The Hebrew University of Jerusalem
Faculty of Mathematics and Natural Sciences

The Fredy and Nadine Herrmann Institute of Earth Sciences

Self Evaluation Report for the year 2011

Written by
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Executive Summary

- *A short summary of the main strengths and weaknesses that were pointed out in the self-evaluation process.*
- *A short description of the actions the Institution, the Parent Unit and the Department are going to take in order to improve the weak points that were found.*
- *A brief statement as to the extent which the Study Program has achieved its mission and goals and whether the outcomes comply with its mission statement. Are the Institution, Parent Unit and Department satisfied with the outcomes of the Study Program?*

The current evaluation of the Institute of Earth Sciences (IES) of the Hebrew University of Jerusalem (HUJI) is the fourth such process conducted since 2005. The first was carried out by an external committee chaired by Prof. Hanoch Gutfreund, former president of HUJI, and included Profs. Edward M. Stolper (Caltech), Francois Morel (Princeton University), Kerry Emanuel (MIT), and Vincent Courtillot (Institut de Physique du Globe de Paris). The Review Committee's overall evaluation was "**that the IES is in good health. Both individually and collectively, the quality and standing of the faculty is high, and several faculty members are international leaders in their disciplines. In view of these strengths, which provide a strong platform for future development, the Review Committee believes that by focusing on a few critical issues and by defining for itself distinct areas of research, the Institute can improve its already high national and international standing**" (Appendix 1, 1b).

The IES subsequently conducted two internal evaluation and planning campaigns (Appendix 2, 3), in which we addressed most of the points made by the 2005 Review Committee. In 2006, we drafted a plan for the years 2006-15 (Appendix 2) and in 2010 we re-evaluated it, made a few amendments, and extended our planning to 2020. Hence, we now have a 10-year plan of operation (2010-20) which touches upon most aspects of the IES' life.

Following these extensive and comprehensive self-evaluations we feel that the IES is in excellent scientific health – it is an active and dynamic academic unit with an unusually cohesive and synergistic team of researchers. One expression of this is our decision in recent years to establish three new inter-disciplinary teaching programs: (1) Climate-Atmosphere-Oceanography Sciences (CAOS) – a BSc program, (2) Hydrology – an inter-faculty MSc program (in conjunction with the Faculties of Agriculture and Social Sciences), and (3) Fossil Energy – an option to specialize within the MSc Geology program.

Broadly speaking, we identified several weaknesses and strengths pertaining to our teaching programs, as listed below. We are constantly addressing these points, and re-examine ourselves periodically.

Weaknesses:

- We see a relatively high dropout rate after the first year.
- Students are taking longer to complete their degrees (undergraduate and graduate) than the university sees as the optimal duration.
- There is a lack of contact between the IES and its alumni, especially those who do not remain in academe or the general research system.
- BSc students who conduct independent research projects do not receive adequate credit for doing so (as their counterparts do in the "*Honors*" system elsewhere).
- There is a continuous movement away from the traditional bell-shaped grading curve which leads to an inflation in BSc and MSc grades.
- Over the years, the field of Earth Sciences has become more sophisticated and the need for more instrumentation and computer power has increased. This in turn requires more professional technical staff. However, this is not supported by HUJI. Instead, technical positions are continuously being cut and, as a direct result, we have a hard time maintaining our laboratories.
- The same can be said with respect to the absorption of new faculty members. The HUJI administration does not always provide sufficient funds required for the proper absorption of new and young faculty and we have had to rely on the good will of

established IES faculty members (and their budgets) to provide even the basic equipment they need.

Strengths:

- We have the only Earth Sciences program in Israel offering undergraduate and graduate studies of all three geospheres (lithosphere, hydrosphere and atmosphere).
- We attract many top MSc and PhD students who graduated from other institutions in Israel (particularly Ben-Gurion University and the Technion), as well as from other HUJI units (Agriculture, Biology, Physics, Computer Science).
- Our open and informal teaching atmosphere provides the students with fast and easy access to all the teaching staff regarding a broad range of matters – from consulting to complaining.
- The students are very united and active in the IES academic life.
- From year one, students at the IES can benefit from professional advice regarding their studies and future directions.
- We encourage and supervise senior undergraduate students who wish to conduct independent research (some have even published in peer-review journals).
- A very high percentage of our graduate students (about 40%) continue on toward higher degrees.
- Graduates of IES programs comprise an important part of the academic and research staff in all institutions of higher education and major research institutes in Israel and in first-class universities abroad.
- The IES attracts a continuous flow of high-level visitors from abroad, for short and long periods of time, who are keen to take a part in our diverse activities.
- Our institute is characterized by strong internal and inter-disciplinary collaboration.
- Beyond (and due to) such professional collaboration, our faculty members are willing to share resources to ensure that the IES as a whole remains on the cutting edge. This can be seen in faculty coming forward when others need financial help for research, equipment, etc., or to share the teaching load when required. Moreover, most of the introductory-level courses and courses for non-Earth Science students are taught by the senior faculty members.
- We have a small but dedicated administrative and technical staff that helps maintain the IES and its laboratories, and this too contributes to our study programs running smoothly and efficiently.
- The IES is an active and dynamic academic unit which quickly responds to new directions and challenges in Earth Sciences, be they in Israel, the world, the sea or space.
- We have a very strong group of bright young faculty members who come from leading institutions abroad armed with the newest concepts and research tools.
- We have several promising graduate students who look set to help assure our future both at the IES and indeed in the realm of Earth Sciences.

Chapter 1 – The Institution

1.1 *A brief summary (up to one page) describing the institution and its development since its establishment, including details of the campus(es) where the institution's teaching activities take place (number and location), the faculties in the institution, the over-all number of students studying towards academic degrees in the institution according to degree (first degree, second degree with thesis, second degree without thesis, doctoral degree), the date of recognition by the Council for Higher Education.*

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. 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 for a new Hebrew University campus. 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.

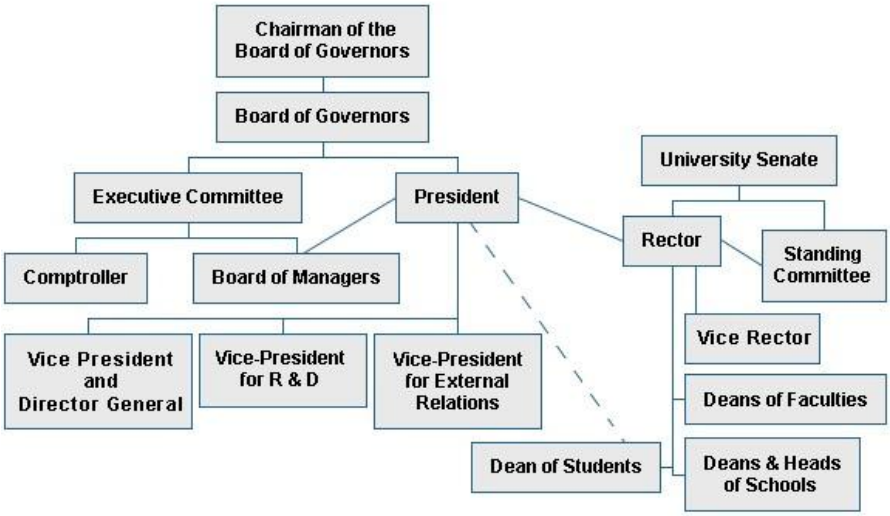
- Ein Kerem campus, site of the Faculty of Medicine (the Hebrew University–Hadassah Medical School, School of Public Health and Community Medicine, School of Pharmacy, and the School of Nursing) and the Faculty of Dental Medicine.

- 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 Unit Operating the Study Programs Under Evaluation

In this chapter, please relate to the broader organizational framework in which the evaluated study program operates. If there is no such framework, please note it. Then answer paragraph 2.5 and 2.6 (only), and then move on to chapter 3.

2.1 *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 later formed 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, the construction of a new campus began on Givat Ram in the heart of Jerusalem (currently the Edmond J. Safra Campus). During the Sixties and Seventies research and teaching activities were all transferred to this campus.

2.2 *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 are based on advanced academic and scientific expertise and 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 Faculty of Science and Mathematics by the Shanghai Academic Ranking of World Universities is 36. In their work, spanning many disciplines, our scientists and research students contribute to the accumulation of knowledge worldwide. The Faculty's aim is to maintain cutting edge scientific research in all of its disciplines by providing its faculty members, both junior and senior, with advanced facilities and means and by monitoring their academic achievement record.

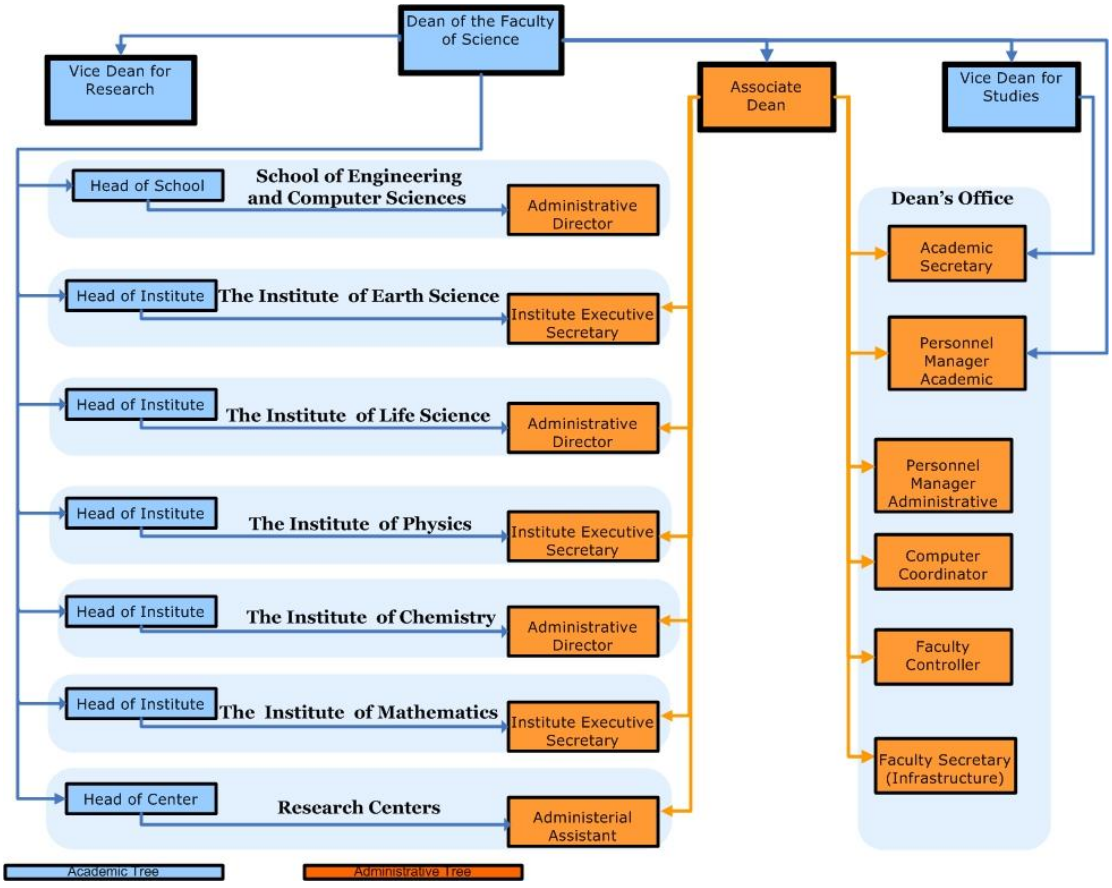
2.3 *Description and chart of the unit's academic and administrative organizational structure (including relevant committees).*

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 in 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. A variety of 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, The Multi-Disciplinary Center for Environmental Research, the graduate program of Hydrology, and The Sudarsky Center for Computational Biology*. The Faculty comprises some 240 faculty members, approximately 2,000 undergraduates, and roughly 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, Prof. Y. Kolodny, Earth Sciences, 2010); **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, Earth Sciences, 2006; Prof. Batsheva Kerem, Life Sciences, 2008; Prof. I. Willner, Chemistry, 2008, 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** (Prof. 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 of the Teaching Program who is an ex-officio member of the Faculty's Teaching Committee under the Vice Dean for Teaching.



2.4 *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

2.5 *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** BSc programs of study (**Bachelor of Science**) and **23** MSc (**Master of Science**) and PhD programs of study. All these programs are run by the five research institutes and by *the School of Engineering and Computer Science.* The studies towards PhD degree are administered within the framework of the HUJI 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.

- **Bachelor of Science**

  Upon successful completion of the required BSc course of studies in the Study program(s) of …

בוגר אוניברסיטה במדעי הטבע BSc לאחר שסיים את מסכת הלימודים בחוג ... או בתוכנית משולבת בחוגים ...

- **Bachelor of Science**

  Upon successful completion of the required BSc course of studies in the Study program(s) of …

  With Specialization in **...**

בוגר אוניברסיטה במדעי הטבע BSc לאחר שסיים את מסכת הלימודים בחוג ... בהתמחות ...

- **Master of Science** upon completing the required course of studies and submitting research thesis in the Study program of …

מוסמך אוניברסיטה במדעי הטבע MSc לאחר שסיים את מסכת הלימודים וחיבר עבודת גמר בחוג ...

- **Master of Science** upon completing the required course of studies and submitting research thesis in the Study program of … with Specialization in …

מוסמך אוניברסיטה במדעי הטבע MSc לאחר שסיים את מסכת הלימודים וחיבר עבודת גמר בחוג ... בהתמחות ...

