for a genomic and

proteomic approach will provide us with the necessary tools to unravel the mechanisms of GNE protein in normal muscle tissue and possible steps for the eventual correction of the mutation effect in HIBM. In addition we are now involved in AAV mediated gene therapy for GNE myopathy.

Molecular markers for the detection of breast and colon cancer micrometastases in axillary lymph nodes Micrometastases in axillary lymph nodes have been detected by serial sectioning and immunohistochemistry., and shown to have prognostic significance. When compared to node-negative disease, the presence of even a single micrometastasis in a lymph node, is associated with a significant difference in recurrence and survival, and therefore will determine the nature of the treatment to follow. In collaboration with Dr Aviram Nissan, we are developing assays for an increased rate of detection of tumor involvement within an excised node, by the measurement of differentially expressed gene transcripts and microRNAs, using a Real Time PCR amplification methods.

Congenital Muscular Dystrophies: **Genetic classification** Lately a relatively important number of genes have been associated to various types of congenital muscular dystrophies (CMD). We have established the basis for genetic diagnosis of the different types of CMD and occasionally search for the gene responsible of a novel entity occurring in single families. These studies are performed in collaboration with Prof Yoram Nevo, head of the Neuropediatric Unit at Mount Scopus.

Prof. Ariella Oppenheim

Development of somatic gene therapy We have developed a unique SV40 vector, based on its production through assembly of recombinant capsid proteins around plasmid DNA. The vector has a wide tropism to human organs and tissues and very low (to nill) immunogenicity. Its production in vitro from purified capsid proteins and DNA promises high quality medical product.

Development of treatment for acute kidney failure Our basic studies revealed that empty SV40 virus-like particle trigger signaling of survival pathway. We have applied this property to ameliorate kidney failure in animal models: Hg-insult in mice and cisplatin induced failure in mice and in rats. The results show dramatic effect on animal survival.

SV40 virus assembly We study the process of assembly on SV40 capsid proteins from biochemical, biophysical and physical perspectives, including small angle X-ray scattering. These basic studies are aimed at producing SV40 nanoparticles of various sizes and properties for a wide spectrum of potential applications.

SV40 cell entry As part of the development of SV40 for medical applications we need to understand which pathways they induce in the infected host. We have found that both the wild type virus and empty particles induces robustly balanced signaling network that includes apoptotic, survival and stress pathways.

Dr. Jacob Rachmilewitz

Our lab is studying the interaction between immune cells and their cellular microenvironment. Specifically we are studying the way the surrounding cells regulate immune responses and maintain tolerance, under normal healthy conditions.

We further study mechanisms by which immune cells sense stress and novel mechanism by which these cells promote the recovery of stressed cells, thus maintain tissue integrity.

Dr. Stefan Rokem

- Production of metabolites by bacteria and fungi
- Hydrocarbon formation by actinobacteria
- Modeling of metabolic networks based on genomics (In collaboration with Prof. J. Nielsen)
- Treatment of sewage with toxic chemicals (in collaboration with Prof. C.L. Greenblatt)

C. Faculty of Agriculture

Prof. Nor Chejanovsky

My research group focuses on the biology of insect viruses, with the emphasis on baculoviruses and most recently in honeybee viruses.

Baculoviruses: we are interested in the determinants of their host range and the improvement of their insecticidal activity against Lepidopteran insects. To achieve our aims we take advantage of molecular tools and *in vitro* cell culture systems that allow to genetically modify the viruses introducing reporter genes and insecticidal genes. Moreover, we are interested in the anti-viral immune response of insects permissive and non-permissive to baculoviruses. We study this aspect by using a combination of the above and other molecular tools and insect bioassays.

Bee viruses: Honeybees (*Apis mellifera*) play an important role in the global economy and agriculture, in balancing the environment pollinating many plant species, including a wide variety of crops, and producing honey, beeswax, propolis and other hive products. Since 2006 it became clear that the honebee population is suffering an alarming decline. Our goals are to understand the bee viruses infectious cycles, their pathogenicity to the honey bee [focusing on IAPV and Deformed Wing Virus (DWV)], and its relevance to colony losses world wide, including CCD (Colony Collapse Disorder) using a combination of molecular tools, in vitro cell culture bioassays and advanced genomic and bioinformatics technologies. Moreover, our aim is to develop an *in vitro* cell culture system susceptible to infection by honey bee viruses that will enable to make rapid progress in studying the molecular basis of virus pathogenicity. Achievement this aim is hampered by the unavailability of honey bee cell lines to study bee virus infections. By achieving our goals we will develop useful tools to understand the biology of IAPV and DWV, the basis of their pathogenicity to honey bees by providing cloned viral stocks, enabling reverse-genetic approaches and protein tagging, and future design of tools to control these and other honey bee viruses.

Dr. Nir Dai

Strawberry fruit quality - In collaboration with Dr. Ephraim Lewinsohn (Neve- Yaar) and Prof. Michael Aviram (Technion Institute) we have screened our strawberry germplasm collection for fruit compounds, including sugars, organic acids, vitamins, flavenoids, polyphenols and aromatic volatile during two sequential years. In this study we are also studying the effects of environmental factors on their accumulation and evaluate strawberry fruit potential preventing LDL Oxidation when added to human diet. Dependent on parent combination in exclusive breeding program, we aim to elevate specific beneficial phytochemical or volatile compound in a new cultivar.

Strawberry flowering regulation – Recently, we identified a strawberry T-DNA mutant line which affects the balance between vegetative runner and flower initiation. Using this mutant

we aim to study the process of strawberry flowering regulation that yet needs to be revealed.

Strawberry powdery mildew - Powdery mildew (PM) of strawberry caused by the obligate parasite *Podosphaera aphanis* is one of the major fungal diseases of this crop worldwide. Strawberry PM genetic resistance is one of the research goals in my lab, and probably the efficient way to reduce the negative economic impact of this disease and the need for fungicide application.

Developing an efficient transformation procedure for several strawberry cultivars - we succeeded to develop a simple transformation procedure for the strawberry cultivars: Malach, Hadas and Barak. This transformation is being utilized in my lab as an important tool in strawberry molecular studies.

Strawberry cultivar identification - we developed a set of CAPS DNA markers, which enable to distinguish among all the commercial cultivars grown in Israel.

Establishment of National strawberry stock collection - This strawberry stock serves as genetic basis for the ARO's breeding program, backup source of all the commercial cultivars for the authorized nurseries and sources for genetic research of diverse strawberry types.

The National ARO's strawberry breeding program - From 2003, we have renewed the ARO breeding program which aims to develop early yielding cultivars bearing premium quality fruits with high shelf life suited for local and European markets. The breeding program is partially financed by the Plants Production and Marketing Board, Vegetable division, Strawberry section. This activity has proved to be relevant to the Israeli strawberry growers and yielded so far 4 commercial cultivars named Tamir, Barak, Yasmin and Shani.

Dr. Dani Eshel

1. Molecular aspects of dormancy release and apical bud dominance in potato tuber
2. Caspase like proteins and programmed cell death in plant bud meristem
3. Alternative methods to inhibit sprouting of stored potatoes and onions
4. Prolonging storage and increasing quality of potato, sweet potato, carrot and onion
5. Combining control treatments with biological control to synergistically improve postharvest disease control

Dr. Yoram Eyal

Chlorophyll catabolism – developing insights into the role and regulation of pathway enzymes.

Flavonoid biosynthesis – emphasis on studying flavonoid modification enzymes, in particular glycosyltransferases (GTs) that affect physico-chemical characteristics of flavonoids. Developing insights regarding GT function and specificity and utilizing GTs for metabolic engineering.

Isoprenoid biosynthesis – emphasis on developing insights into regulation of flux and compartmentalization of the isoprenoid biosynthetic pathways, and potential applications in metabolic engineering.

Prof. Edouard Jurkevitch

Predatory bacteria Predation is an important ecological force for all life forms, including prokaryotes. Bacteria that prey upon other bacteria are ubiquitous in the environment.

They exhibit a variety of hunting strategies, belong to many taxa and widely differ in morphological, physiological and molecular features. Among these predators, *Bdellovibrio* and like organisms (BALOs) are obligate predatory bacteria of gram negative cells. Their life cycle is fascinating: small, highly motile cells attach to and usually penetrate prey cells. They then engage in growth and replication at the expense of the prey's contents, yielding progeny cells that lyze the remains of the consumed host cell. The lab investigates; the ecology and phylogeny of BALOs, to understand the role they may have in nature and in man-made habitats on the mortality and functioning of bacterial populations, and; the cell biology of the predators, to understand what renders a bacterial cell predatory.

Microbiology of fruit flies It is commonly though of multicellular organisms as biological units, or as populations composed of individuals. However, most (if not all) bear associated bacterial communities that perform functions essential for their well being – or in other terms functions that may impact upon their fitness. Insects are practical models to study such interactions as they are small, numerous and may sustain less complex bacterial communities than larger organisms. Moreover, certain insects, like *Ceratitis capitata*, the Mediterranean fruit fly and *Bactrocera olea*, the olive fly, are important pests. The medfly is ubiquitous, and as its larva grows within fruits, it causes major damage to the fruit industry. *Bactrocera olea* causes extensive damage to olive production. The laboratory has a close collaboration with that of Boaz Yuval from the Department of Entomology at the Faculty, and together, we are investigating the structure, the functions and the impact of the medfly's gut bacterial populations on the fitness of these insects, and ways to apply these associated microbitotas to combat these pests.

Forensic analysis of soils with microbial populations The diversity of microorganisms in soils is tremendous. Knowledge about this diversity is rapidly increasing, mostly due to the application of molecular principles, the development of high throughput technologies and of bioinformatic tools for the treatment of large-scale data sets. An implication of these advances is that it may be possible to develop protocols to use microbial population profiles to characterize soils and correlate between them. Possible applications include ecological studies (e.g. population distribution), agricultural manipulations (e.g. the impact of waste/reclaimed water) and, importantly forensic uses (e.g. matching locations using soil samples in criminal investigations).

Prof. Rina Meidan

Angiogenesis – the ovary as a model for angiogenic control. The corpus luteum is a highly vascular gland; the short period of extensive angiogenesis in the CL results in development of an elaborate network of capillaries that endows this gland with one of the highest blood flow per unit mass in the body. Furthermore, the CL undergoes dynamic changes in its vasculature; the angiogenesis in the developing CL is later followed by either controlled regression of the microvascular tree in the non-fertile cycle during Prostaglandin F 2a (PG) – induced luteolysis. Therefore, factors affecting vascular fate are likely to play a major role in regulating luteal function. We showed that quite a few of the novel PG-regulated genes we have found are involved in angiogenesis (being pro or antiangiogenic). For instance we found elevated expression of the proangiogenic growth factor, FGF2 following PG injection in PG-refractory, day-4 CL. In contrast, PG administration to d 11 CL resulted elevated expression of antiangiogenic thrombospondins and PTX3. These observations indicate that the balance

between pro- and anti-angiogenic responses to PG could be decisive whether or not PG administration results in luteolysis.

Roles of endothelin-2 (EDN2) in ovarian physiology. Our working hypothesis is that EDN2 plays a key role in CL formation. Induced by LH and hypoxia, EDN2 promotes luteal cell survival and angiogenesis. Therefore, knockdown of the peptide will impair the normal process of luteinization. We further hypothesize that besides cell survival and induction of proangiogenic factors, EDN2 impinges on other genes that take part in the development of a fully functional CL.