- **Master of Science** in the frame of direct studies to PhD in the Study program of …

מוסמך אוניברסיטה *במדעי הטבע MSc במסגרת המסלול הישיר לדוקטורט בחוג ...*

- **Master of Science** upon completing the required course of studies in the Study program of …

מוסמך אוניברסיטה במדעי הטבע MSc לאחר שסיים את מסכת הלימודים בחוג ...

Table 2.5: List of Departments and Programs of Study

Mathematics	מתמטיקה	BSc	MSc	PhD
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 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	.

2.6 *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). Please provide this data in the format of a table.*

The number of students in the Faculty of Science in the last five years is listed in the Table 2.6:

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 more than one study program

2.7 *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). Please provide this data in the format of a table.*

Table 2.7 lists the Faculty's numbers of graduates:

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

2.8 *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 and 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 3 - The Evaluated Study Program

***Note**: In this chapter we require separate reference to each of the study programs under examination at each of the levels taught (first, second, doctoral degree). The identical data for all the programs will appear only once.*

3.1. The Goals and Structure of the Study Program

3.1.1. *The name of the study program, a **brief** summary describing its development since its establishment.*

The name of the study program in the Institute of Earth Sciences (IES) is "Earth Sciences". The program includes two BSc specializations one in Geology and the second in Climate, Atmosphere and Oceanography (CAO). The graduate (MSc and PhD) program includes three curriculums: Geology, Atmospheric Sciences and Oceanography. In addition the IES is a senior participant in two inter-faculty curriculums, (1) Hydrology and Water Resources, and (2) Environmental Sciences in which the current heads of studies are IES faculty.
The IES was formed in 1978 by uniting the departments of Geology (established in 1934 by Prof. Leo Picard), Atmospheric Sciences and Physical Geography of which the Department of Geology was the largest body. Over the years, the Department of Atmospheric Sciences increased its activity while new fields emerged such as oceanography and environmental sciences. About 17 years ago the physical geography group (3 scientists) left the IES and joined the Department of Geography in the Faculty of Social Sciences in Mount Scopus campus.

Since 2000, eight faculty members retired and eight full and two partial new faculty members joined the IES. Currently, the academic staff includes 23 members (including one member who resides in Eilat, and one member with a joint appointment with Archaeology). The BSc program evolved from two separated teaching programs in atmospheric sciences and geology into the present structure in which all 1st year Earth Sciences studies are consolidated into one program including basic sciences, introduction to the atmosphere, lithosphere, hydrosphere and solar system and basic field work (see Appendix 4). At the end of the first year, each student selects one of the two specializations. In addition, all Earth Sciences students are obliged to take several joint courses during each of the consecutive two years. An evolving trend resulting from the interdisciplinary nature of earth sciences is enrolment of students with BSc from other fields of natural (and sometimes social) sciences (e.g., biology, physics and chemistry) to the different graduate programs (MSc and PhD curricula as detailed below). These students are absorbed into the regular graduate programs after fulfilling complementary prerequisite studies which are specific to each of the different curriculums.

3.1.2. *Mission statement of the study program, its aims and goals.*

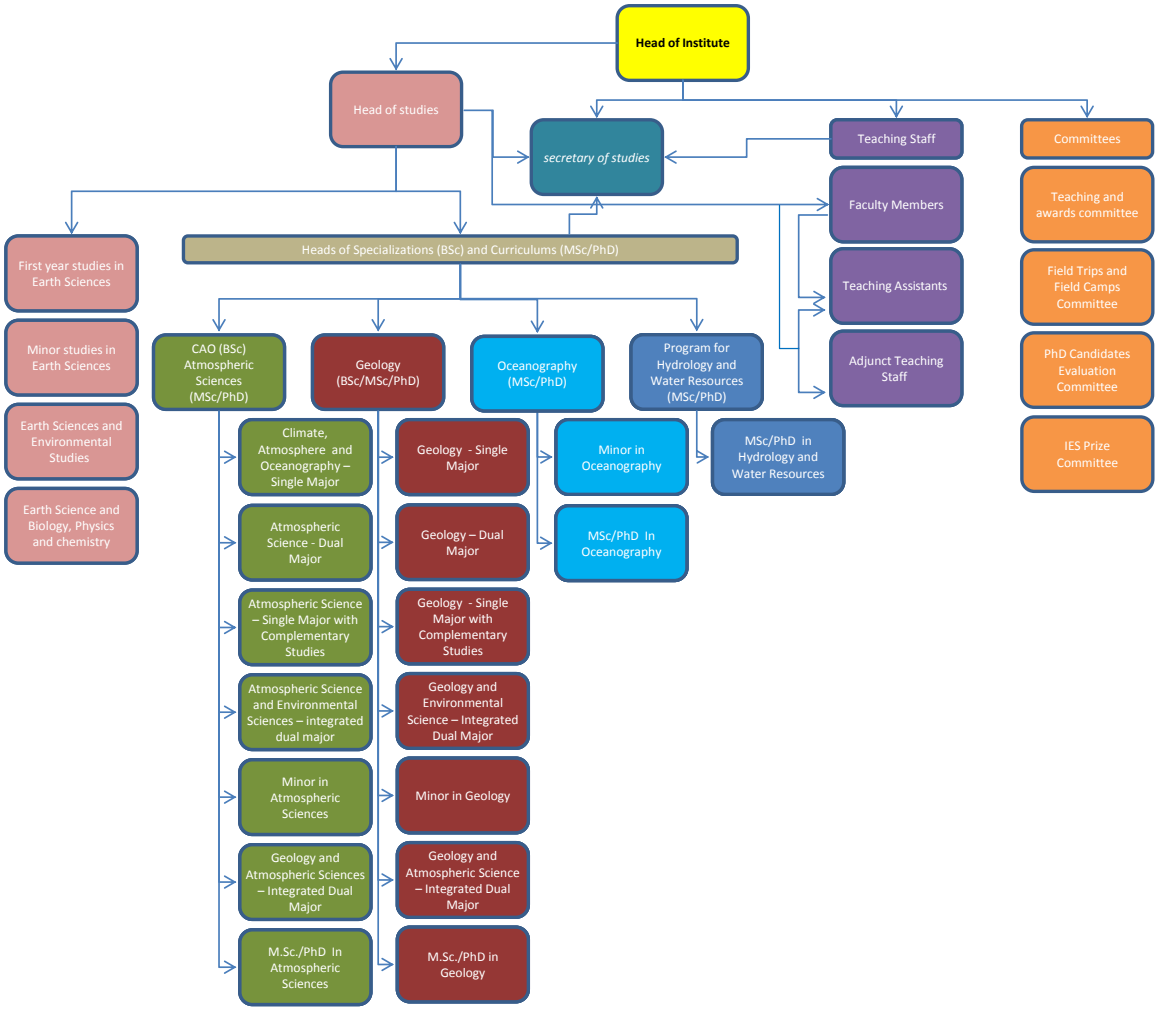
Understanding the major Earth systems and their interactions is the main goal of the study program in Earth Sciences. The undergraduate and graduate study programs cover all three geospheres: lithosphere, atmosphere and hydrosphere. The courses and the teaching programs emphasize basic science with involvement in applied sciences through participation in inter-faculty programs in hydrology (mainly hydrogeology) and environmental sciences (atmospheric and geological aspects).

Undergraduate Studies: We believe that a strong background in basic science is crucial for the education of an earth scientist therefore our undergraduate mandatory studies include two and a half semesters of mathematics, two semesters of physics, two semesters of chemistry and two semesters of programming (with emphasize on Matlab). In order to expose earth sciences to students concentrating in all fields of natural sciences, we offer a special minor program (32 credits) in Marine Sciences (Oceanography). Similar minor programs are offered also in Geology and CAO. Students who wish to invest extra efforts and get more comprehensive earth science training are studying in a dual curriculum program (two major subjects). The program integrates one of the Earth Sciences specializations with other field of

natural sciences or social/humanities. About half of the students are taking such program mainly together with Environmental Sciences, Life Sciences and Physics. The basic courses for each of the integrations are determined with the help of the curriculum advisors. In order to expose the undergraduates to the research advances in earth sciences participation in IES seminar is mandatory to all senior (third year) students. Applied aspects of the program are given in several field camps and field trips during the studies (especially for geology majors). Senior students are encouraged to participate in a "Supervised Research Project" (resembling the "honors" system in USA universities). Students taking this course are conducting, during the third year, a small research project under the supervision of a faculty member. The participating student summarizes the finding in a small thesis, which is graded by the advisor. We offer several courses in various aspects of earth sciences for non-earth science students. The courses are taught at the Edmond Safra campus for natural sciences students, at the Faculty of Agriculture in the city of Rehovot and at Mount Scopus campus for social and humanities students.

Graduate Studies: The graduate program is the backbone of research and teaching in the IES. The graduate program trains students as professionals (MSc and PhD) and educates the field's research scientists and potential faculty (PhD). As mentioned above, we offer MSc and PhD programs in Geology, Atmospheric Sciences, and Oceanography, and our faculty members are heading the inter-faculty programs in Hydrology and Water Resources, and the Environmental Sciences. All graduate programs comprise of courses (32 and 12 credits for MSc and PhD, respectively), research project, and a thesis. Complementary studies are required from students that are accepted with insufficient background in the specific curriculum. Several of the graduate programs have a mandatory core curriculum for part of the degree credits. Teaching assistantship is considered as part of the training and is offered for the best MSc students and most of the PhD students. We consider it as an important experience in the general training of an earth sciences graduate. An important part of the graduate training is active involvement in writing either the grant proposals and/or the reports for the granting agencies on their research projects. Summing up the research leads into professional papers for all PhD students and most of the MSc students, and at least one paper is included as a chapter in the theses of most PhD students. Our graduates serve on the faculty of all research universities in Israel, many research institutions in Israel and first class universities in Europe and America (see Appendix 5). Many graduates have positions in the industry, government and NGO's.

3.1.3. *Description and chart of the academic and administrative organizational structure of the study program (including relevant committees).*



The figure above describes the organizational structure of the study program in "Earth Sciences". The Head of the IES is responsible for hiring new faculty members and for the Institute's budget (more than 90% of the annual running budget, received from the HUJI is allocated for teaching). Teaching budget includes TAs' salaries, field trips and field camps, teaching aids, stipends for exceptional students, etc. The Head of Studies is responsible for operating the teaching program and hiring the TAs with the help of the heads of curriculums and specializations. The Head of Studies is responsible also for one of the specializations, either Geology or CAO (depending on his/her field of research). The secretary of studies is coordinating the study program, planning the courses locations and schedules and is the liaison officer for the students helping them with university bureaucracy and general administrative issues. The heads of specializations/curriculums and the head of studies are advising the students in all matters regarding course programs (this is especially relevant for "Integrated Dual Major" programs in which course schedule may overlap). Our faculty members teach almost all the courses except for ~5 that are taught by volunteer teachers from the Geological Survey of Israel, including one Adjunct Professor. In addition, distinguished teachers from abroad are giving one or two classes every year as "Selected Topics". The TAs are the skeleton of the teaching program, they participate in petrographic laboratories, physical demonstrations, field trips, field camps, and frontal exercises.

3.1.4. *Names of holders of senior academic and administrative positions.*

<u>Heads of program</u>
Yigal Erel – Head of the Institute of Earth Sciences (IES).
Boaz Lazar – IES Head of Studies (and the head of undergraduate specialization in geology

and the graduate curriculums in geology and oceanography.
Carynelisa Haspel – Head of the undergraduate specialization in climate, atmosphere, and undergraduate minor studies in oceanography and the head of the graduate curriculum of atmospheric sciences.

Committees
Screening Committee: Yigal Erel (head), Amotz Agnon, Jonathan Erez, Alan Matthews, Daniel Rosenfeld, Shimshon Belkin (external member – Institute of Life Sciences).
Teaching and Students Awards Committee: Amotz Agnon, Alon Angert, Ronit Kessel, Dov Avigad
Field Trips and Field Camps Committee: Amotz Agnon, Dov Avigad, Yehouda Enzel, Ari Matmon.
PhD Candidates Evaluation Committee (new): Dov Avigad, Carynelisa Haspel, Simon Emanuel, Einat Aharonov.
IES Prize Committee: Carynelisa Haspel, Alon Angert.

Administrative
Ms. Shoshana Bousheri – executive secretary (on leave of absence since April 2011).
Ms. Magiuy Perkin – secretary of studies.

3.1.5. *Please provide in the format of a table, the number of students enrolled in the program in each of the last five years according to level of degree (first degree, second degree with thesis, second degree without thesis, doctoral degree).*

Table 2 shows all teaching programs, including BSc in Atmospheric Sciences, which was discontinued in the school year 2011. The Minor undergraduate programs are included within each specialization while the Minor in Oceanography is indicated separately. All MSc studies in the Earth Sciences program require a submission of a thesis. The graduate students in the Hydrology and Water Resources program are included in Geology. Graduate students conducting their research in the Environmental Sciences program with IES advisors are not included in table 2a.

Table 2a: Number of students enrolled in the various programs of the IES, not including Environmental Studies.

Program/code#			Class				
			2011	2010	2009	2008	2007
BSc	Earth Sciences – 1st year	595	44	33	35	48	36
	Geology	590	35	45	35	33	36
	Atmospheric Sciences	545	2	11	12	9	15
	Climate, Atmosphere and Oceanography (CAO)	547	8	12	11	7	5
	Minor in Oceanography	592	-	5	3	-	1
MSc	Geology	590	25	24	27	21	26
	Atmospheric Sciences	545	5	6	7	6	9
	Oceanography	592	1	3	5	6	1
PhD	Geology	590	19	17	19	20	16
	Atmospheric Sciences	545	8	9	7	6	9
	Oceanography	592	10	6	3	3	3

3.1.6. *Please provide in the format of a table, the number of graduates from the program 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 2b: Graduating students from the program in the last five years. All our students graduate with thesis.

Program/code#			Class				
			2011	2010	2009	2008	2007
BSc	Geology	590	13	8	17	19	9
	Atmospheric Sciences	545	6	3	5	6	5
	Climate, Atmosphere and Oceanography (CAO)	547	6	2	3	-	-
	Minor in Oceanography	592	0	0	0	0	0
MSc	Geology	590	2	9	7	4	7
	Atmospheric Sciences	545	2	0	4	4	4
	Oceanography	592	2	0	2	0	2
PhD	Geology	590	4	1	2	1	3
	Atmospheric Sciences	545	1	0	0	0	2
	Oceanography	592	1	0	0	0	1

3.2. The Study Program – Contents, Structure and Scope

3.2.1. *The name of the study program, specializations/tracks within the program, the campus where it is taught (if the institution operates on a number of campuses). If the study program is offered on more than one campus, is the level of the program uniform on different campuses, and what measures are taken in order to ensure this?*

The program is called *Earth Sciences*. It is comprised of two specializations: Geology and Climate, Atmosphere and Oceanography Sciences (CAOS). All first year students have the same curriculum, and at the end of the year they select their field of specialization. Students may study earth sciences either as a "single major", "single major with complementary studies" and "integrated dual major". We offer also a "complementary studies" track in one of the Earth Sciences fields (Geology, CAOS, Oceanography) for students majoring in other fields within the Faculty of Natural Sciences. Several students from other faculties (Humanities and Social Sciences) are enrolled in the "integrated dual major" program, these students have to study all the basic science courses according to the mandatory program for Earth Sciences students.

The minimum number of total credit points required for graduation at the Hebrew University is 134 (a credit point is the equivalent of 1 weekly hour of lecture during one semester, or two days of field trip, or ~1.3 days of field camp. This is calculated according to the load of the field work/lecture/laboratory work). The minimum requirement to graduate from one of the IES "single major" BSc program (Geology or CAOS) is 144 credits. The total number of credits of an undergraduate student enrolled in one of the other combinations ("single major with complementary studies" and "integrated dual major" and "minor") exceed this figure by about 10%. Due to conflicts in course schedules, such dual-major studies sometimes exceed the normal BSc duration (six semesters) by up to two semesters.

The following list summarizes the requirements in the various tracks detailed in Appendix 4.
1. *Single Major:* Minimum credits of basic studies: 58; Minimum credits within the program: 72.
2. *Single Major with Complementary Studies:* Minimum credits of basic studies: 58; Minimum credits within the program: 48.
3. *Integrated Dual Major:* Minimum credits of basic studies: 58; Minimum credits within the program: 48.

4. *Complementary Studies:* Minimum credits of basic studies: according to the major program; Minimum credits within the program: 32.

MSc graduate studies: The MSc program in Earth Sciences includes several curriculums: "Geology", "Atmospheric Sciences" and "Oceanography". In addition, one of our faculty members (Prof. Haim Gvirtzman) is heading the new inter-faculty graduate program in "Hydrology and Water Resources" and another faculty member (Prof. Yehouda Enzel) is heading the undergraduate and graduate intra-faculty programs in "Environmental Sciences". IES faculty members teach most of the courses in these two programs. Also, this year we are initiating a new program "Fossil Energy" – a specialization program within the MSc in Geology.

The MSc program accepts undergraduate students that finished their BSc with average grade of 85 or equivalent in one of the recognized universities. The students are obliged to contact with an advisor within the first two semesters. The studies committee evaluates and can accept students with lower BSc grades, ranging between 80 and 84.9. Earth Sciences students that specialized in Geology or CAOS (or equivalent) in one of the IES tracks: "single major", "single major with complementary studies" and "integrated dual major" (or equivalent programs in other universities) are accepted without any complementary courses. Student with insufficient background are accepted after fulfilling complementary courses (for which they receive no credits) as outlined by the teaching committee. Depending on the background of the student, the complementary studies may last up to four semesters (e.g., in the case of a Humanities student with no training in basic sciences). The MSc program requires studying courses of total 32 credits. The "Oceanography" program (and the new "Hydrology and Water Resources" program) has a mandatory core curriculum as part of the 32 credits. Students with minimum average BSc grade of 87-88 were eligible for appointment as teaching assistants (TA).

The MSc program is planned for four semesters (the time period allowed by the HUJI for appointing a TA). However many students manage to fulfill all their obligations (see below) after five to six semesters.

During their training the students have to fulfill the following requirements:
1. Submit a research proposal (10-15 pages) after two semesters and defend it in front of a committee (15% of the total grade).
2. Take courses equivalent to 32 credits within four semesters (40% of the total grade).
3. Conduct a research project and submit a final thesis (up to 100 pages) to the committee for grading (30% of the total grade).
4. Defend the thesis in a final exam (15% of the total grade).

PhD studies: The HUJI's Authority of Research Students has managed the PhD program in Earth Sciences (and all other programs at the HUJI) until last year. Starting this year we have been reviewing and accepting each PhD candidate by a special IES committee. The PhD program is conducted in the same curricular framework as described above for the MSc program, except that students with MSc have to take only 12 credits for their PhD studies.

The PhD program accepts students who finished their MSc with minimum average grade of 85 and a minimum MSc thesis grade of 85 (or equivalent in one of the recognized universities). Excellent MSc students (according to their grades and evaluation of their research progress) are encouraged after 2-3 semesters to move directly to the PhD program in a direct PhD track. These students receive MSc degree based on an extended report that they submit to their committees and a candidacy exam. The PhD program lasts for eight semesters (the time period allowed by the university to appoint a PhD TA); however, several students fulfill all their obligations after nine to ten semesters. The program includes 12 credits, but students with no sufficient background should complement their studies by taking additional courses with no credit. Each PhD student has an academic committee. The committee convenes 3-4 times during the PhD studies, where the first meeting is conducted in order to review the student's research proposal and approve it. There are 1-2 meetings for reviewing the interim reports and a final meeting for approving the thesis. Students who have published

at least one paper are permitted to defend their theses in front of an ad-hoc PhD approval committee (not the accompanying committee) that convenes at the university within two months after thesis submission. Otherwise, the PhD theses are sent for external review. Students that have at least two accepted papers are allowed to submit paper-based thesis for the external review.

The Earth Sciences program is being taught mainly at the Edmond J. Safra Campus (since the end of the 1960s). There are no parallel courses in the program either in Edmond Safra or any other campus. Program teachers are teaching concentrated courses (up to 10 days) at the Interuniversity Institute (IUI) for Marine Sciences, located in Eilat, and these courses are part of the program's undergraduate and/or graduate studies. Part of our new inter-faculty program in "Hydrology and Water Resources" is being taught at the Rehovot campus of the Faculty of Agriculture.

3.2.2. *Please provide in the format of* ***Table 1*** *(page 14) the structure of the study program, its content, and scope (years of study, semesters, hours per year and credits) and the distribution of the studies throughout the academic year. Does the study program supply courses to other units within the institution?*

The requested data is included in Appendix 4.

In addition to the courses listed in Appendix 4, we offer several general service courses. We offer an introduction to earth science course for Faculty of Sciences students (who do not major in any of the disciplines of earth science) in the Edmond J. Safra Campus, a geology course in the Faculty of Agriculture in the Rehovot Campus, and courses for the Faculties of Social Sciences and Humanities (mainly within the "*Corner Stones*" program) in the Mount Scopus Campus. We teach also Interuniversity courses in the campus of the Interuniversity Institute for Marine Sciences in Eilat (IUI). Undergraduate and graduate students from all research universities in Israel take these courses (including the School of Marine Sciences at the Ruppin College).

There are several introductory courses in Earth Sciences; they are given by different teachers in various levels according to students' background. The best example is introductory geology that is given for first year earth sciences students under the name "*Dynamic Earth*". The main subjects of this topic are being taught in service courses in Edmond Safra campus to all science students (Introduction to Earth Sciences); to Faculty of Agriculture students in the Rehovot campus (Introduction to Geology for Agriculture Students); and to Mount Scopus Geography students (Introduction to Earth Sciences). The list of service courses is given in Table 3.

Table 3: Service courses.

	Course Title	**Credits**	**Teaching Staff**
70135	Introduction to Geology	4	Prof. Oded Navon
70150	Introduction to Earth Sciences – basic level	3	Prof. Yigal Erel
89106	Introduction to Earth Sciences – comprehensive level	5	Prof. Yigal Erel
70160	Introduction to Geology for Agriculture Students	4	Prof. Alan Matthews
70519	The Ocean in the Global System	2	Prof. Boaz Luz
70572	Rock Tales: Planet Earth and Us	2.5	Prof. Oded Navon
70580	Earthquakes and Tsunami in History	2	Prof. Amotz Agnon Prof Ronnie Ellenblum
82508	Climatic Change	2	Prof. Daniel Rosenfeld
89309	Introfuction to Environmental Sciences	3	Prof. Yigal Erel

3.2.3. *Specify what bodies are responsible for the planning and managing of the study program. What are the mechanisms responsible for introducing changes and updating the study program, and how do they operate. If fundamental changes have been introduced into the study program during the last five years, please specify what they are.*

The Earth Sciences curriculum is managed directly by the Head of Studies and the Heads of undergraduate specializations and MSc curriculums. The Head of Studies is responsible also for managing the specialization of his field (the present Head of Studies is also responsible for the Geology specialization). A general assembly of the Earth Sciences curriculum convenes once each semester and on specific occasions for reports, discussions, reviewing and updating the teaching program. *Ad hoc* committees are appointed for specific tasks. For example, we nominated a committee for integrating the courses given on numerical methods (used to be separated for atmospheric sciences and geology) into one course given by two teachers.

Two major changes were introduced during the last years. The first was integrating the separate BSc curriculums in Atmospheric Sciences and Geology into one BSc curriculum in Earth Sciences with two concentrations in Geology and CAOS and a minor program in Oceanography. The second was a comprehensive revision of the first year studies by forming a unified Earth Sciences program containing eight core courses in basic sciences (mathematics, physics, chemistry, and programming, two courses in each subject). Specific exercise groups for earth Sciences students were given in physics and chemistry and the chemistry laboratory. The syllabus of the second programming course ("Matlab") was planned according to the specific requests of Earth Sciences teachers. Five introductory earth sciences courses were selected to expose the students to the diverse field of earth sciences: "*Introduction to Climate*", "*Dynamic Earth*", "*The Earth as a Planet* (introduction to the planetary astronomy)", "*Introduction to Oceanography*" and "*Geology in the Negev* (the first geological field trip)". The courses in "Mineralogy" and "Dynamic Meteorology" were moved to the second year. At the end of the first year student are selecting their field of specialization. In addition, several courses in the second and third years were selected as mandatory for all Earth Sciences students.

Several small changes were introduced during the last five years, the most important are: Additional mathematics training is given to all Earth Science BSc students during the second year (2-credit course "*Introduction to Earth Science Modeling*"). This course is planned to expand to 3 credits in the near future. First year students receive tutoring in all basic sciences (e.g., mathematics, physics, chemistry) by Earth Sciences TAs. The amount of elective courses in the undergraduate program was drastically reduced and is not available in the "single major with complementary studies", "integrated dual major" programs. Third year students are obliged to attend the IES seminar. Courses in Social Sciences and Humanities became mandatory as part of the "Corner Stones" program. Most importantly, a new inter-faculty graduate program in "Hydrology and Water Resources" was formed, CAOS (see section 3.1.2) was established, and this year we are initiating the Fossil Energy program within MSc in Geology.

3.2.4. *Describe the mechanism for coordinating and examining the contents that are, in fact, being taught, if such a mechanism exists.*

There is no formal apparatus for systematic review of the teaching material. Courses reviews are discussed during Earth Sciences curriculum meetings. Critics and reviews of courses are solicited from the students during meetings conducted by the IES Head and all programs heads. These meeting are conducted each semester in three separate groups: first year BSc students, second and third year BSc students and graduate students (and TAs). The information is passed on to the relevant teacher/TA for consideration.

3.2.5. *Are additional non-academic bodies involved in the running and the activities of the parent unit and study program? If so, what are these bodies and what is the mutual relationship between them and the leadership of the parent unit (for instance, the mutual relationship between the Business School and the Manufacturers' Association or Industrial Factories)?*

There are very close relationships with the Geological Survey of Israel (GSI) that is located in close proximity to the IES. Undergraduate Earth Sciences students find jobs as research assistances at the GSI. The work exposes them already in early stages of their university studies to research in Earth sciences. The GSI provides stipends to some of the graduate students that conduct part of their research at the GSI. GSI scientists participate also in joint advising (with IES faculty members) graduate students of the Earth Sciences program. Several GSI research scientists participate as outside teachers in the Earth Sciences program. One GSI research scientist (Prof. Mordechai Stein who is teaching three courses in the program) received recently an adjunct professorship at the HUJI. We hope to open a second appointment procedure for another GSI scientist, Dr. Zohar Gvirtzman who teaches a mandatory course in "Stratigraphy". Most of the GSI's research scientists are graduates of our program.

Several graduate students are receiving stipends from the Israeli Water Commission (Ministry of Infrastructure) because their research projects have aspects relevant to Israel water resources. Every year, the Water Commission is funding the research projects of several graduate students in the program. Special grants were also received for graduate research projects from Mekorot, the national water company of Israel. Several research and administrative positions in these bodies are held by graduates of our program.

3.2.6. *What are the future development plans of the evaluated study program, and how were they decided upon?*

We are opening a new graduate program for "Fossil Energy" this year within the Geology MSc curriculum. The program is headed by Prof. Einat Aharonov with the help of several faculty members. The final structure of the program will be decided during this school year by the faculty of the Geology Curriculum. After finalizing the program we will seek the university approval as a separate graduate program. Part of the teachers in this program will come from the oil, gas and oil shale industry and geophysical prospecting companies. Decisions about future developments are made in our Faculty meetings.