Prof. Naomi Ori

My research group studies shoot apical meristem, leaf and fruit development in Arabidopsis, tomato, and occasionally other species. Specifically we are dissecting the mechanism that controls the rate of maturation and the balance between indeterminate and determinate growth, which we have discovered as a key aspect in the control of plant and leaf architecture. We are using developmental genetics to identify genes involved in this pathway, and potentially use them to affect plant architecture and fruit development. We are studying the interaction between transcription factors and plant hormones such as cytokinin, giberrelin and auxin in these processes.

Prof. Dov Prusky's

My research focuses on the basis of resistance and susceptibility of fruits and vegetables to postharvest disease as a universal model system for understanding the mechanism of pathogen attack and host spoilage of fruit and vegetables. The questions that I handle is what is the mechanism of host/pathogen regulation of the activation of fungal infections I have published a total of 135 reviewed articles in leading international scientific journal. In my studies, I pioneered the discovery of the mechanism of pathogen quiescence in resistant fruits to postharvest pathogens and identified first the chemical basis for fruit resistance of unripe fruits compared to ripe susceptible fruits. At the same time our lab developed a new pioneering understanding of the mechanistic process leading to the activation of quiescent infection. This simple, universal mechanism leading to the activation of pathogen attack of unripe fruit and vegetables included the modulation of metabolic processes of the fungus directed to change the host environment as way for signaling the expression of pathogenicity process. These leading publications have been cited and to this day they have become the basis for books descriptions of the mechanism of fruit resistance to fungal attack.

My studies on the mechanism of host pH environment regulation, lead to the discovery that pathogens activate metabolic pathways involved in the secretion of simple molecules that modulate the host pH environment and became key signals for activation of pathogenicity factors. Our lab identified for the first time the capability of pathogens to secreted ammonia and organic acids as gluconic for modulating the host pH environment. The ammonia secreted was found to i. modulate the host pH around the infection point, ii. to activate the transcript activation of pathogenicity factors and to iii. Induce host cell leakage, ROS production and cell death resulting in the enhanced transformation of quiescent to active infection in ripening fruits. My laboratory demonstrated as well that the activation of

pathogenicity factors follow the activation of the transcription factor pacC by the alkaline conditions induced during ammonia secretion. Having indentified the fungal factors that modulate gene expression, I analyzed the effect of ammonia on host response. Also in this relation we identified the effect of ammonia on ROS production and cell death as a pre-ambul for necrotrophic development of the pathogen.

However not all the pathogens modulate the host environment by alkalinization. Some of them modulate the host environment by acidification including the secretion of organic acids as gluconic acid. *Penicillium expansum* reduced the host pH in the diseased region by secretion of organic acids. Acid pH activates as well the expression of pathogenicity factors organic acids followed by fungal attack.

The present factors indicate simple processes that activate the secretion of acid or alkaline inducing effectors that modulate pathogenicity factors as well as fungal resistance.

Prof. Alexander Vainstein

1. Genomic/metabolomic/proteomic approaches for identification of novel (regulatory and biosynthetic) aroma genes
2. Metabolic engineering of plants and yeast
3. Site-specific genome modification and genetic engineering in plants

Prof. David Weiss

O-GlcNAc protein modifications- Addition of *O*-GlcNAc to Ser and Thr residues by OGTs regulates the post-translational fate and function of target proteins. The Arabidopsis OGT, **SPY**, regulates hormone activities it suppresses **gibberellin** signaling and promotes **cytokinin** responses. Our goal is to elucidate the mechanism by which SPY regulates hormone responses.

Gibberellin signal transduction- The current model suggests that SPY promotes the activity of the DELLA proteins in the nucleus to suppress gibberellin responses. We found that SPY acts in the cytosol. We are studying if a cytosolic gibberellin signaling pathway exists.

GAST-like proteins and gibberellin responses- The gibberellin regulated ***GAST1***-like genes code for small proteins with a conserved cysteine-rich domain. Our results suggest that gibberellin regulates these genes, and the encoded proteins are used to translate the gibberellin signal by regulating the redox status of specific targets.

Gibberellin and osmotic stress - We found that reducing the levels of active gibberellins in tomato, by chemical treatments or genetic manipulations, increased the tomato plants' resistance to **drought**. Our goal is to reveal the mechanism by which gibberellin affect plant response to osmotic stress.

Prof. Oded Yarden

The major focus of research in the Yarden lab is the study of molecular mechanisms involved in fungal growth and development. We are currently focusing on the study of cell wall biosynthesis and on involvement of protein phosphorylation in the regulation of hyphal elongation and branching. More recently, we have been studying fungi in their natural environment (including soil and in association with plants and sessile marine animals) and their interactions with other species. We are taking advantage of genetic and biochemical tools developed for such studies, in different fungi, in order to advance our knowledge of fungal biology. We hope that a better understanding of such processes, some of which are

unique to fungi, may provide a basis for designing rational approaches to either affect fungal proliferation or enhance specific traits of fungi used in biotechnology.

4.7 Lists of publications, last 5 years

A. Faculty of Science

Prof. Guy Bloch

Peer-reviewed articles:

1. **Bloch, G**., Shemesh, Y., and Robinson, G. E. (2006) Seasonal and task-related variation in free running activity rhythms in honey bees (*Apis mellifera*). *Insectes Sociaux* 53: 115–118.
2. Yerushalmi, S., Bodenhaimer, S., **Bloch, G**. (2006) Developmentally-determined attenuation in circadian rhythms links chronobiology to social organization in bees. *The Journal of Experimental Biology* 209: 1044-1051.
3. Rubin, R., Shemesh, Y., Cohen, M., Elgavish, S. Robertson, H. M., **Bloch, G**. (2006) Molecular and phylogenetic analyses reveal mammalian-like clockwork in the honey bee *(Apis mellifera*) and shed new light on the molecular evolution of the circadian clock. *Genome Research* 16:1352-1365.
4. The Honey Bee Genome Sequencing Consortium (authors from my group: Rubin, E., Shemesh, Y., Cohen, M., **Bloch, G**.) (2006). Insights into social insects from the genome of the honey bee *Apis mellifera*. *Nature* 443: 931-949. (featured several time in *Nature* top ten - a list of the ten articles most frequently downloaded from the *Nature* website).
5. **Bloch, G**., Meshi A. (2007) Influences of octopamine and juvenile hormone on locomotor behavior and *period* gene expression in the honey bee, *Apis mellifera*. *The Journal of Comparative Physiology – A* 193: 181-199.
6. Shemesh, Y., Cohen, M., **Bloch, G**. (2007) Natural plasticity in circadian rhythms is mediated by reorganization in the molecular clockwork in honeybees. *The FASEB Journal* 21: 2304-2311.
7. Meshi A., **Bloch, G**. (2007) Monitoring circadian rhythms of individual honey bees in a social environment reveal social influences on post-embryonic ontogeny of activity rhythms. *Journal of Biological Rhythms* 22: 343-355.
8. Hagai, T., Cohen, M., **Bloch, G**. (2007) Genes encoding putative Takeout/ juvenile hormone binding proteins in the honeybee (*Apis mellifera*) and modulation by age and juvenile hormone of the Takeout-like gene *GB19811*. *Insect Biochemistry and Molecular Biology* 37: 689-701.
9. Troen, H., Dubrovsky, I., Tamir, R., **Bloch, G**. (2008) Temporal variation in group aggressiveness of honeybee (*Apis mellifera*) guards. *Apidologie* 39: 283-291.
10. Eban-Rothschild, A. D., Bloch, G. (2008) Differences in the sleep architecture of forager and young honeybees (*Apis mellifera*). *Journal of Experimental Biology* 211:2408-2416.
11. Weiss, R., Dov, A., Fahrbach, S. E., **Bloch, G**. (2009) Size-related variation in Pigment Dispersing Factor-immunoreactivity in the brain of the bumble bee *Bombus terrestris* (Hymenoptera, Apidae). *Journal of Insect Physiology* 55:479-487.
12. Shpigler, H., Patch, H. M., Cohen, M., Fan, Y., Grozinger, C. M., **Bloch, G**. (2010) The transcription factor *Krüppel homolog 1* is linked to hormone mediated social organization in bees. *BMC Evolutionary Biology* 10:120.

13. **Bloch G.,** Francoy , T. M., Wachtel, I., Panitz-Cohen, N., Fuchs, F., Mazar, A. (2010) Industrial apiculture in the Jordan valley during Biblical times with Anatolian honey bees. *Proceedings of the National Academy of Sciences USA* 107: 11240-11244.

14. **Bloch G.** (2010) The social clock of the honeybee. *Journal of Biological Rhythms*, 25: 307-317

15. Shemesh, Y., Eban-Rothschild, A. D., Cohen, M., **Bloch, G.** (2010) Molecular dynamics and social regulation of context-dependent plasticity in the circadian clockwork of the honey bee. *The Journal of Neuroscience* 30(37):12517-12525; doi:10.1523/JNEUROSCI.1490-10.2010.

16. **Bloch, G.** and Grozinger C. M. (2011) Social pathways, their origins, and modifications along the evolution of sociality in bees. *Philosophical Transactions of the Royal Society B* 366: 1574 2155-2170; doi: 10.1098/rstb.2010.0346.

17. Eban-Rothschild, A. D., Belluci, S., **Bloch, G.** (2011) Maternity-related plasticity in circadian rhythms of bumble bee queens. *Proceedings of the Royal Society of London B*. (in press)

Book chapters

1. **Bloch, G.** (2009) Socially mediated plasticity in the circadian clock of social insects. Chapter 18. pp. 402 – 431, *In Organization of Insect Societies - From Genome to sociocomplexity* (Gadau, J. and Fewell, J. Ed.). Harvard University Press (*invited review*, peer reviewed).
2. **Bloch, G.**, Shpigler, H., Wheeler, D. E., and Robinson, G. E. (2009) Endocrine influences on the organization of insect societies. Volume II. Non-Mammalian Hormone-Behavior Systems, Non-Mammalian Invertebrates, chapter 30, pp. 1027-1068 in *Hormones, Brain and Behavior* (Pfaff, D., Arnold, A., Etgen, A., Fahrbach, S. E., and Rubin, R. Eds.) Elsevier Inc., second edition *(invited review*).
3. Eban-Rothschild, A. D., **Bloch, G.** (2011) Social influences on sleep and circadian rhythms in bees. Invited chapter for a book entitled "*The Neurobiology and Behavior of Honeybees*" (Editors Giurfa, M.and.Galizia, G.)*(invited review, peer reviewed, in press).*

Book written/edited:

Bloch G., and Green R. (2011) Review for the book *Photoperiodism: The Biological Calendar* Edited by Randy J. Nelson, David L. Denlinger, and David E. Somers. Oxford and New York: Oxford University Press. The Quarterly Review of Biology, 86 (1): 39-40 (*invited contribution, Guy Bloch*) DOI: 10.1086/658417

Dr. Uri Gat

Peer-reviewed articles:

1. Ittah, S.**,** Cohen, S., Garty, S., Cohn, D. and **Gat, U**[*]. (2006) An Essential Role for the C-terminal Domain of a Dragline Spider Silk Protein in Directing Fiber Formation. **Biomacromolecules**, *7*, 1790-1795**.**
2. Raveh, E, Cohen, S**.**, Levanon, D., Negreanu, V., Groner, Y. and **Gat, U**[*]. (2006)
3. Runx1 is dynamically expressed in skin and its appendages and affects hair structure. **Mechanisms of Development**, *123*, 842-850.
4. Ittah, S.**,** Michaeli, A., Goldblum, A. and **Gat, U**.[*] (2007) A Model for the Structure of the C-terminal Domain of a Dragline Spider Silk and the Role of its Conserved Cysteine. **Biomacromolecules**, *8*, 2768-2773.