3.2.7. *In summary, to what extent has the program achieved its mission and goals? What are its strengths and weakness?*

The Earth Sciences program achieved most of the goals described above. The best evidence for that is that our former students are on the faculty of all Israeli universities and first class universities abroad. Our graduates have positions in major research institutions, government, NGO's and industry (see partial list in section 3.4.2.d below and in Appendix 5).

Main strengths:

- We offer the richest teaching program in Israel in the broad field of earth sciences; for example, our Earth Sciences program is currently the only one in Israel offering graduate studies in Oceanography and undergraduate studies in CAOS.
- Our open and informal teaching atmosphere provides the students with fast and easy access to all the teaching staff regarding a broad range of matters – from consulting to complaining.
- We see a substantial increase of enrolment to our undergraduate and graduate programs during the last years (including the current school year of 2012).

- A very high percentage of our graduate students (about 40%) continue on toward higher degrees.
- Graduates of IES programs comprise an important part of the academic and research staff in all institutions of higher education and major research institutes in Israel and in first-class universities abroad.

Main weaknesses:

- The large dropout between the first and second years of the undergraduate studies. We hope that the tutoring system in basic sciences, which we offer to our first year undergraduates, will reduce the dropout.
- There is a continuous movement away from the traditional bell-shaped grading curve which leads to an inflation in BSc and MSc grades. This problem is observed also in other programs in the Faculty and at the HUJI and is probably the result of the pressure to receive teaching assistantships and stipends. It is possible that the open atmosphere in the institute contributes to this problem as well. We already started addressing this problem by toughening the MSc final exams and toughening the standards of thesis reviewing. We plan a gradual decrease in grades over several years to "acclimate" the students and reduce their expectations. Such toughening may reduce the number of candidates for the program but will definitely increase its prestige and will help in attracting the best students.

3.3. Teaching and Learning Outcomes

3.3.1. *What steps are taken in order to evaluate teaching and improving teaching? How are the results of these activities used, specifically, the negative findings about staff members' teaching? Does the unit act in order to locate and encourage excellent teachers? Does the unit or the institution offer the teaching staff regular and systematic activity, including courses/in-service training/instruction and guidance programs in order to improve the quality of teaching? Do new staff members receive special support?*

The university performs a thorough survey of each course and issue a report at the end of each semester. A few years ago the written evaluation report given to students at HUJI was replaced by *on-line* questionnaires. Despite the fact that on-line questionnaires are easier to fill up, student participation has decreased, especially for courses with multiple lecturers. Due to this reason we think that the questionnaires tend to over-represent students that were either particularly happy, or particularly unhappy with the course.

The results of these surveys are sent to the lecturers and are also checked by the head of the teaching program. In a case of severe criticism by the students, the head of the program meets the teacher in question to discuss the students' remarks and possible means to alleviate the problems. Results of surveys are supposed to be posted on the website as part of the site of the course. This will be implemented in the near future. Top teachers are listed in the faculty web-site and their names are posted in several locations on campus. This list includes typically 1-2 IES faculty members each year. The teaching surveys play an important role in assigning courses to the faculty members and TAs (some teachers are more suitable to certain types of courses). Teaching evaluation reports of faculty member coming up for promotion/tenure are requested by the Faculty and the HUJI. The decisions of the Promotion and Tenure Committee (Faculty/University level) are very much influenced by negative reports on teaching.

A summary for the school years 2007, 2009, 2010 and 2011 is given in Table 4 (excluding the faculty strike year 2008 in which evaluation questioner was not conducted).
Still, the most rapid and efficient feedback system for evaluating teaching and identify problems is the informal meetings of the program heads with separate student groups during each semester (mentioned in section 3.2.4. above). Furthermore, the open students/teachers relations that characterize the IES and the free atmosphere encourage students to discuss their

critics with the secretary of studies and the head of the studies program. These pathways are by far the best as they address the problem in real time. Rarely these meetings lead to the replacement of a teacher or TA and even in one occasion expelling a TA.

During the last two years we are offering a teaching workshop for all new teachers and TA's. The one-day workshops are provided by the University's Continuing Education Program and Professional Development Department, School of Education and the interested teaching programs. They are sponsored by the Faculty. The workshops concentrate on five major subjects:

1. Improving frontal teaching by designing lecture structure and using dynamic elements.
2. Avoiding unnecessary conflicts with students by setting clear demands and exercises and demonstrating common goals for students and teachers.
3. Excellence encouragement and efficient use of advisory time to lower first year drop-out extent.
4. Sensing the "pulse" of the class and identifying individuals that contribute or disturb teaching.
5. Planning the course. Planning the whole process, from a single lecture to a complete course program, including tasks.

During the next several years we make sure that all faculty members will participate in these workshops.

3.3.2. *Please provide in the format of Table 4 (page 18) as an appendix to the report, the rankings of the courses as found in the results of the teaching surveys given by the program in the last 5 years (those of faculty members and those of adjuncts). Please divide the information by obligatory courses, elective courses, seminars, and labs/workshops. If the program is using other methods of evaluation, please specify them.*

The Faculty of Natural Sciences could not provide the needed information that enables producing Table 4 in the format requested at the section heading. Thus, we submit a much shorter version of Table 4 as part of the report itself.

Table 4: Average Score of Teaching Surveys in the Last 5 Years, Institute of Earth Sciences, Range of scores: 1-22.5

Academic Year	Average Score for Course				Average Score for Teacher			
	1st semester		2nd semester		1st semester		2nd semester	
	Mean	N. of courses	Mean	N. of courses	Mean	N. of courses	Mean	N. of courses
2011	15.88	33	-	-	16.07	33	-	-
2010	15.34	38	15.34	31	15.66	38	16.53	31
2009	17.25	24	14.71	18	16.90	24	16.07	18
2007	16.85	28	16.15	30	17.00	28	16.56	30

In 2008 the teaching survey was not conducted due to a strike of the academic staff.

3.3.3. *Describe the use of information technology in teaching and learning: methods, scope types of course etc*.

Up to this year we were using the "Owl" e-learning portal (http://owl.huji.ac.il/) which during coming school year is about to be fully replaced by "Moodle": (http://moodle.huji.ac.il/nu08/course/category.php?id=2). Currently both portals are working in parallel. Some courses use, general e-mail service and free online storage spaces (e.g., drpobox: https://www.dropbox.com) and private homepages (on institute's website) for posting students' learning material. Each course site offers course material developed by the Hebrew University staff and by the teacher. The sites may include lecture notes, lecture presentations, complementary material and suggested web sites, additional reading papers not covered in the lecture, weekly exercise assignments and answers, practice exams, notes for the students and final exams.

The students receive from the university a free access to many e-journals and databases. These resources can be accessed from the campus as well as from dormitories or home. The student union operates its own academic bank, which contains lecture notes, exams etc. (http://aguda.org.il/abank/16). This bank is constantly updated and includes already more than hundred files related to the Earth Sciences program.

3.3.4. Learning Outcomes

3.3.4.1. What are the program's intended Learning Outcomes (LO)? How were they set?

The knowledge, skills, and abilities that our students attained in the Earth Sciences program (the learning outcome, LO) evolved over the years as a product of the tremendous development in the field in general and the scientific development of the IES within the HUJI in particular. The LO vary for undergraduate and graduate students. We think that an Earth Sciences undergraduate student should have a good training in basic sciences and a basic understanding of his/her field of specialization and the Earth as a dynamic system. The undergraduate studies were planned to be comprehensive enough to allow our graduates to succeed in graduate studies in any first class university. We believe that the understanding approach that is "behind" our teaching program is an advantage for any student that wants to go out on the free job market. We think that for this reason our BSc and MSc graduates can be found in the best graduate schools around the world as well as in seemingly non-relevant positions such as the high tech material industry, computer systems analysis, forensic laboratories, etc. The graduate programs are much more specific and rely on close tutoring by the advisors in order to improve the research skills of the student.

As mentioned above, the LO is a natural evolution stemming from the general views of the teachers on the important issues in the field, and the developments in earth sciences. We discuss these issues in our faculty meetings, and by our teaching committee (see 3.1.4).

3.3.4.2. Describe the methods applied to measure Learning Outcomes according to the following:

3.3.4.2.1. Examinations

a. *Describe the method of examinations and their character, the relative weight of each type of examination in the final grade (written/oral/open/multiple-choice etc.).*

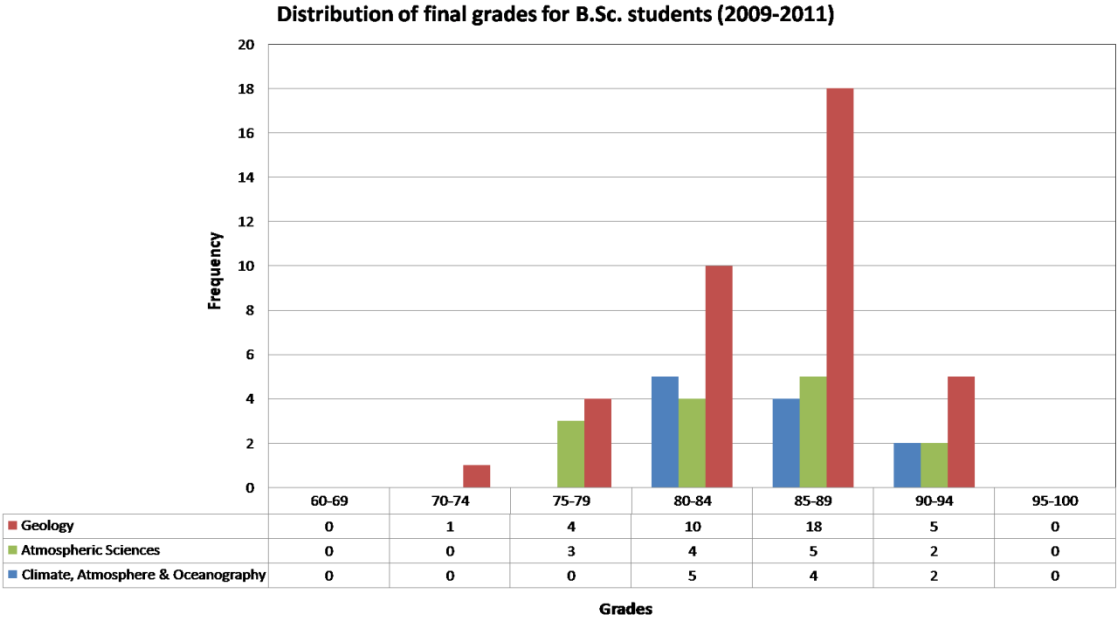
We use all types of exams depending on the nature of the course. Written exams are the most abundant type of examination. Typically, the final exam counts for 80-90% of the course grade and the exercises and/or midterm for 10-20%. Multiple-choice exams are used mainly in our service courses where large number of students is enrolled. Several courses use mixed written/multiple-choice method of examination. The final exams of graduate students are always oral. Orals are also used to grade students that missed their official schedules due to reserve service or sickness. Take-home exams are given in few courses. These exams are much harder than the regular exams and demand reading of new material, understanding it and performing quantitative tasks. Field camps often require multiple types of exanimations, written or multiple-choice, written reports, and presentations. Laboratory course is graded by

averaging the grades of all the laboratory reports. In multiple type examinations, the weight of each part is determined by the teachers, according to the efforts in fulfilling them.

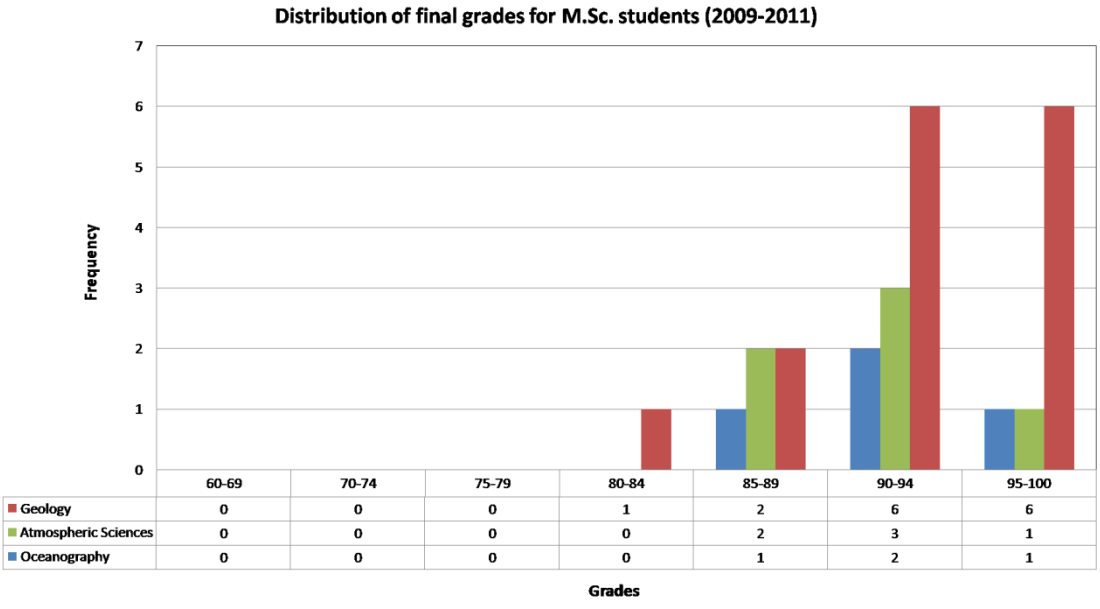
b. Who constructs the examinations and how is the validity of the examinations assessed?

The teachers with the help of the TAs are responsible for constructing the exams. There is no independent way for checking the validity of the exams. The rare students' complains are reviewed very carefully by the teacher and head of studies. For example, an ambiguous answer in a multiple-choice exam is usually explained and corrected by the teacher (after student's question) already during the exam.

c. Please provide in the format of a histogram how the final grades are distributed in all study programs and all degree levels in the last 3 years.



	60-69	70-74	75-79	80-84	85-89	90-94	95-100
Geology	0	1	4	10	18	5	0
Atmospheric Sciences	0	0	3	4	5	2	0
Climate, Atmosphere & Oceanography	0	0	0	5	4	2	0



	60-69	70-74	75-79	80-84	85-89	90-94	95-100
Geology	0	0	0	1	2	6	6
Atmospheric Sciences	0	0	0	0	2	3	1
Oceanography	0	0	0	0	1	2	1

d. If the relevant information is available, please present (in the format of histogram) the distribution of the overall average grade

of the graduates (not including the grade of the thesis for the second degree) for each of the last three years.

The relevant information could not be obtained from the Faculty and therefore not presented.

3.3.4.2.2. Written assignments (projects, thesis, dissertations)

a. *Describe the types of written assignments and other projects required in the program, their contents and scope (seminar papers, degree papers, thesis, training period, practical training etc).*

Written assignments (not homework problems) are quite common in the program either in advanced undergraduate years or graduate courses. The BSc and MSc seminars require an oral lecture and a submission of an abstract of the presentation. The first part of the BSc seminar course is aimed to teach the students how to construct a lecture and a written report. All field camps require submission of written reports, which summarize the findings of the students. The laboratory course requires a written report after every laboratory. The third year courses "Supervised Research" and "Supervised Research for Excellent Students" require a submission of a 10 pages thesis on the research subject. The MSc and PhD theses are always independently written compositions that may contain also chapters consisting of submitted and/or accepted and/or published papers in professional journals. Examples of PhD and MSc theses are in Appendix 6.

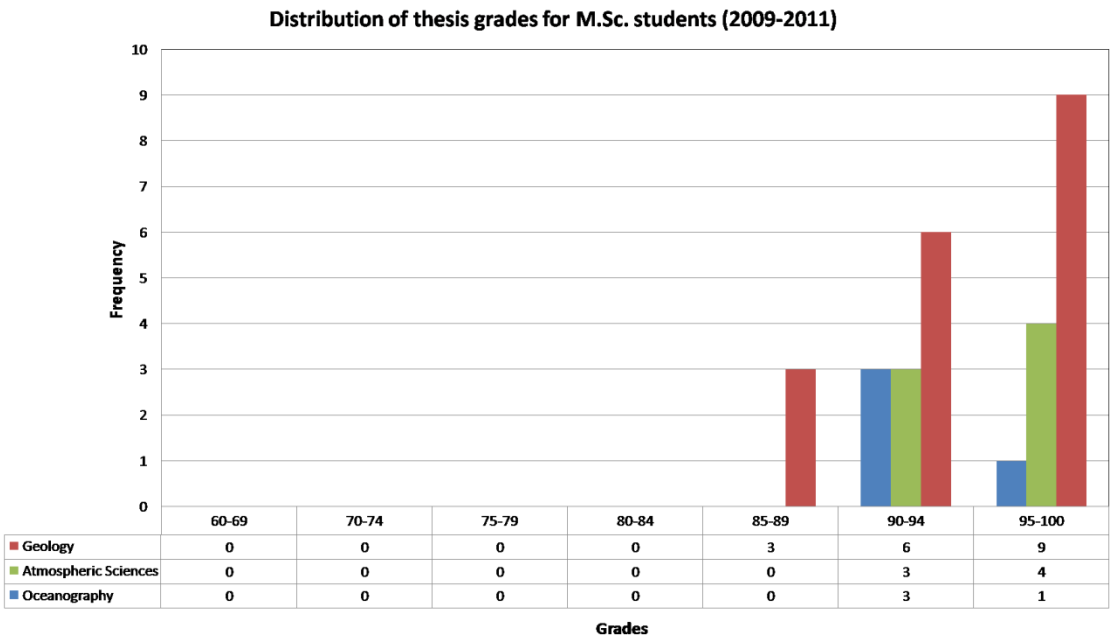
b. *Who constructs the assignments and how is the validity of the assignments assessed?*

The teachers are responsible for constructing the written assignments and train the students how to fulfill these assignments. The general structure of the written assignments is discussed in curriculum meetings and small group-discussions of relevant teachers. There is no central body that checks the validity of every written assignment.

c. *What are the methods applied to evaluate written assignments and projects? What kind of feedback, apart from the grade, is given to the students in relation to these assignments and projects?*

Most written assignments are evaluated both by the teachers and the TAs. Generally, we allow students to improve their assignment. Therefore, following the initial submission of the assignment, students who show poor performance are informed about their errors and the need to correct their assignments within an accepted time period (about a week). The final grade is given after submission of the corrected assignment. In courses that require a submission of a written assignment prior to giving a lecture, the assignments are being discussed during the student's seminar in front of the whole class.

d. *What is the average grade given to the graduates of the program in the final project/final seminar/thesis in each of the last three years? Please present (in the format of histogram) the grades distribution of the final project/final seminar/thesis.*



3.3.4.3. Please specify the number of graduates who graduated with honors.

We have no official honors system as common in USA universities for BSc students (mentioning in the graduation certificate students who conducted an undergraduate thesis). The Earth Sciences program has its internal honors system intended for student who are taking during their third year one of the courses: "Supervised Research" or "Supervised Research for Excellent Students". This course requires conducting a small research project and submitting a small thesis (about 10 pages) on the research project. One to three students take this course every year and sometimes their research becomes a part of a professional paper of which the student is a co-author. In Table 5 we listed the number of excellent students that graduated from the program.

Table 5: Number of graduates with distinction (2009 – 2011)

Program		magna cum laude (with honors)	summa cum laude (highest honor)
BSc	Geology	**2**	**0**
	Atmospheric Sciences	**0**	**0**
	Climate, Atmosphere & Oceanography	**1**	**0**
MSc	Geology	**8**	**0**
	Atmospheric Sciences	**1**	**0**
	Oceanography	**2**	**0**

3.3.4.4. *<u>Other</u> - any other methods applied to measure the achievements of the students used by the institution*.

In field camps the teachers and TAs also evaluate students according to their general performance during the camp (the way they conduct field measurements, use field equipment, etc.). This evaluation makes up to 10% of the grade.

3.3.5. *In summary, to what extent have the methods applied to measure the teaching and learning outcomes achieved their goals? Do you think that the intended LO were achieved by the students?*

We think that the measuring methods are adequate for measuring the LO. As mentioned above, we feel that the average grades are too high and we started already to reduce the average grade in the MSc program. We hope to continue with this effort by toughening the standards of checking all written exams in the program. We think that this will increase the prestige of the program but may reduce the number of applicants that have substantially increased in recent years. In summary, it appears that the intended learning outcomes were achieved by the program's serious students who invest the time in fulfilling all their assignments.

3.4. Students

3.4.1. *Please provide in the form of a table the number of students enrolled in the program (on all levels) over the past 5 years.*

This information was presented in section 3.1.5.

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

Admittance to the first year: A student is admitted to the first year of the program if his or her "admittance grade" (which is a number calculated from the matriculation average and the national psychometric exam grade, on a 50% - 50% basis) is above a certain "admission threshold" (in case of Earth Sciences this number varies over the years and is now about 18.75 out of 26). Setting the admission criterion and selecting the students is the responsibility of a central administrative unit at the university - the Authority for Students Admission - and not the teaching unit. The admission threshold is determined so as to achieve a target number of students admitted each year. In the case of Earth Science it is about 50 people. Since Earth Sciences is not a very popular discipline, the admission criterion to the program is one of the lowest in the Faculty of Natural Sciences (similar to physics and mathematics). The small enrollment is because the program attracts only a special type of people, those with special affection for nature, curiosity to understand natural processes and environmental awareness. Most of the candidates the HUJI are looking for a study program that provides them with profitable high/bio-tech jobs. In spite of all these, we have been witnessing an increase in the number of first year BSc students in IES, from 30+ in 2007-2010 (w/ one exception in 2008) to 44 in 2011 (Table 2) and to 52 this year.

Admittance to graduate studies: Generally, the number of MSc and PhD students in Earth Sciences is quite high as compared to BSc students and make up about 30-40% of the total students in the program. This is because many students feel that the BSc studies provide just the very basis and one needs at least MSc in order to become a professional earth scientist.

The MSc program: A student is admitted to the MSc program after the head of the curriculum reviewed his/her file that had arrived from the Faculty office. The average requirement for admission is and average BSc grade of 85 (or equivalent in one of the recognized universities). The files of students with average grade between 80 and 85 are reviewed by the teaching committee and they need to supply a recommendation letter from their potential advisor/s. Excellent MSc students (based on course grades and evaluation by their advisor) are encouraged to move directly to the PhD program after 2-3 semesters. These students receive MSc degree on the basis of an extended report that they submit to their committees and the results of their candidacy exam.

The PhD program: The HUJI Authority of Research Students had managed the PhD program in Earth Sciences (and all other programs in the Faculty) up to very recently. Starting this year we have started to review each PhD candidate by a special IES committee. In order to be admitted, the student needs a minimum MSc grade of 85 and a minimum thesis grade of 85.

Students without sufficient background in the field of earth sciences but with suitable grades are accepted "on probation" for complementary studies (with no credits) that last up to

4 semesters, depending on the needs.

Please submit data concerning the number of applicants, admitted students, and enrolled students in the program in the last five years (divided by degree).
a. The number of candidates that applied to the program, the number of admitted students, the number of students that began their studies, and the number of students that completed their studies, including those admitted "on probation".

Table 6: Statistics of applicants, admittance, and starting students separated by degree and year. For number of students that completed their studies – see Table 2a.

Degree	Program		Class				
			2011	2010	2009	2008	2007
BSc First year	595	Applicants	169	145	178	183	183
		Admitted*	71	67	72	101	78
		Started	44	32	33	51	35
MSc First year	590	Applicants	11	11	13	10	10
		Admitted*	7	8	8	4	5
		Started	7	8	7	3	4
	592	Applicants	4	6	3	13	9
		Admitted*	1	1	1	4	0
		Started	1		1	3	0
	545	Applicants	4	6	7	4	7
		Admitted*	3	2	4	1	4
		Started	2	1	3	1	3

*Admitted group includes applicants who requested the program in a lower priority and later were accepted to the program they requested in higher priority.

*b. What are the **de facto** admission criteria for the program? If there is a discrepancy between the admission criteria and the de facto admission data please specify.*

According to the table in item c below, the *de facto* admissions criteria (student that actually started their studies as compared to students that were accepted to the program) during 2007, 2009 and 2010 were lower than the admission criteria of the accepted students. The discrepancy was reversed during 2008 and 2011, in which the admission criteria of the starting students were higher than the admission criteria of the accepted students. It seems that it is correlated with the number of candidates. The higher the number of candidates, the higher the admission criteria of the starting students. The 2012 school year (not reported here) show the same trend as the school year 2011. It seems that the relative popularity of the program in the last two years brings better students that are selecting the Earth Sciences program as their first (or second) choice.

Additional notes regarding acceptance to the program:
1. Applicants with a high matriculation average grade can be accepted directly and are not obligated to take the psychometric exam.
2. The final score of the pre-academic "*Mechina*" program (the university's preparatory program) as well as earlier academic grades are used as alternative for matriculation to calculate the overall "admittance grade" (together with the psychometric grade).
3. New immigrants without Israeli matriculation are accepted based on their psychometric score or a foreign alternative.

c. *In the format of a histogram, please present the range of psychometric test scores or the equivalent as well as the range of matriculation averages of the students that were admitted to the program in the last five years.*

The data was supplied by the Authority of Admissions: The psychometric test scores and matriculation averages statistics for students admitted and that began their studies. We think that this format is better than a histogram.

Table 7: Psychometric test scores

			Class				
			2011 (תשע"א)	2010 (תש"ע)	2009 (תשס"ט)	2008 (תשס"ח)	2007 (תשס"ז)
Admitted students	Matriculation	Mean	10.21	10.15	10.10	9.97	9.93
		Standard deviation	0.58	0.67	0.63	0.57	0.73
		Number	63	59	67	85	70
	Psychometric	Mean	646.9	668.7	660.1	646.3	646.7
		Standard deviation	58.0	57.0	52.0	56.0	53.2
		Number	67	60	66	95	77
Students who started their studies	Matriculation	Mean	10.24	9.96	9.81	9.96	9.77
		Standard deviation	0.58	0.65	0.61	0.55	0.84
		Number	40	26	30	43	31
	Psychometric	Mean	651.9	654.1	657.1	647.0	640.4
		Standard deviation	62.0	55.5	42.6	64.1	55.9
		Number	42	27	29	47	35

d. Data regarding the alumni of the programs (in all levels): E.g., the number of students who continued on to advanced studies, employment data.

We do not keep detailed records on the employment history of our graduates. In the last decade about 40% of the BSc graduates continued to MSc studies and more than half of them continued to PhD. Our graduates hold academic and research positions in all research universities in Israel and as well as in research institutions in Israel and abroad. As an example for the employment data we provide in Appendix 5 a partial list of more than 100 alumni of our graduate program that are still active.

3.4.3. *Describe the selection and admission process, the criteria of advancement from year to year and for completion of the studies, including the requirements for being entitled to receive an academic degree. Is there a policy of affirmative action and standards for the admittance of candidates with special needs? In case such policy and standards have been established, please describe them. How are the admission criteria decided upon, and to what extent are the criteria and procedures for admission related to the aims of the program? What have been the lowest admission data (psychometric score and matriculation grades) for the program?*

The basis of the admittance process for the undergraduate and graduate programs was described in section 3.4.2. Below, are detailed several additions not described above.