5. 4. Gilon, M., Sher, N., Cohen, S. and **Gat, U.*** (2008) Transcriptional activation of a subset of hair keratin genes by the NFκB effector p65/RelA. **Differentiation**, *76*, 518-530.
6. Ortt, K., Raveh, E., **Gat, U**. and Sinha, S. (2008) Runx1 is a direct transcriptional target of ΔN-p63. **Journal of Cellular Biochemistry**. *104*, 1204-19
7. Sullivan, J.C., Sher, D., Eisenstein, M., Shigesada, K., Reitzel, A.M, Heather, M., Levanon, D., Groner, Y., Finnerty, J. R. and Gat, U.* (2008) The evolutionary origin of the Runx/CBFbeta transcription factors – Studies of the most basal metazoans. **BMC Evolutionary Biology**, *8*, 228-248.
8. Ittah, S., Barak, N. and **Gat, U.** (2009) A proposed model for dragline spider silk self-assembly: Insights from the effect of the repetitive domain size on fiber properties. Biopolymers, *93*, 458-468.
9. Hilman, S. and **Gat, U.** (2011) The Evolutionary History of YAP and the Hippo/YAP Pathway. **Molecular Biology and Evolution**, *28*, 2403-17.

Patents:

1. **Gat, U**., Scheibel, T., Huemmerich, D. (2004) Spider Silk Protein as a Biomaterial: Recombinant Expression of Spider Silk in Insect Cells Using the Baculovirus System, *international patent application PCT-EP2005/006905*.
2. **Gat, U**., Barak, N., Ittah, S., (2008) Synthetic Dragline Spider Silk-Like Proteins. *US application no. 13/113,453*.

Prof. Gidi Gross

Peer-reviewed articles

1. Margalit, A., Migalovich Sheikhet, H., Carmi, Y., Berko, D., Tzehoval, E., Eisenbach, L. & **Gross, G.** (2006). Induction of anti-tumor immunity by CTL epitopes genetically linked to membrane- anchored β_2 microglobulin. J. Immunol. 176, 217-224.
2. **Gross, G.** & Margalit, A. (2007). Targeting tumor-associated antigens to the MHC class I presentation pathway. Endocrine, Metabolic & Immune Disorders - Drug Targets. 7, 99-109.
3. Scott, G. S., Fishman, S., Margalit, A., Siew L. K., Chapman, S., Wen, L., **Gross, G.** & Wong, F. S. (2008). Developing a novel model system to target insulin reactive CD8 T cells. Ann. N.Y. Acad. Sci. 1150, 54–58.
4. Meyuhas, R., Noy, H., Fishman, S., Margalit, A., Montefiori, D. C. & **Gross, G.** (2009). Enhanced HIV-1 neutralization by a CD4-VH3-IgG1 fusion protein. Biochem. Biophys. Res. Comm. 386, 402-406.
5. Scott, G. S., Fishman, S., Margalit, A., Siew L. K., Chapman, S., Chervonsky, A. V., Wen, L., **Gross, G**. & Wong, F. S. (2010) Immunotargeting of Insulin Reactive CD8 T Cells to Prevent Diabetes. J. Autoimm. 35, 390-397.
6. Cafri, G., Amram, E., Rinot, G., Koifman, G., Fishman, S., Keisari, Y. Tzehoval, E., Margalit, A., Eisenbach, L. & **Gross, G.** (2011). Coupling presentation of MHC class I peptides to constitutive activation of antigen-presenting cells through the product of a single gene. Int. Imm. 23, 453-461.

Dr. Sebastian Kadener

Peer-reviewed articles:

1. Belancortu Y., Weiss R., **Kadener S.**, and Paricio N. "Expression of *Drosophila* cabut during early embryogenesis, dorsal closure and nervous system development" **Gene Expr Patterns** 3-4: 190 (2011).
2. Bekenstein U. and **Kadener S.** "What can *Drosophila* teach us about iron-accumulation neurodegenerative disorders?" **J. Neural Trans** 118(3):389**.** (2011).
3. van der Linden AM, Beverly M., **Kadener S.**, Rodriguez J., Wasserman S., Rosbash M. and Sengupta P. "Genome-Wide Analysis of Light and Temperature-Entrained Circadian Transcripts in *C. elegans*". **PLoS Biology** 8(10):e10000503 (2010).
4. Fathallah-Shaykh H. M., Bona J. L., and **Kadener, S.** "Mathematical Model of the Drosophila Circadian Clock: Loop Regulation and Transcriptional Integration". ***Biophys J.*** 97(9): 2399 (2009). **Cover article. *Selected for Faculty of 1000** (Factor 8 Must read)
5. **Kadener S.**, Menet J., Sugino K., Horwich MD, Weissbein U., Nawathean P., Vagin V., Zamore P., Nelson S. and Rosbash M. "A role for miRNAs in the Drosophila circadian clock. ***Genes Dev.*** 23(8):2179 (2009).*Featured in ***Nature Rev. Neurosciences*** (Oct 2009).
6. **Kadener S.**, Rodriguez J., Abruzzi K. and Rosbash M. "Genome-wide identification of targets of the drosha-pasha/DGCR8 complex." ***RNA*** 15(4): 537 (2009).
7. **Kadener S.**, Schoer R., Menet J., Rosbash M. "Circadian transcription contributes to core period determination in Drosophila" ***PLOS Biology*** 6(5): 119 (2008). ***Selected for Faculty of 1000** (Factor 3 Recommended)
8. **Kadener S.**, Stoleru D, McDonald M, Nawathean P, Rosbash M. "Clockwork orange is a transcriptional repressor and a new Drosophila circadian pacemaker component" ***Genes Dev.*** 21:1675 (2007).
9. Rosbash M, Bradley S, **Kadener S**, Li Y, Luo W, Menet JS, Nagoshi E, Palm K, Schoer R, Shang Y, Tang CH. "Transcriptional feedback and definition of the circadian pacemaker in *Drosophila* and animals" ***Cold Spring Harb Symp Quant Biol.*** 72:75 (2007).
10. **Kadener S**, Villella A, Kula E, Palm K, Pyza E, Botas J, Hall JC, Rosbash M. "Neurotoxic protein expression reveals connections between the circadian clock and mating behavior in Drosophila". ***Proc Natl Acad Sci U S A.*** 103:13547 (2006). ***Selected for Faculty of 1000** (Factor 6 Must Read)
11. Lacadie SA, Tardiff DF, **Kadener S**, Rosbash M. "In vivo commitment to yeast cotranscriptional splicing is sensitive to transcription elongation mutants." ***Genes Dev.*** 20:2055 (2006). **Selected for Faculty of 1000** (Factor 3 Recommended).

Prof. Aaron Kaplan

1. Beresovsky D., O. Hadas, A. Livne, A. Sukenik, A. Kaplan and S. Carmeli (2006) Toxins and Biologically Active Secondary Metabolites of *Microcystis* sp. isolated from Lake Kinneret Israel J. Chem. 46: 79-87
2. Lieman-Hurwitz, J., Asipov, L., Rachmilevitch, S., Marcus, Y. and A. Kaplan (2006) Expression of cyanobacterial *ictB* in higher plants enhanced photosynthesis and growth. In:*Plant Responses to Air Pollution and Global Change Edited by K.Omasa,I.Nouchi,and L.J.De Kok* (Springer-Verlag, Tokyo)
3. Kahlon, S., Beeri, K., Ohkawa, H., Hihara, Y., Murik, O., Suzuki, I., Ogawa, T., and Kaplan, A. (2006) A putative sensor kinase, Hik31, is involved in the response of *Synechocystis* sp. strain PCC6803 to the presence of glucose. Microbiology 152: 647 – 655

4. Eisenhut,M., Hasse, D., Kahlon, S., Lieman-Hurwitz, J., Ogawa, T., Ruth, W., Kaplan, A. and Hagemann, M. (2006) The plant-type C2 glycolate pathway and the bacterial-like glycerate cycle cooperate in the metabolism of phosphoglycolate in cyanobacteria. Plant Physiol. 142: 333-342.
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6. Schatz, D., Keren, Y., Vardi, A., Sukenik, A., Carmeli, S., Börner, T., Dittmann E. and A. Kaplan (2007) Towards clarification of the biological role of microcystins, a family of cyanobacterial toxins Environm. Microbiol. 9: 965-970
7. Vardi, A., Eisenstadt, D., Murik, M., Berman-Frank, I., Zohary, T., Levine, A. and A. Kaplan (2007) Synchronization of cell death in a dinoflagellate population is mediated by an excreted thiol protease. Environ. Microbiol. 9: 360-369
8. Kaplan, A., Hagemann, M., Bauwe, H., Kahlon, S. and T. Ogawa (2008) Carbon acquisition by cyanobacteria: mechanisms, comparative genomics and evolution. In Flores ed. The Cyanobacteria: Molecular Biology, Genomics and Evolution, Horizon Press.
9. Shalev-Malul, G., Lieman-Hurwitz, J., Viner-Mozzini, Y., Sukenik, A., Gaathon, A., Lebendiker M. and A. Kaplan (2008) An AbrB-like protein might be involved in the regulation of cylindrospermopsin production by *Aphanizomenon ovalisporum*. Environm. Microbiol. 10:988-99
10. Kroth, P.G., Chiovitti, A., Martin-Jezequel, V., Mock, T., Schnitzler Parker, M., Stanley, M.S., Kaplan, A., Caron, L., Gruber, A., Weber, T., Maheswari, U., Armbrust. E.V. and Chris Bowler (2008) A model of the carbohydrate metabolism in the diatom *Phaeodactylum tricornutum* deduced from whole genome analysis. PLOS One 3(1): e1426. doi:10.1371/journal.pone.0001426
11. Eisenstadt, D., Ohad, I., Keren, N. and Kaplan, A. (2008) Changes in the photosynthetic reaction center II in the diatom *Phaeodactylum tricornutum* result in non-photochemical fluorescence quenching. Environm. Microbiol. 10: 1997-2007
12. Tchernov, D., Livne, A., Kaplan, A. and A. Sukenik (2008) The kinetic properties of ribulose-1,5-bisphosphate carboxylase/oxygenase may explain the high apparent photosynthetic affinity of *Nannochloropsis* sp. to ambient inorganic carbon. Isr. J. Plant Sci.56: 37-44
13. Bowler, C., Allen, A.E., Badger, J. H., ... Kaplan, A., et al., (2008) The *Phaeodactylum* genome reveals the dynamic nature and multi-lineage evolutionary history of diatom genomes. Nature 456: 239-244
14. Eisenhut, M., Ruth, W., Haimovich, M., Bauwe, H., Kaplan, A. and M. Hagemann (2008) The photorespiratory glycolate metabolism is essential for cyanobacteria and might have been conveyed endosymbiontically to plants. Proc. Natl. Acad. Sci. USA 44: 44: 17199-17204
15. Lieman-Hurwitz, J., Haimovich, M., Shalev-Malul, G., Ishii, A., Hihara, Y., Gaathon, A., Lebendiker, M. and A. Kaplan (2009) A cyanobacterial AbrB-like protein affects the apparent photosynthetic affinity for CO_2 by modulating low-CO_2-induced gene expression. Environm. Microbiol. 11: 927-936
16. Murik O. and A. Kaplan (2009) Paradoxically, prior acquisition of antioxidant activity enhances oxidative stress-induced cell death. Environm. Microbiol. 11: 2301-2309.