The basic requirements for admittance to the first year are:

1. Matriculation scores.
2. Psychometric exam score. Both scores should yield a combined score of 18.75 out of 26.

3. Good knowledge of English (it was level 3 for 2008-2009 and level 2 from 2009-onwards).
4. Good knowledge of Hebrew- A minimum level is set for students that attended non-Hebrew language high-school.

Direct Admittance: Admittance without calculating the "admission criterion" (weighing the matriculation and psychometric exams). Candidates with an Israeli academic degree recognized by the Council for Higher Education with a high matriculation grade can be accepted solely based on this criterion. Alternatively, candidates with a high psychometric grade can be accepted solely based on this criterion (provided they are eligible for matriculation).

Program selection procedure: Every candidate is allowed to select four programs and arrange them by order of preference. The sorting process is conducted according to the selected order. If the candidate stated Earth Sciences as the first choice and was accepted, other choices are not considers (unless the request was for a "Dual Major Program"). If the candidate was not accepted to the first choice, the second choice is examined, and so on. If the candidate has been accepted to the second choice, and is accepted later to his/her first choice, then the admittance to the second choice is cancelled, and so on. Hence, there are probably candidates that were accepted to the Earth Sciences program at an early stage, but dropped at a later stage because they were accepted to their higher preference.

Affirmative action and responsibility for admission criteria: Since 2002, the HUJI has a channel of affirmative action for all the programs. Candidates fitting the criteria of the Association for Promotion of Education can be admitted to the program with an admittance grade somewhat lower than the official one, according to the number of places allocated to such candidates. Since the admission to the program is decided by a central university authority and not by the IES, we have no influence on the policy of affirmative action for acceptance of students.

Advancement from year to year and graduation: A student may pass from first year to the second if he/she has completed the obligatory courses with better than a passing grade (55) and has a grade point average above 60. Exceptions are allowed.

A student can graduate the Earth Sciences program if he/she has successfully passed all the obligatory courses and satisfied the overall course hour requirements, and have a grade point average over 60.

Relevance of the admission criteria: We have noticed that the high average of matriculation grades of the starting students stand in sharp contrast to their overall weak background, and poor working habits, as witnessed by first year teachers and TAs. This raises serious doubts about the value of the matriculation exams as an indicator for the student's performance and knowledge.

3.4.4. *What are 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 is no official policy of affirmative action for transfer from year to year, and *de facto* there is a rather liberal attitude towards students who drag their studies due to insufficient background, bad performance (e.g., requirement to re-take a course after failure) and/or personal or economic problems. It should be noted however that there is no compromise on the academic standards and the requirements for graduation. It is obvious that not all students benefit from the liberal attitude, since sometimes a weak student leaves the program without receiving a degree after 4-5 years of frustrating attempts.

3.4.5. *What is the yearly drop-out rate of students from the program over the last five years, and what are the reasons for their leaving (academic/financial/other)? Is there satisfaction with the drop-out rate? If not, what steps does the unit take in order to prevent, reduce or increase drop-out?*

The data in sections 3.1.5. and 3.1.6. show that the largest dropout of students occurs after the first year. The average dropout rate is 25%; however, the huge standard deviation shows that dropout may reach up to 50%. The small number of students and lack of long-term data, prevent a better assessment of these numbers. From personal conversations with the students we feel that the main reason for the dropout is unrealistic expectations regarding the program's outcome and the relatively high requirements for passing the basic science courses in the program. Many students perceive the program from a "naturalist" idealized point of view (the beauty of nature, field trips etc.). They are not aware that modern earth sciences require a solid background in all basic sciences; and that just three days of field trips (which we consider crucial for the education) are sufficient during the first year, which is devoted to basic sciences. The high demands during the first year and the high course burden deter these students that usually "suffer" also from insufficient scientific background. Another reason for student dropout is the realization of some of the students that they are not interested in earth sciences and transfer to other fields (if their first year grades permit). There is also a small group of students that were not admitted into their first choices (they had a lower "admission criterion" than needed) and used the first year in the Earth Science program to obtain a high course average grade and transfer to their original first choice.

In order to reduce the dropout rate we formed three years ago a tutoring service for the first year students. As explained below, we appointed three TAs to help the students in the exercises and unclear issues in basic sciences (mathematics, physics, and chemistry). Students report that this service has helped them to alleviate their first "shock" encountering the basic sciences. It seems that the total dropout rate during the last three years was lower than the average, about 20%. We are closely monitoring this counseling system in order to evaluate its achievements and needs for change.

3.4.6. *To what extent are the program's students involved in research projects of the staff members? Specify in which projects, the number of students involved and the scope of their involvement. Is there a procedure for encouraging students to carry out independent research of their own?*

Senior students are encouraged to participate in a "Supervised Research Project" and "Supervised Research for Excellent Students" for three and four credits, respectively (resembling the "honors" system in USA universities). Students taking this course are conducting, during the third year, a small research project under the supervision of a faculty member. The participating student summarizes the finding in a small thesis (about 10 pages), which is graded by the advisor. One to three students take this course every year. Such project may sometimes become a part of a professional paper of which the student is a co-author. Students benefit from the close contacts and scientific discussions with the supervisor and from the work in the field/laboratory. Faculty members use these courses as low-cost feasibility studies of "high risk" type research projects that they would not do with a regular graduate student.

Another way for a student to participate in an active research and to earn some money is to work in the IES or the Geological Survey as a research assistants. Ten to fifteen students from all years are working as research assistants every year. Occasionally, these research projects are developed into graduate thesis. The difference between research assistantship and the supervised research projects is that research assistants are usually functioning as laboratory/field technicians, and generally are not required to show an in-depth theoretical understanding of the subject.

We think that establishing an "Honors" system in the faculty, in which the undergraduate research project will be cited in the BSc certificate, would attract many more students to participate in active research during their undergraduate studies.

3.4.7. Counseling systems:

3.4.7.1. *Describe the system of academic counseling for students before and during the period of study (including reference to the*

structuring and approval of the study curriculum). Do students with special needs receive special support? If so, please specify.

The open students/faculty relations in our institute encourage the students to directly approach their teachers (senior faculty members and TAs) for counseling. This is usually conducted every day on a need-basis, after setting an appointment, and not in specific weekly hours. Generally, the time needed to set an appointment with a faculty member or a TA is 1-2 days, and many times the student just walk-in to the office and asks a question or seeks clarification. In addition, during the last three years we have been appointing three tutors for first year Earth Sciences students. The tutors help the students in the exercises and unclear issues in the lectures of their basic sciences (mathematics, physics and chemistry). This tutoring was given in order to reduce the dropout between the first and the second years. There is no special support for special-need students because the counseling in our program is usually accessible for all students.

Students with special needs:

There are a number of facilities available for HUJI students with special needs. A description of them is available for students on the web (HUJI homepage http://www.huji.ac.il/ and click on Information for Students – Dean of Students Office or direct link: http://studean.huji.ac.il). A detailed list of these facilities follows.

Students with physical disabilities:

In 2003 the HUJI began implementing a long-range plan to render all campuses accessible to students with physical disabilities. Construction has now been completed on the Mt. Scopus campus, where appropriate pathways and elevators have been added to accommodate wheelchairs and enable handicapped students access to public facilities, lecture halls, seminar rooms, laboratories, computer facilities, libraries, toilet facilities, cafeterias, etc. The plan will be extended to other campuses when funds become available.

Students with learning disabilities:

Professional personnel provide individual and group counselling and tutoring for students with various types of learning disabilities. The HUJI provides a unique learning environment, which is aimed at helping learning-disabled students maximize their academic achievements.

Blind students and students with impaired vision:

The HUJI houses a unique study center for blind students and students with impaired vision. The center provides sophisticated instrumentation, including an audio library and specially-designed computers which are available both at the center and on long-term loans for home and classroom use. All computer facilities are equipped with special software programs. Private tutoring is available both for academic needs and orientation around the campus. Students are examined in the study center with the help of enlarged questionnaires and reades.

Students with hearing disabilities:

Special audio equipment is available for long-term loan. If needed, tutors, photocopies of study material, and other aids are provided.

Psychological counselling:

Counselling by experienced personnel is available on all campuses for Hebrew University students requiring help with personal crises.

Students on reserve duty:

Students called up for reserve military service during the academic year are provided with assistance to bridge the gap caused by missed class hours (flexibility regarding deadlines, authorization for additional dates for examinations, and coupons for photocopying class notes).

3.4.7.2. Are counseling and assistance provided to students with regard to possible directions for their future professional careers? If so, describe these procedures. Are there work placement services for the graduates? If so, please describe this activity.

There is no mechanism in the IES for help in job hunting. However, companies that have openings in Earth Sciences (e.g., prospecting, environmental assessment, well sitting, etc.) are advertizing on the Institute's board, on the website of the geological society, and/or approach the secretary by e-mail. In addition, The Israel Geology Society is advertizing job offers on its website (http://www.igs.org.il/announcements). Students' advisors are usually very instrumental (and feel obliged) in helping their graduate student to find a position, PhD program or Post-doc program.

3.4.8. *What are the mechanisms that deal with student complaints?*

Student complaints are submitted to either the faculty or the program's secretary, and they are passed on to the Head of Studies and if needed also to the Institute's Head. The open students/teachers relations that are a characteristic of the IES and the open door policy of the program's heads and secretary are helping in solving most of the complaints "in-house". Complaints, which involve faculty members or TAs, are clarified and rectified together with them. If a student finds the "in-house" action unsatisfying, he/she may approach the Faculty's teaching committee for carrying on his complaint. In addition, as described above, most complaints are submitted during the informal meetings conducted by the IES Head and all program heads. These meetings are conducted each semester for three separate groups: first year students, second and third year students and graduate students (and TAs). This is usually the best and fastest instrument for hearing complaints and discussing the solution mechanisms directly with the students.

The Dean of Students acts as the ombudsman for student complaints. Students who have been sexually harassed can contact the Ombudsman for Cases of Sexual Harassment at the Dean of Students office.

3.4.9. *What financial assistance is provided to students with financial problems and to outstanding students? What other types of financial support is available to students?*

Financial assistance for BSc students: Every student of the Hebrew University is entitled to apply for financial aid. The Student Financial Aid Department (SFAD) grants financial aid based on financial status, academic achievement, and/or other criteria related to specific funds. Beginning students are evaluated according to their university admissions data. Students who are borderline candidates for scholarships are offered a loan at preferential terms. Information on all of the above can be found on the university's website, including deadlines for the submission of applications. The information is also prominently published on bulletin boards. Application forms are available from the schools' academic secretaries, at the SFAD office and on the website.

Outstanding students are selected out of the candidates according to their matriculation and psychometric exam grades. There are two types of excellence awards: 1. *Faculty of Natural Sciences Award* grants a full exemption from a yearly tuition to first year candidates; 2. *The Institute of Earth Sciences award* grants a half the yearly tuition.

Second and third year students that appear on the "Dean's List" (the upper 10% of the students that study full program and received an average grade above 85%) can be selected (according to their minimum grade) to receive the above awards as long as they are on the list. Additional, ad-hoc stipend sources are available occasionally. The teaching secretary is keeping track on such stipends and notify potential students.

Financial assistance for graduate students: Students that finished their BSc with a minimum grade of 90% appear on the "Dean's List" and are eligible for awards (up 100% tuition for a determined percentage of the top students from the list). Students finishing their MSc within the second year and their grades are within the top determined percentage are eligible for second year award.

MSc students with minimum BSc grade of 87 and most of PhD students are eligible for teaching assistantship. TAs receive also a minimum of 120% stipend from their advisor (this is obligatory for receiving TA appointment). Many stipend sources are available for graduate

students every year. Several stipends are specifically allocated for one of the Earth Sciences fields. In addition, several competitive awards are granted every year in the field, and the nominees are selected by the awards committee. The teaching secretary is keeping track on every announcement and notifies potential students.

3.4.10. *Does the institution and/or the parent unit maintain contact with their alumni, employers, and with employment market. Please specify the measure of integration of alumni into the labor market (especially relevant when the study program a "professional" one): where have they found employment, what positions do they hold, how much time has elapsed between graduation and employment, and how many students continue their studies to advanced degrees or other areas (specify area of study and degree level). Relevant surveys on this matter would be most appreciated.*

We have quite a comprehensive list of more than 100 alumni that hold academic and research positions (Appendix 5, and section 3.4.2.d above). The IES however has no official policy for keeping track with the alumni that are in the general labor market. Six years ago the IES organized a reunion for all its alumni with an impressive attendance. We know of about hundred of our alumni due to personal contacts with faculty members. These alumni hold jobs in universities, governmental bodies (Ministry of Infrastructure, Ministry of Environmental Protection, Ministry of Transportation), high school teaching positions, professional positions in the energy and mineral industry in Israel and abroad (e.g., the new off shore gas fields, Israel Energy Initiative, phosphate and potash industry, geophysical survey companies abroad), military and police forces (e.g., intelligence and forensic units), owners and employees of environmental assessment companies.

3.4.11. *In summary, what are the strengths and weakness of the issues specified above?*

Main strengths:

- We have the only Earth Sciences program in Israel offering undergraduate and graduate studies of all three geospheres (lithosphere, hydrosphere and atmosphere).
- Our open and informal teaching atmosphere provides the students with fast and easy access to all the teaching staff regarding a broad range of matters – from consulting to complaining.
- The students are very united and active in the IES academic life.
- From year one, students at the IES can benefit from professional advice regarding their studies and future directions.
- We encourage and supervise senior undergraduate students who wish to conduct independent research (some have even published in peer-review journals).
- A very high percentage of our graduate students (about 40%) continue on toward higher degrees.
- Graduates of IES programs comprise an important part of the academic and research staff in all institutions of higher education and major research institutes in Israel and in first-class universities abroad.