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23. Zilliges Y, Kehr JC, Meissner S, Ishida K, Mikkat S, et al. (2011) The cyanobacterial hepatotoxin microcystin binds to proteins andi ncreases the fitness of *Microcystis* under oxidative stress conditions. Plos One 6. e17615.
24. Haimovich-Dayan, M., Kahlon, S., Hihara, Y., Hagemann, M., Ogawa, T., Ohad, I., Lieman-Hurwitz, J. and A. Kaplan (2011) Cross-talk between photomixotrophic growth and CO_2 concentrating mechanism in *Synechocystis* sp. strain PCC 6803. Environm Microbiol 13: 1767-1777.

Prof. Michal Linial

1. Bahir, I., and **Linial, M.** (2006). Functional grouping based on signatures in protein termini. Proteins: Structure , Function and Bioinformatics **63,** 996-1004.
2. **Linial, M.** (2006). The secrets of a functional synapse - from a computational and experimental viewpoint. BMC Bioinformatics. **7** (l), S6.
3. Gibbs R.A., Weinstock, G.M (additional co-authors)…….Kaplan N , **Linial, M**. and the Honeybee consortium (2006) The genome of a highly social species, the honey bee Apis mellifera. Nature **443**, 931-949.
4. Portugaly E, Harel A, Linial N and **Linial M.** (2006) EVEREST: Automatic identification and classification of protein domains in all protein sequences. BMC Bioinformatics. **7,** 277 (23 pages).
5. Brachya, G., Yanay, C and **Linial. M**. (2006) Synaptic Proteins as Multi-sensor Devices of Neurotransmission. BMC Neuroscience **7,** S4.
6. Krispin A, Bledi Y, **Linial M.** and Mevorch D. (2006) Apoptotic cell thrombospondin 1 and heparin binding domain lead to dendritic cell phagocytotic and telorizing state. Blood, **108,** 3580-3589.
7. Kaplan, N. and **Linial, M**. (2007) ProtoBee: Classification and global annotation scheme for the honey bee genome. Genome Research **16,** 1431-1439.
8. Portugaly E, Linial N and **Linial M.** (2007) EVEREST: A collection of evolutionary conserved protein domains. Nucleic Acids research **35,** D241-246.

9. Bogoch Y, Biala YN, **Linial M,** Weinstock M. (2007) Anxiety induced by prenatal stress is associated with suppression of hippocampal genes involved in synaptic function. J Neurochem. **101,** 1018-1030.
10. Varshavsky, R. Fromer, M., Man, A. and **Linial, M**. (2007) When less is more: Improving classification of protein families with a minimal set of global features R. Giancarlo and S. Hannenhalli (Eds.): WABI 2007, LNBI **4645**, pp. 12–24. Springer-Verlag Berlin Heidelberg 2007.
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13. Inberg A, Bogoch Y, Bledi Y, **Linial M.** (2007) Cellular processes underlying maturation of P19 neurons: Changes in protein folding regimen and cytoskeleton organization. Proteomics. 7, 910-920.
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Prof. Ofer Mandelboim

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Patents:

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Prof. Stella Mitrani-Rosenbaum

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Prof. Ariella Oppenheim

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Dr. Jacob Rachmilewitz

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Dr. Stefan Rokem

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2. ISBN 978-1848267053 to 978-1848267190(2009).
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C. Faculty of Agriculture

Prof. Nor Chejanovsk

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Dr. Nir Dai

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Dr. Dani Eshel

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Dr. Yoram Eyal

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Prof. Edouard Jurkevitch

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22. Zeng L., Wang Z., **Vainstein A**., Chen S. and Ma H. (2011) Cloning, localization and expression analysis of a new tonoplast monosaccharide transporter from *Vitis vinifera* L. J. Plant Growth Regul. 30:199–212.

23. **Vainstein, A**., Marton, I., Zuker, A., Danziger, M and Tzfira, T. (2011) Permanent genome modifications in plant cells by transient viral vectors. Trends in Biotech. 29: 363-369
24. Spitzer-Rimon, B., Cna'ani, A. and **Vainstein, A.** (2011) Virus-aided gene expression and silencing using TRV for functional analysis of floral scent-related genes. Methods in Molecular Biology (in press)
25. Farhi, M., Marhevka, E., Masci, T., Marcos, E., Eyal, Y., Ovadis, M., Abeliovich, H. and **Vainstein, A**. (2011) Harnessing yeast subcellular compartments for the production of plant terpenoids. Metab Eng. (in press)

Patents:

1. Vainstein, A. (2006) Conferring resistance to plant pathogens. US Provisional Patent Application.
2. Moyal Ben Zvi, M and Vainstein A. (2007) Method for enhancing plant scent. US Provisional Patent Application.
3. Zuker A. and Vainstein A. (2008) Plant viral expression vectors and use of same for generating genotypic variations in plant genomes. US Provisional Patent Application.
4. Vainstein A. and Zuker A. (2009) Generating genotypic variations in plant genomes by direct gamete infection. US Provisional Patent Application.
5. Farhi, M., Markevka E. Abeliovich H. and Vainstein, A. (2009) Engineering *Saccharomyces Cerevisiae* for the production of terpenoids: mitochondrial subcellular localization of terpene synthases. US Provisional Patent Application.
6. Farhi, M., Markevka E. and Vainstein, A. (2011) Production of artemisinin in a non host plants: Engineering *Nicotiana tabacum* for biosynthesis of anti-malarial drug. US Provisional Patent Application.

Prof. David Weiss

Peer-reviewed articles:

1. Guterman I., Masci T., Chen X., Negre F., Pichersky E., Dudareva N., Weiss D. and Vainstein A. (2006) Generation of phenylpropanoid pathway-derived volatiles in transgenic plants: rose alcohol acetyltransferase produces phenylethyl acetate and benzyl acetate in petunia flowers. Plant Mol. Biol. 60: 555-563.
2. Farhi M., Dudareva N., Masci T., Weiss D., Vainstein A. and Abeliovich H. (2006) Synthesis of the food flavoring methyl benzoate by genetically engineered *Saccharomyces cerevisiae*. J. Biotech. 122: 307-315.
3. Kaminaga Y., Schnepp J., Peel G., Kish C.M.., Ben-Nissan G., Weiss D., Orlova I., Lavie O., Rhodes D., Wood K., Porterfield M., Cooper A.J.L., Schloss J.V., Pichersky E., Vainstein A., and Dudareva N. (2006) Plant phenylacetaldehyde synthase is a bifunctional homotetrameric enzyme that catalyzes phenylalanine decarboxylation and oxidation. J. Biol. Chem. 281: 23357-23366.
4. Wigoda N., Ben-Nissan G., Granot D., Schwartz A. and Weiss D. (2006) The gibberellin-induced, cysteine-rich protein GIP2 from *Petunia hybrida* exhibits *in-planta* antioxidant activity. Plant J. 48: 796-805.
5. Varbanova M., Yamaguchi S., Yang Y., McKelvey K., Hanada A., Borochov R., Yu F., Jikumaru Y., Ross J., Cortes D., Ma C-J., Noel J., Mander L., Shulaev V., Kamiya Y., Rodermel S., Weiss D. and Pichersky E. (2007) Methylation of gibberellins by *Arabidopsis* GAMT1 and GAMT2. The Plant Cell 19: 32-45.

6. Weiss D. and Ori N. (2007) Mechanisms of cross-talk between gibberellin and other hormones. Plant Physiol. 144: 1240-1246
7. Hendel-Rahmanim K., Masci T., Vainstein A. and Weiss D. (2007) Diurnal regulation of scent emission in rose flowers. Planta, 226: 1491-1499.
8. Maymon I., Greenboim-Wainberg Y., Sagiv S., Kieber J.J., Moshelion M., Olszewski N. and Weiss D. (2009) Cytosolic activity of SPINDLY implies the existence of a DELLA-independent gibberellin-response pathway. Plant J. 58: 979-988
9. Farhi M., Lavie O., Masci T., Hendel-Rahmanim K., Weiss D., Abeliovich H. and Vainstein A. (2010) Identification of rose phenylacetaldehyde synthase by functional complementation in yeast. Plant Mol. Biol. 72: 235-245
10. Bar-Akiva A., Ovadia R., Rogachev I., Bar-Or C., Bar E., Freiman Z., Nissim-Levi A., Gollop N., Lewinsohn E., Aharoni A., Weiss D., Koltai H. and Oren-Shamir M. (2010) Metabolic networking in *Brunfelsia calycina* petals after flower opening. J. Exp. Bot. 61: 1393 – 1403
11. Shani E., Melnik H., Shleizer-Burko S., Burko Y., Weiss D. and Ori N. (2010) Cytokinin regulates compound leaf development. The Plant Cell 22:3206-3217
12. Rubinovich L. and Weiss D. (2010) The Arabidopsis cysteine-rich protein GASA4 promotes GA responses and exhibits redox activity in bacteria and *in planta.* Plant J. 64: 1018-1027
13. Fleishon S., Shani E., Ori N. and Weiss D. (2011) Negative reciprocal interactions between gibberellin and cytokinin in tomato. New Phytol. 190: 609-617

Prof. Oded Yarden

Peer-reviewed articles:

1. Harel, A., Bercovich, S. and Yarden, O. 2006. Calcineurin is required for sclerotial development and pathogenicity of *Sclerotinia sclerotiorum* in an oxalic acid-independent manner. Mol. Plant-Microbe Interact. **19**:682-693.
2. Horowitz, S., Freeman, S., Zveibil, A. and Yarden, O. 2006. A defect in *nir1*, a *nirA*-like transcription factor, confers morphological abnormalities and loss of pathogenicity in *Colletotrichum acutatum*. Mol. Plant Pathol. **7**:341-354.
3. Seiler, S., Vogt, N., Ziv, C., Gorovits, R., and Yarden, O. 2006. The STE20/germinal center kinase POD6 interacts with the NDR kinase COT1 and is involved in polar tip extension in a motor protein-dependent manner in *Neurospora crassa.* Mol. Biol. Cell **17**:4070-4082.
4. Divon H.H., Ziv C., Davydov O., Yarden O. and Fluhr R. 2006. The global nitrogen regulator, FNR1, regulates fungal nutrition-genes and fitness during *Fusarium oxysporum* pathogenesis. Mol. Plant Pathol. **7**:485-497.
5. Alkan, N., Gadkar, V., Yarden, O. and Kapulnik, Y. 2006. Analysis of quantitative interactions between two species of arbuscular mycorrhizal fungi, *Glomus mosseae* and *G. intraradices*, by Real-Time PCR. Appl. Environ. Microbiol. **72**:4192-4199.
6. Lotan-Pompan, M., Cohen, R. Yarden, O. Portnoy, V., Burger, Y. and Katzir, N. 2007. Trifluralin herbicide-induced resistance of melon to Fusarium wilt involves expression of stress- and defense-related genes. Mol. Plant Pathol. **8**:9-22.
7. Yarden, O. 2007. Model systems for studying the biology of filamentous fungi - rumors of their death should be postponed. Phytoparasitica **35**:111-115.
8. Yarden, O., Ainsworth, T.D., Roff, G., Leggat, W., Fine, M. and Hoegh-Guldberg, O. 2007. Increased prevalence of ubiquitous ascomycetes in an acropoid coral (*Acropora formosa*)

exhibiting symptoms of brown band syndrome and skeletal eroding band. Appl. Environ. Microbiol. **73**:2755-2757 (featured on the cover).