Main weaknesses:

- We see a relatively high dropout rate after the first year.
- Students are taking longer to complete their degrees (undergraduate and graduate) than the university sees as the optimal duration.
- There is a lack of contact between the IES and its alumni, especially those who do not remain in academe or the general research system.
- BSc students who conduct independent research projects do not receive adequate credit for doing so (as their counterparts do in the “Honors” system elsewhere).

- There is a continuous movement away from the traditional bell-shaped grading curve which leads to an inflation in BSc and MSc grades.

3.5. Human Resources

3.5.1 Teaching Staff

3.5.1.1 Describe the profile of the program's teaching staff in the format of the tables 2A through 2D (pages 15-17).

See Appendix 7 for the list of courses taught at IES by the different faculty members, and see Appendix 7b for course syllabi (see also HUJI year-book: http://shnaton.huji.ac.il/).

3.5.1.2 How are the staff members divided into areas of specialty in the discipline and to what extent does the faculty profile allow flexibility within the study program.

Table 8: Research fields of the IES faculty in 2010. (**a**) According to the same categories as in 2006. (**b**) Division according to disciplines. (**c**) Division according to research methods. All figures are in %.

(a)	Surface Geol.	Hydrology	Solid Earth	Oceanography	Planet. Sci.	Meteor.	Climate	Atm. chemistry	sum
Agnon	80		10	10					**100**
Aharonov	20	10	70						**100**
Amrani			50	20				30	**100**
Angert	40	30					30		**100**
Avigad	20		80						**100**
Emmanuel	10	60	30						**100**
Enzel	50	30					20		**100**
Erel	40						20	40	**100**
Erez				90			10		**100**
Gildor				70			30		**100**
Gvirtzman		90	10						**100**
Haspel				10		10	70	10	**100**
Kessel			70		30				**100**
Khain						100			**100**
Lazar	30	20		50					**100**
Luz		20		40			40		**100**
Matmon	70		30						**100**
Matthews	20	10	40	10			20		**100**
Navon	10		90						**100**
Paldor				40		40	20		**100**
Rabinovich							25		**25**
Rosenfeld						70	20	10	**100**
Shaked				100					**100**
sum	**350**	**270**	**480**	**440**	**30**	**220**	**305**	**90**	**2225**

(b)	Dynamics – solid Earth	Dynamics – fluids and gases	Geochemistry and bio-geochemistry	Petrology Mineralogy Stratigraphy Paleontology	**sum**
Agnon	70	10		20	**100**
Aharonov	100				**100**
Amrani			100		**100**
Angert			100		**100**
Avigad	40			60	**100**
Emmanuel	60		30	10	**100**
Enzel	30	40		30	**100**
Erel			100		**100**
Erez			90	10	**100**
Gildor		90	10		**100**
Gvirtzman		100			**100**
Haspel		100			**100**
Kessel			20	80	**100**
Khain		100			**100**
Lazar			90	10	**100**
Luz		10	90		**100**
Matmon	80		20		**100**
Matthews	10	10	50	30	**100**
Navon	30		30	40	**100**
Paldor		100			**100**
Rabinovich				25	**25**
Rosenfeld		100			**100**
Shaked			100		**100**
sum	**420**	**660**	**830**	**315**	**2225**

(c)	Experimentalist	Theoretician/ modelist	Field-base observations	sum
Agnon	30	20	50	**100**
Aharonov		90	10	**100**
Amrani	80		20	**100**
Angert	70	10	20	**100**
Avigad	20		80	**100**
Emmanuel	40	50	10	**100**
Enzel		20	80	**100**
Erel	50		50	**100**
Erez	70		30	**100**
Gildor		30	70	**100**
Gvirtzman		70	30	**100**
Haspel		90	10	**100**
Kessel	100			**100**
Khain		100		**100**
Lazar	30	30	40	**100**
Luz	80		20	**100**
Matmon		25	75	**100**
Matthews	75	5	20	**100**
Navon	70	30		**100**
Paldor		100		**100**
Rabinovich	20		5	**25**
Rosenfeld	10	10	80	**100**
Shaked	50		50	**100**
sum	**795**	**680**	**750**	**2225**

As described by Tables 8, most of the teachers have interest in more than one discipline in earth sciences, and therefore, there is a great deal of flexibility in teaching. This flexibility is also a result of the fact that many of our faculty members have shifted their research interests over the years.

3.5.1.3 What specializations and skills (including experience and training) are required of the staff members teaching in the study program, including those who teach practical courses/practical training.

Teachers in the program are first of all scientists and are judged based on their research skills. However, using the mentoring system (outlined in Ch. 5) we try to prepare and train our young faculty members how to teach (see section 3.3.1)

3.5.1.4 What steps are taken to ensure that staff members are updated, academically and professionally, with regard to the program?

Because we are research-oriented, all of our faculty members and PhD students participate regularly in scientific conferences. In addition, we have a continuous flow of visitors (see Ch. 5) many of them are leaders in their scientific fields.

3.5.1.5 What are the rules, criteria and procedures for appointing the head of the study program and the staff, including tenure and promotion, the standard duration of service at each position, renewal of appointment in elected positions and dismissals? What steps are taken to ensure that the faculty are informed of these policies and procedures? Are you satisfied with these procedures?

We follow HUJI rules regarding all these issues (http://academic-secretary.huji.ac.il/?cmd=english.511). The head of the IES and the head of the study programs are elected by the members of the Institute in a secret vote, which must be ratified by the Dean. The term of office is usually three to four years, they may be re-elected, and they rotate among the tenured members of faculty whom the majority of members feel have the necessary management skills.

The hiring and dismissal of adjunct members of the IES is done by the head of studies in consultation with the other members of the IES. The decision to hire or dismiss is based on teacher evaluations, student evaluations, and budgetary considerations. The offering of courses to adjunct faculty is always made with the express warning that the IES (and Faculty) will not know until late in the summer if it will receive a large enough budget in the Fall to enable their employment.

Recruiting tenure-track appointments depends on the decision of the Dean of the Faculty of Mathematics and Natural Sciences as to whether or not the IES will receive a future position. The Dean makes his/her decision, among other things, based on the recommendations and requests of the different institutes. As a first step, all members of the IES receive the CVs of all candidates and express their priorities with respect to our 10-year development plan (Appendix 3). Then, the IES screening committee (nominated by the Dean after consulting with the IES head) receive letters of recommendations from 5-10 scholars (whose names were approved by the vice Dean for Research) for each candidate and rank the candidates according to the letters, the candidates CVs and discussion of the merit of the candidates' publications (we ask members of the committee to present 1-2 key publications). The results of the ranking procedure are reported to the IES members and then the top candidate is brought up for discussion by the development committee of the Faculty of Mathematics and Natural Sciences. If approved, the candidate is considered for appointment by the HUJI Rector and President.

Granting of tenure begins after the IES head consult with the tenured IES faculty members, whose recommendation is passed on to the Dean. Promotions are the responsibility of the Dean and any member of the faculty may recommend to him that another member be promoted.

The Office of the Dean is responsible for conducting academic promotions. In the case of lecturers without tenure, university regulations stipulate that they are reviewed after three years, and after six years they must be either put forward for promotion or dismissed. For promotions to Associate Professor and Full Professor, the Academic Secretary of the university circulates a notice each year inviting members of all faculties to recommend to their Deans colleagues, who, in their opinion are worthy of promotion. The Dean and Rector, and not the Chair of the Department, decide on the latter promotions.

We have faculty meetings at least once every semester and the head of the IES updates all faculty members about HUJI policies and procedures. We consider transparency as a key issue in running an academic unit, and we act accordingly. We are satisfied with these procedures.

3.5.1.6 What is the definition of the position of the head of the study program? What credentials (experience and education) are required for this position?

Following the rules of the HUJI, the head of study program is a senior faculty member who has a lot of experience it teaching. In most cases he or she already served as members of the teaching committee prior to their appointment.

3.5.1.7 How is full employment defined in the institution for senior and junior staff, and how many hours are they required to teach in each of the study programs?

Full employment is defined by the HUJI (and by the IES) as six hours (or their equivalents – see section 3.2.1) of teaching per week for the entire academic year.

3.5.1.8 Are staff members obliged to serve as advisors for final projects, theses and dissertations? Are there criteria for assigning advisors to the above-mentioned papers and projects?

Staff members are not obliged to serve as advisors, but all of them do that. All our faculty members have graduate students and all of us are involved in supervising BSc seminars. See also sections 4.5 and 4.6 in Ch. 4.

*3.5.1.9 What is the policy regarding recruiting and absorbing teaching staff (senior as well as junior) and what are the plans for the **future** recruitment to the study program? How are these plans made and by whom?*

Regarding policies: see section 3.5.1.5. Plans for future recruitments are detailed in Ch. 5.

3.5.2 Technical and administrative staff

Describe the technical and administrative staff, including the number of staff members and their job descriptions. What kind of support does the technical and administrative staff provide for the academic activity?

Table 9: Job descriptions and the type of support that the technical and administrative staff provides for the academic activity.

Administration	
Busheri Shoshana	IES administrator
Chanuka Dikla	Research budget administrator
Moshe Batya	Assistant to IES administrator
Perkin Magi	Secretary of studies
Technical assistance	
Barkan Eugeni	Manager of stable isotope lab
Dvir Omri	Technician of petrology and laser ablation labs.
Krugliak Haim-Zvi	Computer clusters technician
Mazeh Shunit	Technician – cosmogenic and bio-geochemistry labs.
Podelko Andrei	Electrician
Portnoy Avraham	Personal computers technician and software support person
Seid Ahmed Ward	Manager of organic geochemistry lab
Sherer Yosi	Chief technician of IES
Tirosh Ofir	Lab manager of analytical & clean laboratories
Weiss Yaakov	Electron-probe, Raman, FTIR technician and curator of mineral collection

*3.5.3 **In summary,** what are the points of strength and weakness of the human resources (teaching staff, technical and administrative staff)?*

Weakneses:

- In certain fields we still rely on external teachers (stratigraphy, fossil fuel resources).

Strengths:

- Our senior teachers are all active researchers in their respective fields and are experienced lecturers.
- We give most of the teaching with relatively small reliance on external teachers.
- Teaching in relatively small classes helps the teachers to better explain the studied material and sometimes actively tutor the students.
- We have a small but dedicated administrative and technical staff that helps maintain the IES and its laboratories, and this too contributes to our study programs running smoothly and efficiently.
- The IES is an active and dynamic academic unit which quickly responds to new directions and challenges in Earth Sciences, be they in Israel, the world, the sea or space.
- We have a very strong group of bright young faculty members who come from leading institutions abroad armed with the newest concepts and research tools.
- We have several promising graduate students who look set to help assure our future both at the IES and indeed in the realm of Earth Sciences.

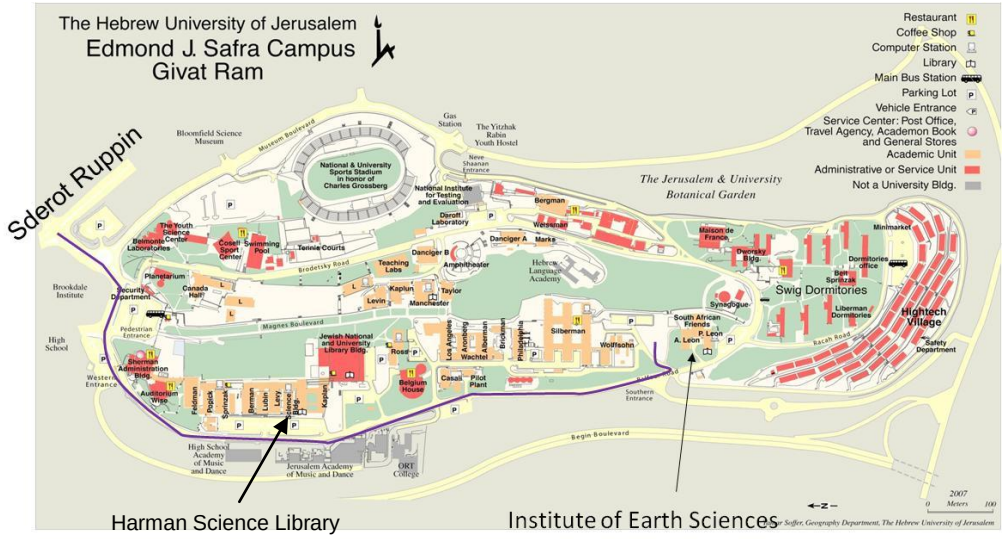
3.6. Infrastructure

Note: In this chapter, describe the overall physical infrastructure that serves the unit and the study program under evaluation. To what extent does this infrastructure enable the parent unit to operate the study program according to the set aims and goals?

3.6.1 Administration

3.6.1.1 What is the physical location of the unit in the institution, in which building is it located, and where does the study program under evaluation operate? Do other study programs share the building?

The IES is located in the Edmond J. Safra Campus of the HUJI (see map). All the courses taken by IES students except for the basic courses in mathematics, physics and chemistry are taught in the IES building. No other programs share the building. The IES building has two wings (north and south) each has four floors. They are connected through a two-floor hallway.



3.6.1.2 How many rooms serve the academic staff (senior, junior and external) and technical staff of the program, and what equipment is available in each room?

The senior academic staff (including emeriti professors have 36 offices and the TAs have 19 rooms (2-4 TAs in most of the rooms). All the senior academic staff members have their own room, and the professor emeriti share offices, unless they teach (then they have their own office). The equipment available in the IES is described in great details in Ch. 4 (section 4.9).