9. Erental, A., Harel, A. and Yarden, O. 2007. Type 2A phosphoprotein phosphatase is required for asexual development and pathogenesis of *Sclerotinia sclerotiorum*. Mol. Plant-Microbe Interact. **20**:944-954.
10. Gerlitz, G., Livnat, I., Ziv, C., Yarden, O., Bustin, M. and Reiner, O. 2007. Migration cues induce chromatin alterations. Traffic **8**:1521-1529.
11. Ziv, C., Gorovits, R. and Yarden, O. 2007. Carbon Source affects PKA-dependent polarity of *Neurospora crassa* in a CRE-1-dependent and independent manner. Fung. Genet. Biol. **45**:103-116.
12. Horowitz Brown, S., Yarden, O., Gollop, N., Chen, S., Zveibil, A., Belausov, E. Freeman, S. 2008. Differential protein expression in *Colletotrichum acutatum*: changes associated with reactive oxygen species (ROS) and nitrogen starvation implicated in pathogenicity on strawberry. Mol. Plant Pathol. **9**:171-190.
13. Erental, A., Dickman, M.B. and Yarden, O. 2008. Sclerotial Development in *Sclerotinia sclerotiorum*: Awakening Molecular Analysis of a "Dormant" Structure. Fung. Biol. Rev. **22**:6-16.
14. Levy, M., Erental, A. and Yarden, O. 2008. Efficient gene replacement and direct hyphal transformation in *Sclerotinia sclerotiorum*. Mol. Plant Pathol. 9:719-725.
15. Maerz, S., Ziv, C., Vogt, N., Helmstaedt, K., Cohen, N., Gorovits, R., Yarden, O. and Seiler, S. 2008. The Ndr kinase COT1, and the MAP kinases MAK1 and MAK2 genetically interact to regulate filamentous growth, hyphal fusion and sexual development in *Neurospora crassa*. Genetics 179:1313-1325.
16. Resheat-Eini, Z., Zelter, A., Gorovits, R., Read, N.D. and Yarden, O. 2008. The *Neurospora crassa* colonial temperature sensitive 2, 4 and 5 (*cot-2*, *cot-4* and *cot-5*) genes encode regulatory and structural proteins required for hyphal elongation and branching. Fung. Genet. Rep. 55: 32-36.
17. Aly, R., Cholakh, H., Joel, D.M., Leibman, D., Steinitz, B., Zelcer, A., Naglis, A., Yarden, O. and Gal-On, A.. 2009 Gene silencing of mannose 6-phosphate reductase in the parasitic weed *Orobanche aegyptiaca* through the production of homologous dsRNA sequences in the host. Plant Biotech. J. 7:487-498.
18. Ein-Gil, N., Ilan, M., Carmeli, S., Smith, G.W. Pawlik, J.R. and Yarden, O. 2009. Presence of *Aspergillus sydowii*, a pathogen of gorgonian sea-fans in the marine sponge *Spongia obscura* ISME J. 3:752-755.
19. Gellerman, G., Pariente, N., Paz, Z., Shnaiderman, A and Yarden, O. 2009. Synthesis and antifungal activity of β-trifluroalkyl aminovinylketone derivatives. J. Agric. Fd. Chem. 57:8303–8307.
20. Maerz, S. Dettmann, A., Ziv, C., Liu, Y., Valerius, O., Yarden, O. and Seiler, S. 2009. MOB1-DBF2 and MOB2A/2B-COT1 function as distinct modules during septation and tip growth in *Neurospora crassa*. Mol. Microbiol. 74:707-723.
21. Ziv, C., Kra-Oz, G., Gorovits, R., Maerz, S., Seiler, S. and Yarden, O. 2009. Cell elongation and branching are regulated by differential phosphorylation states of the NDR kinase COT1 in *Neurospora crassa*. Mol. Microbiol. 74: 974–989.
22. Salame, T.H., Yarden, O. and Hadar, Y. 2010. *Pleurotus ostreatus* manganese-dependent peroxidase silencing impairs decolorization of Orange II. Microb. Biotech. 3: 93–106.

23. Dvash, E. Kra-Oz, G. Ziv, C. Carmeli, S. and Yarden, O. 2010. The NDR kinase DBF-2 is involved in regulation of mitosis, conidial development and glycogen metabolism in *Neurospora crassa*. Eukaryot. Cell 9:502-513 (featured on the cover).
24. Paz, Z., Komon-Zelazowska, M., Druzhinina, I.S., Aveskamp, M.M., Schnaiderman, A. Aluma, A., Carmeli, S., Ilan, M. and Yarden, O. 2010. Diversity and potential antifungal properties of fungi associated with a Mediterranean sponge. Fung. Divers. 42:17-26.
25. Salame, T.M., Ziv, C., Hadar, Y. and Yarden, O. 2011. RNAi as a potential tool for biotechnological applications. Appl. Microbiol. Biotech. 89:501-512.
26. Denisov, Y., Freeman, S. and Yarden, O. 2011. Inactivation of Snt2, a BAH/PHD-containing transcription factor, impairs pathogenicity and increases autophagosome abundance in *Fusarium oxysporum*. Mol. Plant Pathol. 12:449-461 (featured on the cover).
27. Riquelme, M., Yarden, O., Bartinicki-Garcia, S., Bowman, B., Castro-Longoria, E., Free, S., Felissner, A., Freitag, M., Lew, R.R., Mourino-Perez, R., Plamann, M., Rasmussen, C., Richthammerj, C., Roberson, R.W., Sanchez-Leon, E., Seiler, S. and Waters, M.K., 2011. Architecture and development of the *Neurospora crassa* hypha – a model cell for polarized growth. Fung. Biol. 115:446-474.
28. Costantino, V., Mangoni, A., Teta, R., Kra-Oz, G. and Yarden, O. 2011. Neurosporaside, a tetraglycosylated sphingolipid from *Neurospora crassa*. J. Nat. Prod. 74:554-558.
29. Cohen, E., Koch, L., Myint Thu, K., Rahamim, Y., Aluma, Y., Ilan, M., Yarden, O. and Carmeli, S. 2011. Novel terpenoids of the fungus *Aspergillus insuetus* isolated from the Mediterranean sponge *Psammocinia sp*. collected along the coast of Israel. Bioorg. Med. Chem. (in press).
30. Gal-Hemed, I., Atanasova, L., Komon-Zelazowska, M., Druzhinina, I.S., Viterbo, A. and Yarden, O. 2011. Marine isolates of *Trichoderma* as potential halotolerant agents of biological control for arid-zone agriculture. Appl. Environ. Microbiol. 77:5100-5109.
31. Amselem, J., Cuomo, C.A. , van Kan, J.A.L., Viaud, M., Benito, E.P., Couloux, A., Coutinho, P.M., de Vries, R.P., Dyer, P.S., Fillinger, S., Fournier, E., Gout, L., Hahn, M., Kohn, L., Lapalu, N., Plummer, K.M., Pradier, J.-M., Quévillon, E., Sharon, A., Simon, A., ten Have, A., Tudzynski, B., Tudzynski, P., Wincker, P., Andrew, M., Anthouard, V., Beffa, R., Benoit, I., Bouzid, O., Chen, Z., Choquer, M., Collémare, J., Cotton, P., Danchin, E.G., Da Silva, C., Gautier, A., Giraud, C., Giraud, T., Gonzalez, C., Grossetete, S., Güldener, U., Henrissat, B., Howlett, B., Kodira, C., Kretschmer, M., Lappartient, A., Leroch, M., Levis, C., Mauceli, E., Neuvéglise, C., Oeser, B., Pearson, M., Poulain, J., Poussereau, N., Quesneville, H., Rascle, C., Schumacher, J., Ségurens, B., Sexton, A., Silva, E., Sirven, C., Soanes, D.M., Talbot, N.J., Yandava, C., Yarden, O., Zeng, Q., Rollins, J.A., Lebrun, M.-H., Dickman, M.B. 2011. Genomic analysis of the necrotrophic fungal pathogens *Sclerotinia sclerotiorum* and *Botrytis cinerea*. PLOS Genetics 7: e1002230. doi:10.1371/journal.pgen.1002230
32. Denisov, Y. Yarden, O. and Freeman, S. 2011. The transcription factor SNT2 is involved in fungal respiration and reactive oxidative stress in *Fusarium oxysporum* and *Neurospora crassa*. Physiol. Mol. Plant Pathol. 76:137-143.
33. Kapri-Pardes, E., Haviv, H., Mahmoud, Y., Ilan, M., Khalfin-Penigel, I., Carmeli, S., Yarden, O. and Karlish, S.J.D. 2011. Stabilization of the α2 isoform of Na,K-ATPase by mutations in a phospholipid binding pocket. J. Biol. Chem. (in press).

34. Bardea, A., Burshtein, N., Rudich, Y., Salame, T., Ziv, C., Yarden, O. and Naaman, R. Sensitive detection and identification of DNA and RNA using a patterned capillary tube (PCT). Anal. Chem. (in press). (featured in chemical and Engineering News)

Book Chapters:

1. Osherov, N. and Yarden, O. 2010. The fungal cell wall. Pages 224-237 in: Borkovich, K.A. and Ebbole, D.J. (eds). Cellular and Molecular Biology of Filamentous Fungi. American Society of Microbiology Press.
2. Ziv, C. and Yarden, O. 2010. Gene silencing for functional analysis: Assessing RNAi as a tool for manipulation of gene expression. Pages 77-100 in: Sharon, A. (ed) Molecular Biology Methods for Fungi. Humana Press.

4.7 Research Grants, last 5 years

A. Faculty of Science

Prof. Guy Bloch

1. Functional Genomics of Chronobiological Plasticity in the Honey Bee. Binational Science Foundation (BSF). 2004 – 2008 (US$192,000).
2. Social Regulation of Chronobiological Plasticity in the Honey Bee. The National Institute for Psychobiology. 2004-2006 (US$20,000).
3. Clock organization and socially mediated behavioral plasticity in honey bees. German – Israeli Foundation (G.I.F.), 2006-2008, (€180,000).
4. Endogenous toxins as modulators of brain function and behavior: The honey bee as a test case. The Robert Szold Funds, The Wolfson Foundation for Scientific Research, 2006 – 2007 (US$40,000).
5. Minerva Short-Term Research Grant (training for my student Noa Kahana), 2007 – 2007 (€1300).
6. Social regulation of plasticity in circadian rhythms in honeybees. ISF – Ravson fund, 2007 – 2011 (1,084,000 ILS, =~US$253,000).
7. The insulin/ insulin-like pathway, and size-related division of labor in bumblebees, (BSF). 2008 – 2012 (US$192,000).
8. Functional genomics of reproduction and division of labor in a key non-Apis pollinator. BARD, 2011 - 2014 (US$280,000).
9. Minerva Short-Term Research Grant (training for my student Moshe Nagari), 2011 – 2011 (€1300).
10. Defining molecular and neuronal pathways mediating social modulation of plasticity in the circadian system of the honey bee, ISF, 2011- 2015 (234,000 ILS per annium, about US$268,000 in total).
11. A taxonomic survey assessing the influence of introduced *Bombus terrestris* populations on plant and bee biodiversity in the Judean Hills. Israel Taxonomy Initiative (ITI), 2011-2012 (US$9150).

Dr. Uri Gat

1. The “Bikura” program of the Israel Science Foundation (ISF), “Emission and absorption of EMR by human skin in the spectral range of 0.1-1 THz (Terahertz). Yuri Feldman and Uri Gat. Duration: 10/2005-10/2008. NIS 35000/176000.

2. An internal Hebrew University grant from the Ascheim US foundation, "Production of spider silk protein fibers". Duration 6/2007-6/2007. $ 20000.
3. Binational Science Foundation USA-Israel (BSF), "Isolation and Molecular Analysis of Hair Keratin Producing Cells" Duration: 10/2006-9/2010, $140000.
4. An applicative internal Hebrew University grant, "Synthetic spider silk fibers as novel biomaterials". Duration: 8/2008-8/2009, $25000.
5. The Israel Science Foundation (ISF), "The Sea-anemone *Nematostella* Runx gene – study of a basal progenitor of a mammalian gene family important for cell fate decisions". Duration: 10/2007-9/2011, $190000.
6. The DFG German-Israel-Palestinian trilateral science program, "RBM28: comprehensive analysis of its role in human disease and neuroepithelial tissue development". Duration: 9/2011-9/2013, €35000.

Prof. Gidi Gross

1. 2011, ISF-JDRF (Israel Science Foundation – Juvenile Diabetes Research Foundation) Redirecting regulatory T cells against diabetogenic T cells for the immunotherapy of type 1 diabetes, $ 130,000/y3y
2. 2011, ICRF (Israel Cancer Research Fund), A combined genetic approach for improving adoptive T cell therapy of cancer, $ 30,000/y2y
3. 2010, ISF, The pioneer round of translation and MHC-I antigen presentation, 218,000 NIS/y 4y
4. 2009, European Found. for the Study of Diabetes (EFSD) and JDRF, Novel approaches for the immunotargeting of islet-reactive CD8 T cells to prevent diabetes, € 20,000 /y 2y
5. 2008, Ministry of Industry, Trade & Labor, Improving the clinical efficacy of adoptive T cell cancer therapy, 200,000/$ y 3y
6. 2008, Ministry of Health, Pre-clinical evaluation of novel RNA vaccines against melanoma, 100,000NIS/y 3y
7. 2007, ICRF, Pre-clinical evaluation of novel genetic cancer vaccines encoding dendritic cell activation receptors, $ 30,000 / y 2y
8. 2007, Ministry of Science (Zemer Program), Development of universal vaccines against allergic diseases, 250,000NIS/y 2y
9. 2006, ISF, Genetic cancer vaccines encoding DC activation receptors (mouse model), $ 45,000/y 4y
10. 2006, ICA (Israel Cancer Association), Development of multi-functional cancer vaccines, 75,000 NIS/2y

Dr. Sebastian Kadener

1. **European Research Council,** 2011-2016. "Towards a systemic view of the circadian clock: Integration of miRNAs into the molecular, cellular and neural circadian networks". Total Funds: €1,487,000.
2. **Human Frontiers Science Program,** 2011-2014. "The birth of the circadian clock". Co-PIs: Prof. Aviv Regev (Broad Institute, Cambridge, MA, USA) and Dr. Eran Meshorer (HUJI). Total Funds: $900,000.
3. **Human Frontiers Science Program**, 2009-2012: "How circadian clocks keep time: insights from Drosophila". Total Funds: $300,000.
4. **Israeli Science Foundation**, 2010-2014. "Biochemical and behavioral characterization of

the miRNA-mediated regulation of circadian rhythms in *Drosophila*". Total Funds: $323,545.

5. **Israeli Science Foundation.** Legacy Program, 2010-2013 "Development of a high throughput system for *in vivo* following of polyglutamine-mediated neurodegeneration in *Drosophila"*. Total Funds: $255,000.
6. **Israeli Science Foundation**. F.I.R.S.T. Program, 2010-2013 "Genomic analysis of the coupling between transcription, splicing and miRNA processing". With Prof. Gil Ast (Tel Aviv University). Total Funds: $165,000.
7. **US-Israel Binational Science Foundation.** Young Investigator Set Up Grant 2010, " How does the *clock* keep time? Studying the differences between central and peripheral circadian oscillators in *Drosophila*". With Prof. Michael Rosbash (HHMI, Brandeis University, USA). Total Funds: $60,000.
8. **Marie Curie Reintegration Grant (European Union)**, 2009-2013: "Circadian Rhythms". Total Funds: €100,000.
9. **Fritz-Thyssen Foundation Grant,** 2010-2012: "Development of new high throughput methodologies to follow *in vivo* neurodegeneration in a *Drosophila* model of Friedrich's ataxia". Total Funds: €80,000
10. **German-Israeli Foundation, Young Scientists Program**, 2010: "A small answer for a big question? Determining the role of siRNAs in circadian timekeeping". Total Funds: €33,000.
11. **National Institute for Psychobiology Grant**, 2011-2012: "Development of new models for Friedrich's Ataxia". Total Funds: $ 20,000.
12. **Abisch-Frenkel Foundation Grant**, 2009-2011: "Behavioral markers for assessing neurodegeneration in a Drosophila model of Neurodegeneration with Iron accumulation (NBIA)". Total Funds: $ 36,000.
13. **Lewja Found for Biochemistry**, 2008-2009. "Biochemical characterization of miRNA-mediated regulation of circadian rhythms in *Drosophila*". Total Funds: $35,000
14. **Pending**: **Deutsch-Israelische Projektkooperation (DIP)**, 2011-2016: "Searching for the roles and mechanism of action of the Nedd8 pathway in the brain". In collaboration with: Prof. Adi Mizrahi (Israel), Prof, Yosi Yarom (Israel), Prof. Nils Brose (Germany), Prof. Wolfgang Wurst (Germany) and Dr. Damian Refojo (Germany).

Prof. Aaron Kaplan

1. **Israel Science Foundation** on "Enhanced antioxidant activity stimulates cell death in photosynthetic microorganisms".
2. **Israel Science Foundation (Bikura)** on "Transforming the photooxidative resistance from cyanobacteria inhabiting biological sand crusts to higher plants" with Nir Keren
3. **DFG** on "The Role of Photorespiration and Glycine-Decarboxylase-Complex in Cyanobacteria" with Martin Hagemann.
4. **GIF** on "living well with scrambled metabolism in diatoms" with Peter Kroth
5. **Water Authority** on "The spring bloom of Peridinium in Lake Kinneret" With Assaf Sukenik and Shmuel Carmeli.
6. **Internal HU sources** on "control of toxic *Microcystis* blooms by means of allelochemical produced by a green algae"
7. **EU Assemble** on " enhancing marine research"

8. MOST center of knowledge on marine research

Prof. Michal Linial

1. Bioinformatics in Europe. Network of Excellence, NoE BioSapiens- Genome. Total EU Framework 6 (14 countries) 420,000 Euro for ML 5 years 2005-2009
2. Cell cycle consortium for bioinformatics platform. EU Framework 6 3 years (7 groups.) 60,000 Euro / year ML 3 years. 1/2005- 12/2007
3. Bee behavior and New toxin like proteins Horowitz Foundation 50000 $ 2 years (2 groups)
4. Stem Cells Consortium (MAGNT) BERESHIT Consortium Year 2006 110000 NIS/ year
5. Prospects. Proteomics Mass Spectrometry signaling EU Framework 7 200,000 Euro per year, 5 years Coordinated by M. Mann (Max Planck, Munich), Funding for 5 years 2008-2013
6. BSF Dark Matter in Proteomics 160000 $ with J Marto from Dana Faber Research Center, Harvard USA Years 2007-2011 - Grant number 592/07
7. Peptide – Toxin modulation in cells ISF 240,000 $ for 4 years 2008-2012

Prof. Aharon Oren

1. The role of organic osmotic solutes in the carbon cycle of hypersaline microbial mats, The Israel Science Foundation, 2010-2013, $ 190,000
2. Trophic interrelationships between Dunaliella, Haloquadratum and Salinibacter in hypersaline environments, The Israel Science Foundation, 2007-2010, $ 160,000
3. Biological investigations in the Dead Sea, The World Bank – through Tahal, Tel Aviv, and Yissum, 2010-2011, NIS 174,782
4. Characterization of the phototrophic communities in the hot springs on the eastern shore of the Dead Sea, The Bridging the Rift Foundation, 2006-2008, $ 32,000
5. Degradation of aromatic organic compounds by halophilic bacteria from the Dead Sea area, Tamar Regional Council – R&D Dead Sea, 2005-2007, NIS 57,765

Prof. Etana Padan

1. EDICT, EDICT-European Drug Initiative on Channels and Transporters; Grant number: EU EP7 2007-2011, about 35000EU per year.
2. T he USA-Israel Binational Science Foundation Grant number: BSF 20050130. The Na^+/H^+ antiporters, structure and evolutionary-bioinformatics based functional study. 2006-2011 approximately 35000$ per year

Prof. Hermona Soreq

1. microRNA involvement in Alzheimer's disease, Israel Science Foundation Legacy Program, 2011-2015, 250,000$
2. Exploring causes and consequences of splicing impairments in Alzheimer's disease, German Israel Foundation, 2011-2014
3. Parkinson's biomarkers, Thyssen Foundation, 2010-2012, 85,000$
4. PTSD in victims of War, German Research Foundation Trilateral Grant Program, 2010-2012, 100,000$
5. Neuroinflammation and Alzheimers Disease, Israel Science Foundation Legacy Program, 2008-2011, 250,000$

6. Alternative acetylcholinesterase variants - from molecular mechanism to neuropathology, Israel Science Foundation, 2007-2011, 160,000$
7. Validated Predictive Dynamic Models of Complex Intracellular pathways Related to Cell Death and Survival, European Community FP6, 2006-2009, 300,000$
8. Novelty Tuning: behavioural, electrophysiological and molecular mechanisms underlying the processing of novel stimuli, European Community FP6, 2006-2009, 300,000$

Prof. Shimshon Belkin

1. Biosensor nanoarrays for environmental monitoring (Biomonar); EU 7th framework. 2010-2014
2. Spatial biodiversity of the Tamarisk phyllosphere; BSF; 2011-2014
3. Remote sensing of buried land mines; Israel Ministry of Defense; 2009-2012
4. Cytotoxicity screening of water; US Army; 2009-2010
5. Ecology of the microbial populations on a salt-secreting desert tree; BSF; 2007-2010
6. Innovative microbead-based smart cell chips; KNF, Korea; 2010-2013
7. Indicator and pathogenic microorganisms on office surfaces; Ministry of Trade; 2009-2011
8. An innovative device for monitoring genotoxicity in water; Israeli MOST/German BMBF; 2006-2010
9. A Whole-Cell Biosensor Panel for Agricultural chemicals; BARD, 2006-2009
10. Development of whole-cell biosensors for water toxicity monitoring (Toxichip); EU 6th framework ; 2006-2009

B. Faculty of Medicine

Prof. Ofer Mandelboim

1. 2006-2009 A grant from the European consortium MRTN-CT-2005 Title: NK defense and therapy, Coordinator Dr. Erhard Hofer, 75,000 Euro/year for three years, total €225,000. €225,000/225,000.
2. 2006-2009 A grant from the European consortium LSHC-CT-2005-518178 "Anti-tumor targeting". Coordinator Dr. Erhard Hofer, 75,000 Euro/year for three years, total €225,000. €225,000/225,000.
3. 2006-2007 A grant from the ministry of health 80,000 shekels/year for two years, Short title TAP2-deficiency and tumors. Total 160000 NIS. 160000/160000.
4. 2007-2009 A grant from the Israeli Cancer Research Foundation (ICRF), $30,000/year for two years. Title: Tumor development in the absence of the NK activating receptor Ncr1. Total $60,000.
5. 2007-2009 A grant from the Roosetrees Trust. 9000 pounds/year for 3 years. Title: The Role of Natural Killer Cells in Pregnancy and in Cancer: Identification of Proteins that are Recognized by Natural Killer Cells in Pregnancy and in Cancer**.** Total 27000 pounds.
6. 2007-2010 A grant from the AICR. $80000 for three years. Title: Tumor development in the absence of NK activating receptors.
7. 2008-2012 A grant from the Israel Science Foundation (ISF). Title: Killing of pathogens in the absence of NCR1. $70,000/year for four years, total $280,000. $280,000/280,000.
8. 2009-2010 A grant from the JDRF, Grant Number: 5-2008-801 Killing of beta cells by the NK killer receptor NKp46 $110000/one year.

9. 2009-2012- A grant from the ISF (Morasha). Title: The function of Natural Killer cells in TAP-2 deficient patients (Application number 1838/08). $100,000/year for 3 years.
10. 2009-2011-A grant from the Israel Croatia Joint Research Grants. Title: The function of the NK killer receptor NKp46 in CMV and Influenza infections. $25000/year for 2 years.
11. 2010-2013-A grant from the DKFZ-MOST. Title: Regulation and function of viral and cellular microRNAs controlling the immune response 40,000 Euro/year for 3 years.
12. 2010-2013-A grant from the AICR. Title: Identifying microRNA-based tumor immunoevasion mechanisms through the study of viral microRNAs. $60000/year for 3 years.
13. 2010-2010- A grant from the Israel Cancer Association (20100003) Identification of cellular microRNAs controlling the function of tumor cells. 45000 Shekels.
14. 2010-2011- Lewis family donation-Eradication of lymphomas by the NK killer receptor NKp46. $45000.
15. 2010-2017-ICRF professorship grant. Learning from viruses: MicroRNAs controlling tumor cell attack by NK cells. $50000/year for 7 years, $350000 in total.
16. 2011-2011- The Israel Science Association (# 20112002). Learning from viruses: The identification of miRNAs enabling tumor cells to avoid detectyion by the immune system. 30,000 shekels

Prof. Stella Mitrani-Rosenbaum

1. 2006 *In vitro* and *In vivo* Experimental systems for Hereditary Inclusion Body Myopathy. Advancement of Research for Myopathies (ARM). $50,000
2. 2006- 2008 Mouse Model for HIBM. Association Francaise contre les Myopathies (AFM). 70,000 Euros
3. 2006-2010Role of GNE in the muscle pathophysiology of hereditary inclusion body myopathy (HIBM). Israel Science Foundation (ISF). $120,000
4. 2008-2010 The pathological mechanisms of hereditary inclusion body myopathy - characterization of novel biochemical GNE functions in human cells. German Israel Fund (GIF). 70,000 Euros
5. 2007-2010 Therapy strategies for hereditary inclusion body myopathy. Neuromuscular Disease Foundation (NDF), $380,000
6. 2011 Therapy strategies for hereditary inclusion body myopathy Hadassah, South California Chapters, $180,000
7. 2011-2015 Hereditary Inclusion Body Myopathy: Elucidating the role of GNE in Muscle in a Zebrafish model. Israel Science Foundation (ISF), $220,000
8. 2012-2014 The Pathological Mechanisms of Hereditary Inclusion Body yopathy: Characterization of inter-GNE and GNE-muscle proteins interactions in health and disease. German Israel Fund (GIF), 100,000 Euros

Prof. Ariella Oppenheim

1. Identification of novel genetic modifiers in beta-thalassemia, DFG, 2004-2006, ERU 38,200
2. Protein-DNA assemblages in SV40 assembly, ISF, 2004- 2007, NIS 400,000
3. EPI-VECTORS, EU, 2005- 2007, ERU 254,000
4. Genetics of SV40 Entry and Minichromosome Transport, NIH, 2004-2009, $410,000
5. Thermodynamics and kinetics of SV40 capsid assembly, BSF, 2006 –2010, $ 180,000

6. Interplay of SV40 with host factors during assembly, ISF, 2007- 2011, NIS 1,168,000

Dr. Jacob Rachmilewitz

1. 2004-2007 Israel Science Foundation award (ISF), "Mechanism for immune tolerance induced by human mesenchymal stem cells", 594,000 NIS
2. 2003-2006, Horowitz Fund, "PP14: toward therapeutic use", 200,000/200,000$
3. 2006 Zaltzberg Fund, "Characterization of tumor infiltrating natural killer (NK) cells" 12,000$
4. 2007-2008 Ministry of Health, "Characterization of Breast Carcinoma infiltrating natural killer (NK) cells" 180,000NIS /180,000NIS
5. 2008-2009 National Multiple Sclerosis Society Pilot Research Application –Pilot 40,000$
6. 2009-2010 Israel Science Foundation (ISF), 812,000NIS
7. 2009-2010 ICRF : "Characterization of tumor infiltrating natural killer (NK) cells" 60,000$

Dr. Stefan Rokem

1. 2006 – 2009 Keren Ritoff for Research in Applied Microbiology
2. 2010 – 2011 Kraft Foods

C. Faculty of Agriculture

Prof. Nor Chejanovsky

1. 2004-2007, The Israeli Academy of Sciences. Involvement of the baculovirus proteins IE0 and IE1 in regulation of infection by the *Autographa californica* multiple nucleopolyhedrovirus. US $ 90,000 /90,000.
2. 2005-2008, BARD: "Potentiation of pest control by insect immunosuppression". Nor Chejanovsky and Bruce A. Webb US 300,000.
3. 2006 Volcani Chief Director Fund "Insect Genomics: a new tool to control agricultural pests", for one year US $120,000/ year.
4. 2008-2011, Chief Scientist of the Ministry of Agriculture. " Colony decline and Colony collapse disorder in Israel : Evaluation of situation and potential causes". US$ 80,000 .
5. 2009-2012, Chief Scientist of the Ministry of Agriculture. " Honey Bee's immunity and susceptibility to Pathogens ". US$ 115,000.
6. 2010-2013, US-IS BARD (Binational Agricultural Research and Development) "Honeybee modulation of infection with the Israeli Acute Paralysis Virus, in asymptomatic, acutely infected and CCD colonies" US$ 290000.

Dr. Nir Dai

1. 2008: MERC grant. Title: Disease – **indexing and mass propagation of superior strawberry cultivars.** Cooperating Investigator, for 5 years.Budget: Total $84,000/year; Researcher's part $20,000/year
2. 2006: Chief Scientist of the Ministry of Agriculture grant. **Studying the mechanism and the inheritance of resistance to powdery mildew in strawberry for the developed of resistant cultivars.** Principal Investigator, for 3 years, Budget: Total: $20,000/year.
3. 2007: The Israel Science Foundation (ISF). **The molecular evolution of sucrose accumulation in tomato fruit as determined by transcriptional control of vacuolar invertase activity**. Cooperating Investigator, for 2 years. Budget: Total: $52,000/year.

4. 2008: Chief Scientist of the Ministry of Agriculture grant. **Strawberry fruit quality and phytochemicals beneficial to health.** Principal Investigator, for 3 years, Budget: Total: $29,000/year.
5. 2009: Chief Scientist of the Ministry of Agriculture grant. **Simulating short day light in field nursery for early fruit bearing in strawberries.** Principal Investigator, for 3 years, Budget: Total: $27,000/year.
6. 2009: Chief Scientist of the Ministry of Agriculture grant. **Application of the symbiotic fungus *Sebacina vermifera* and plant growth promoting bacteria to increase yields and stress tolerance to vegetable crops**. Cooperating Investigator, for 3 years, Researcher's part $15,000/year
7. 2005: Vegetable Board grant (Ministry of Agriculture). **Preserving the genetic collection of strawberry lines as a resource for breeding new cultivars.** Principal Investigator, for 2 years. Budget: Total: $4,600/year.
8. 2006: The Plants Production and Marketing Board (Vegetable division, Strawberry section). **Israeli strawberry breeding program for the improvement of new strawberry cultivars.** Principal Investigator, for 3 years. Budget: Total: $75,000/year.
9. 2009: The Plants Production and Marketing Board (Vegetable division, Strawberry section). **Israeli strawberry breeding program for the improvement of new strawberry cultivars.** Principal Investigator, for 3 years. Budget: Total: $70,000/year.
10. 2010: The Plants Production and Marketing Board (Vegetable division, Strawberry section). **Indexing of anthracnose relative tolerance in new strawberry cultivars.** Principal Investigator, for 1 year. Budget: Total: $2,700.
11. 2011: The Plants Production and Marketing Board (Vegetable division, Strawberry section). **The Israeli strawberry breeding program.** Principal Investigator, for 3 years. Budget: Total: $70,000/year.

Dr. Dani Eshel

1. 2005 Chief Scientist of the ministry of agriculture grant; Title: Development of an accurate steam depositor to treat carrot and sweet potato against pathogens before storage. **Cooperating Investigator**, for 3 years. Budget: Total $90,000, researcher part $40,000.
2. 2006 Chief Scientist of the ministry of agriculture grant; Title: Improving sweet potato quality and variety – for export. **Cooperating Investigato**r, for 3 years. Budget: Total $55,000.
3. 2006 Chief Scientist of the ministry of agriculture grant; Title: *Storing root vegetables for use during Shmitta*. **Cooperating Investigator**, for 3 years. Budget: Total $80,000.
4. 2007 Chief Scientist of the Ministry of Agriculture grant. Title: *Improving sweet potato quality in Ramat-Negev – use of salty water*. Cooperating Investigator, for 3 years. Budget: Total $40,000. researcher part $4,000.
5. 2007 Chief Scientist of the ministry of agriculture grant; Title: *Characterization of dark lesions syndrome on the skin of organic potato and improvement of their quality*. Principle Investigator, for 3 years. Budget: Total $75,000.
6. 2007 Chief Scientist of the ministry of agriculture grant; Title: *Improvement of sweet potato quality with transition from a niche crop for export to an extensive crop*. Principle Investigator, for 3 years. Budget: Total $60,000.

7. 2009 Chief Scientist of the ministry of agriculture grant; Title: *Development of environment friendly anti-sprouting agents to improve postharvest storage of potato tubers.* Principle Investigator, for 3 years. Budget: Total $80,000.
8. 2009 Chief Scientist of the ministry of agriculture grant; Title: *Combining control treatments with biological control to synergistically improve postharvest disease control.* Principle Investigator, for 3 years. Budget: Total $60,000.
9. 2007-2010 Onion Board; Title: I*mprovement of onion quality by combining postharvest treatments.* Principle Investigator, for 4 years. Budget: Total $10,000 for each year.
10. 2007-2010 Potato Board; Title: *Improvement the quality of potato during Postharvest storage*. Principle Investigator, for 4 years. Budget: Total $5,000 for each year.
11. 2007-10 Sweet potato Board; Title: *Development of combine treatment to improve postharvest sweet potato quality in storage*. **Principle Investigator**, for 4 years. Budget: Total $5,000 for each year.
12. 2007-10 Carrot Board; Title: *Improving Postharvest storage of carrot*. **Principle Investigator**, for 4 years. Budget: Total $5,000 for each year.

Dr. Yoram Eyal

1. 2004 – 2007, Chief Scientist of the Ministry of Agriculture Biotechnology Panel grant. Title: Metabolic engineering to enhance production of "foreign" terpenoids in transgenic plants. Principal Investigator, for 3 years. Budget: Total $95,000.
2. 2004 – 2008, Israel Academy of Science. Title: Regulatory aspects of chlorophyll degradation in plants. Principal Investigator, for 4 years. Budget: Total $200,000.
3. 2005 – 2008, Chief Scientist of the Ministry of Agriculture Biotechnology Panel grant. Title: Developing knowledge and tools to affect flavor and aroma in citrus. Principal Investigator, for 3 years. Budget: Total $120,000.
4. 2008 – 2012, Israel Academy of Science. Title: Compartmentalization and regulation of flux and products of the isoprenoid biosynthesis MVA pathway in plants. Principal Investigator, for 4 years. Budget: Total $200,000.
5. 2009 – 2012, Chief Scientist of the Ministry of Agriculture Biotechnology Panel grant. Title: Study and manipulation of structure/function and expression of glycosyltransferases in plants for natural synthesis of novel flavonoid derivatives in plants. Principal Investigator, for 3 years. Budget: Total $120,000.
6. 2010, Ministry of Science and Technology. Title: Developing glycosyltransferase encoding genes as tools for biotechnology in algae. Principal Investigator, for 1 year. Budget Total $100,000
7. 2010 – 2013**,** THE GERMAN ISRAELI FOUNDATION FOR SCIENTIFIC RESEARCH AND DEVELOPMENT (G.I.F). Functional and structural analysis of natural product branch-forming glycosyltransferases in plants. Principal Investigator, for 3 years. Budget Total: $150,000

Prof. Edouard Jurkevitch

1. 2003-2007 Israel Science Foundation. Analysis of the dimorphic life cycle of the predatory bacterium *Bdellovibrio bacteriovorus* 109J and of related organisms. E. Jurkevitch 948,000/948,000 NIS. #33, 34, 35, 38.
2. 2004-2005 Chief Scientist-Ministry of Agriculture. Integration of predatory bacteria in pest management of fruit flies. Boaz Yuval, HU. 55,000 NIS.
3. 2004-2005 Joseph Nahmias Fund at HU. Ecological implications of transgenes for the bacterial food chain. E. Jurkevitch $10,000/10,000.
4. 2006-2009 Binational Agricultural Research and Development Fund (BARD). C.Lauzon, CSU East Bay, CA, B. Yuval, HU. E. Jurkevitch. $90,000/270,000.
5. 2007-2008* Applied Funds, First stage HU. Influence of bacterial amendments on the growth, survival and competitiveness of Mediterranean fruit flies used in the sterile insect technique. With B. Yuval (co-PI), HU. $15,000/$25,000.
6. 2008-2009* Innovative Fund, HU. An examination of prokaryotic predatory in the treatment steps of a zero discharge aquaculture system. With J. Van Rijn (co-PI), HU. $24,000/24,000.
7. 2008-2010* Israel Police and US Department of Justice. Use of soil microbial DNA in forensics. 300,000/300,000 NIS.

8. 2008-2011* Israel Science Foundation (ISF). A one-sided molecular dialog: Molecular interactions between *Bdellovibrio bacteriovorus* and its bacterial prey. With S. Pietrokovski (co-PI), The Weizmann Institute of Science. 315,000/630,000 NIS.
9. 2009-2010* HU Applied Funds Second stage. Influence of bacterial amendments on the growth, survival and competitiveness of Mediterranean fruit flies used in the sterile insect technique. With B. Yuval (co-PI), HU. $30,000/40,000.
10. 2010-2013 Symbiosis in the Olive fly and its contribution to the fly's fitness. Ministry of Agriculture. With B. Yuval (co-PI), HU. 120,000 NIS
11. 2010-2011 Ministry of Agriculture. Effect of treated wastewater irrigation on proliferation of antibiotic resistance in agricultural soils. With Eddie Cytryn (PI), ARO.
12. 2010-2011 Ring Fund. Potential microbial activity and CO2 emission during plant litter decomposition in a Mediterranean ecosystem during the rainless season. With Jose Gruenzweig (PI), HU. 25,000 NIS
13. 2011-2013* Korean-Israeli Joint Research Cooperation. Ministry of Science and Technology. The effects of predatory bacteria on bioremediation. With Robert Mitchell (co-PI), Ulsan National institute of Science and Technology, Korea. 180,000 NIS

Prof. Rina Meidan

1. Role Of Endothelin-1 In The Development Of Diabetic Vascular And eproductive Disorders (D-Cure 2008-2008)
2. D eciphering the luteal transcriptome: Insights into mechanisms regulating corpus uteum regression BARD (US-Israel Binational Agriculltural research & development) 2006 -2009
3. P rokineticin-1, a novel activator of luteal endothelial cells: insight into ovarian function and beyond Israel Science Foundation (2006-2009(
4. U nderstanding the physiological role of Endothelin'2 in the ovary: towards better control of corpus luteum formation? Israel Science Foundation (2010 -2013)

Prof. Naomi Ori

1. 2008-2011 United States-Israel Bi-national Agricultural Research and Development Fund (BARD). " The role of GOBLET and auxin in controlling organ development and patterning", Naomi Ori and Mark Estelle. $195,000/285,000.
2. 2009-2012 Ministry of Agriculture, Chief Scientist, Biotechnology committee. "Identification of genetic factors controlling leaf and fruit development downstream of ENTIRE in tomato". IS 495,000/495,000.
3. 2010-2014 Israel Science Foundation (ISF) – "Characterization of the morphogenetic activity of the tomato leaf margin". IS1,312,000/1,312,000.

Prof. Dov Prusky

1. 2006 Recipient of Binational Agricultural Research and Development (BARD-Queensland) for a period of 3 years acting as principal investigator in cooperation with Dr. Robert Fluhr and Drs. Peter Hofman, Dr. Elizabeth Dann and Dr. Lindy Coates. Title: Pre and postharvest factors modulating avocado fruit quality and decay development by *Colletotrichum gloeosporioides* 250.000$

2. 2008 Recipient of Binational Agricultural Research and Development (BARD-Texas) for a period of 3 years acting as principal investigator in cooperation with Dr. Robert Fluhr and Dr. Marty Dickman. Title: The effect of pH modulation and ROS production by postharvest pathogens on postharvest disease development 310.000$
3. 2008 Recipient of National Academy of Israel Fund grant for a 4 year period acting as Principal Investigator in cooperation with Dr. A. Sherman and Dr. Amnon Lichter. 280.000$
4. 2011 Recipient of Binational Agricultural Research and Development (BARD) for a period of 3 years acting as principal investigator in cooperation with Dr. Robert Fluhr and Dr. Megiste Tesfaye. Title: Mechanisms activated by fungal-based host pH modulators during quiescent infections and active postharvest disease development. 310.000$.
5. 2011 Recipient of Biotechnological, Ministry of Agriculture Grant for a 3 year period acting as Principal Investigator. Title: pH signaling in Penicillium expansum: a role in pathogenesis and mycotoxin production. 480.000 NIS

Prof. Alexander Vainstein

1. Ministry of Agriculture
2. Ministry of Industry
3. Trade and Labor
4. Ministry of Science
5. The Israel Science Foundation
6. BARD; AID-CDR;
7. Yissum (private companies)

Prof. David Weiss

1. "The Role of Serine/Threonine O-GlcNAc modifications in hormone signaling" BARD, 2006-2009, $350,000
2. "Interaction between GA and Cytokinin Signaling Pathways" ISF, 2006-2010, $275,000
3. "Introduction of new ornamentals" Ministry of Agriculture, 2008-2011, $60,000
4. "Methylation of gibberellin by GAMT to promote tolerance to osmotic stress in tomato" Ministry of Agriculture, 2009-2012, $130,000
5. "Genetic modification of growth and branching in ornamentals" Ministry of Agriculture, 2011-2013**,** $70,000
6. "Developing *Eucomis* as new cut-flower and pot-plant" Ministry of Agriculture, 2011-2014, $75,000
7. "Gibberellin signaling in tomato" BARD, 2011-2014, $150,000
8. “The role of SPY and class I TCPs in hormone responses and plant development” ISF, 2011-2015, $340,000

Prof. Oded Yarden

1. 2006-2011–ISF – Fungi in marine sponges - 409,000 NIS
2. 2009-2012–ISF – COT1 and regulation of hyphal integrity in *Neurospora crassa* 1,200,000 NIS
3. 2010-2013–GIF – The role of phosphorylation in regulation of NDR kinases 90,000 Euro
4. 2011-2013–DFG - Regulation of COT1NDR kinase function 100,000 Euro

5. 2011-2014-BARD - Genetic and chemical intervention in control of *Sclerotina sclerotiorum* $140,000

Chapter 5

THE SELF-EVALUATION PROCESS, SUMMARY AND CONCLUSIONS

5.1 How the self evaluation process was conducted

As indicated several times throughout the preceding chapters, The Hebrew University Biotechnology Program is an M.Sc. teaching program only, with no teaching stuff of its own and no research activities. Thus, the data collection efforts were not as intense as those necessitated, for example, by self-evaluation reports prepared for regular departments or for entire institutes.

The process was conducted as follows:

- Chapters regarding the University and the parent faculties were provided by the relevant offices
- The program director has prepared the report skeleton and has mapped areas in which information needed to be collated and calculated
- The information was collected by the Program's secretary, Ms. Margalit Fingerhut
- This information was integrated into the text written by the program director
- We were assisted by Dr. Zvi Hayouka in putting together the final document
- The final document was reviewed and approved by the office of the Vice Rector in charge the Council for Higher Education review process, Prof. Yaakov Schul

5.2 The consolidation process

The consolidation process was conducted by the program director; staff members' input was mostly limited to Chapter 4 (research).

5.3 Follow up

The Hebrew University has adopted a monitoring and review process as a deliberate and systematic policy of proper administration. It is regarded as an integral part of the functioning of all academic units. Review and evaluation at regular intervals are essential in order to prevent stagnation and to allow for improvement, rectification of problems, adequate use of available resources and growth. The Committee's report is submitted to the Rector, and its recommendations are carefully studied by the reviewed units and the deans. The report is then discussed by the University's Committee for Academic Policy, which decides on steps to be taken both in the long and in short term. The person responsible for the reviews and the academic evaluation at the Hebrew University is the Vice-Rector, Prof. Yaacov Schul.

5.4 Accessibility

The report will be accessible to program's members and to the HUJI administration.