3.6.2 Classes

3.6.2.1 How many classrooms, seminar rooms, rooms for group activities, and auditoria serve the study program, how many seats do they have, and what is the equipment can in each room /classroom/auditorium (including reference to the possibility of using personal laptop computers on campus).

The IES has seven class rooms. All of them, except for the microscope class room (room 103, south wing) have been renovated in the past few years. Two class rooms are located on the ground floor of the north wing (126 and 125 – the Bentor room – see picture). Both can host up to 35 students each. In the central hallway is located the largest classroom in the building (109 which has a capacity of 175 people – see picture). On the ground floor of the south wing are located three classrooms: 102 – our IES seminar room (up to 70 people – see picture), 103 - the microscope class room, and 101 – our computer classroom. In the basement of the south wing we have a small classroom which is used mostly for informal meetings and for MSc and PhD exams (Picard room – see picture)

3.6.2.2 Do the parent unit and study program have access to additional facilities for special purposes, e.g. conference rooms, study centres, research centres and meeting rooms? If teaching activities take place

outside the campus, please specify which activities and the frameworks in which they are carried out.

The Faculty of Sciences has many additional teaching facilities, including classrooms and computer rooms. However, since we are satisfied with our teaching setup, we seldom use them, except for using their remote teaching facility. But we are now in a process of purchasing one for us (jointly with IUI – Eilat). Once we have it, we will be able to conduct all our teaching within our building.

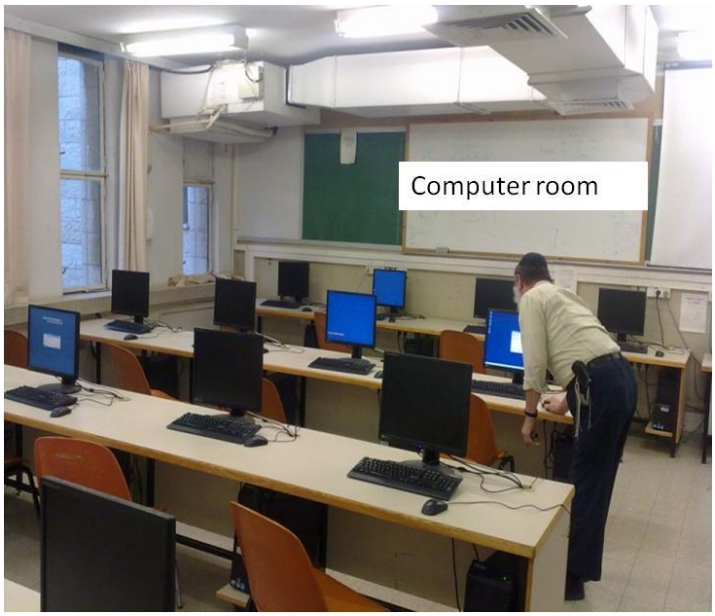
3.6.3 Computerization

Please specify the computer layout, and how does it serves the study program. E.g., how many computer labs serve the students in the program, and how many computers are there in each lab? Specify the existing hardware and software, and state if it includes special hardware and/or software.

The Earth Sciences Institute has one computer lab (room 101 on the ground floor of the south wing – see picture below) containing sixteen Pentium 4 computers with 3GB ram each. They run on Windows XP operating systems and their software arsenal contains, besides such standard programs as office, PDF reader, email programs and internet browsers, also programs requested by staff members for specific course needs such as GIS, Matlab, Jump and SAS.

The lab also contains a printer which serves the students' needs as well as a scanner. The lab's primary cliental are the Institute's undergraduate students as well as students from the Program of Environmental Sciences, as all graduate (both Master's and Ph.D.) students have "personal" computers in their work rooms. A central printing facility is provided for them in the computer lab.

Besides being used by the students to prepare their own work (projects, reports, computer assisted learning, email and internet browsing), courses requiring the hands on use of computers are conducted in the lab. In addition, wireless connection is available everywhere in the building, and all offices have LAN connection (100 Mbps/full duplex; 10 offices have 1 Gbps connection).



3.6.4 Laboratories

What laboratories serve the program, who makes use of them, how are they equipped, and how many seats do they have?

See section 4.9.

3.6.5 Library and Information Technology (IT)

3.6.5.1 Describe the library, which serves the students and the teaching staff of the study program: location, physical structure, number of titles according to subjects, journals and e-journals, computerised databases, number of obligatory books relative to the number of students, opening hours, number of seats, number of computers, the library's professional staff and their qualifications. To what extent do the students receive assistance and guidance in the library, the ability of students and teaching staff to use the databases from outside the library? Specify likewise the policy guiding the purchase of material for the library: who make the decisions with regard to the purchase of books, journals, computerised databases etc. and based on which recommendations/requirements, what are the procedures for updating the library, is there a clear and well-defined budget for the library?

Until 2011 IES had a library in the building. Recently, this library closed down (we are planning to convert its space into an open space for students where they will be able to study and prepare their assignments). Now, the IES collection of journals and books is operated by the Harman Science Library. The Harman Science Library is part of the Hebrew University Library Authority and is the central science library of the Faculty of Science. The Harman Science Library is located on the Edmond J. Safra Campus at Givat Ram (see map in section3.6.1.1.1). The library building is approximately 3750 square meters. In 2009-2010 the library underwent extensive renovations. The renovation included the establishment of group and individual study areas, group study rooms including LCD, modern computer systems, rest areas with comfortable sofas and cushions, new furnishings, lighting and air-conditioning.

The Collection is arranged as an open shelf system in which students search the online catalogue and have free access to books and journals. Most journals and series are located on three levels, each arranged alphabetically by title. Some are located in offsite storage room and are available upon request. Monographs, which include text books, research books, reference books, dictionaries, theses and rare books, are located on two levels arranged by the Library of Congress Classification. The library collection includes 76,126 monograph titles, 100,114 monograph items including volumes and multiple copies, 4,255 journal titles, 238,280 journal volumes. The electronic collection in earth sciences has 1462 titles. In addition, the library has 37 science electronic databases.

The library purchases textbooks that are assigned as required reading by lecturers. In order to meet the needs of students, the library tries to maintain a proportion of one copy per 8-10 students registered in the course. Starting 2009, the library has been purchasing electronic format in addition to the print version of textbooks whenever available.

Library hours between October and the end of July are: Sun-Wed 9:00 – 22:00, Thurs 9:00 – 18:30. Summer hours are Sun – Thurs 9:00 – 18:00. There are approximately 500 seats distributed throughout the library. Two levels have been designated as group study areas and the other as quiet areas. There are 55 computer stations available for patrons, as well as four printers and one scanner, interspersed on all levels. In addition, there are ten laptop computers for loan, together with electronic dictionaries and scientific calculators. Wireless connection is available everywhere in the building.

The library staff is comprised of librarians, an administrative assistant and students who are hired on an hourly basis. All professional librarians have library degrees: MLS

or diplomas. Librarians are active in both inter- and intra-university forums, publish in professional journals, lecture at conferences, and have served as chairpersons of national committees. There are currently 14 employees out of which 8 tenured. In addition, the library employs students for an average of 600 hours/month.

Library orientation sessions are offered to new students at the beginning of each academic year by our reference staff. Since 2007/8 academic year, the library staff has launched an online course "Library resources". The course is compulsory and a pre-requisite for participation in all seminar courses for the BSc students.

Access to our databases and electronic journals is available on any computer that is connected to the university network. Undergraduate students can access electronic databases and electronic journals from home by entering a personal identification code via VPN communication. Graduate students, researchers and faculty are able to connect to internet access from home by entering a personal access code arranged by the Computation Authority of the Hebrew University for qualified members. This means that our electronic collection is accessible 24 hours a day 7 days a week to the entire Hebrew University community.

Collection development - Acquisitions policy in the library

The library budget is used to purchase print and electronic monographs (for courses and research), series, journals and databases. The major portion of the budget is spent on journal subscription and a very small percentage is available to purchase monographs. Dissemination of scientific reports is mainly via journals. The emphasis in the Harman Science Library, as in most other academic science libraries, is to develop and maintain the journal collection.

- Purchasing Books

Decisions relating to monograph purchases and collection development is based on recommendations from the academic staff and researchers of the Faculty of Science as well as the reference librarian. The library director coordinates and approves all purchase decisions. Textbook acquisition orders are placed after checking for the latest editions and for the number of available copies to determine the needs of the students registered in the course.

- Journal and database subscriptions

The library has a core journal collection which reflects the most important journals in the science in which our academic researchers work. Subscription decisions to new titles are based on a variety of parameters such as the impact factor, price, the number of researchers in the field that express interest in the title, etc. In addition to the titles to which the library directly subscribes, our users have access to a huge number of titles thanks to the agreements the Library Authority signed with certain publishers. The Hebrew University also signed contracts with the country's consortium, MALMAD, which enables access to package agreements with the world's largest publishers at reduced prices.

- Database subscriptions

Databases in the sciences are extremely expensive and it is very difficult for a faculty library to maintain the expense. The decision to acquire a new database is made on academic and budgetary considerations. The Library Committee and Faculty of Science Institute representatives make the academic recommendations. Part of the subscriptions is acquired in cooperation with other libraries in the Hebrew University, as well as through MALMAD. Subscriptions to new databases are approved only after a trial period has been made available to the librarians, researchers and teachers who are requested to give their evaluation. The collection development is a joint effort of librarians and faculty members.

Library Budget

The library budget is allocated by the Library Authority based on the consideration of several parameters relating to the libraries. The budget is defined at the beginning of the academic year and is divided and designated by different budget codes, each defined for a particular type of expense. Most of the budget, as previously stated, is for

journal subscriptions and for database subscriptions. The remaining amount is for monographs. The library (in New Israeli Shekels) budget has not increased in many years in-spite of the fact that the price of scientific journals, especially in the experimental sciences, has become very expensive. The average increase from year to year is about 8%-12%.

3.6.5.2 Do the institution and the study program take steps to enable the convenient access of the students with special needs to the study material and the different facilities, e.g. classrooms, laboratories, library? If part of the programs takes place on different campuses, how is equal opportunity of access to the facilities and equipment at the main campus ensured for all students?

In both wings of the building we have elevators which make all of our facilities availability to students with special needs. However, we still do not have any restroom in the building suitable for people with special needs. Although this point was brought up a few years ago, nothing has been done so far.

3.6.5.3 In summary, what are the points of strength and weakness of the physical infrastructure?

Weaknesses:

- Over the years, the field of Earth Sciences has become more sophisticated and the need for more instrumentation and computer power has increased. This in turn requires more professional technical staff. However, this is not supported by HUJI. Instead, technical positions are continuously being cut and, as a direct result, we have a hard time maintaining our laboratories.
- The same can be said with respect to the absorption of new faculty members. The HUJI administration does not always provide sufficient funds required for the proper absorption of new and young faculty and we have had to rely on the good will of established IES faculty members (and their budgets) to provide even the basic equipment they need.

Strengths:

- Our institute is characterized by strong internal and inter-disciplinary collaboration.
- Beyond (and due to) such professional collaboration, our faculty members are willing to share resources to ensure that the IES as a whole remains on the cutting edge. This can be seen in faculty coming forward when others need financial help for research, equipment, etc., or to share the teaching load when required. Moreover, most of the introductory-level courses and courses for non-Earth Science students are taught by the senior faculty members.

Chapter 4 - Research

4.1 What is the department's perception of research, and what are the expected outcomes?

The first goal set up by the IES in his 2006 and 2010 work plans was "**to carry out research and teaching in Earth Sciences at the highest academic international level possible under the conditions offered in Israel and at the Hebrew University**." We expect from our faculty members and their research students to conduct cutting-edge research and to present their work in the leading journal of Earth Sciences and in international conferences. Indeed, **all** our faculty members have active research groups and many of them are leaders in their fields. This is demonstrated by the list of national and international honors (see section 4.10), by the large number of invitations to conferences and research institutions world-wide (see CVs in Appendix 8), and by the number of scientific citations.

4.2 What are the department's special strengths and uniqueness in research (areas, fields?).

The IES has 21 full time faculty members, two part-time faculty members (Shaked and Rabinovich), one adjunct faculty member (Stein), two research associates (Ron, Pinsky), and 12 emeritus professors (Table 4.1). Historically, the IES can be viewed as the gradual consolidation of the various disciplines and departments of Earth Sciences in the Hebrew University. The last forty years have seen Earth Sciences change from a one of the more traditional branches of science into a modern quantitative experimental and theoretical discipline rooted in modern physical, biological, chemical and mathematical sciences. At the same time, this greater depth of understanding of the complex, sometimes fragile and catastrophic interactions between the solid earth, its biosphere and atmosphere, require an increasingly multidisciplinary approach involving several groups of researchers. Earth Science is a rapidly evolving field, and the continuous challenge is to move with this change through competitive research, quality teaching and intelligent appointments.

What are our strengths and uniqueness? As recognized by the criteria of awards, publications, research competitivity, professional and public activity (see personal CVs in Appendix 8) IES members have been successful in meeting many of these challenges. International and national recognition has come with several members receiving awards or becoming leading figures in international organizations (see section 4.10). Institute members are on the Editorial Boards of a number of international journals or have edited books. We have been very active in Israeli professional organizations, with members acting as presidents of scientific societies or on various national scientific or decision-making bodies. Our faculty has been responsible for the training of many of the high ranking scientists of the Geological Survey and faculty at the geosciences departments at Ben-Gurion and Tel-Aviv Universities (See Appendix 5).

Research has always been a forte of our Institute and often at the forefront of new developments. The late **Raphael Freund** was amongst the first to recognize the significance for plate tectonics of the large horizontal movements along the Dead Sea Rift and in New Zealand. **Z. Garfunkel** made major contributions to understanding mantle convection and he and his Ph.D student (now Professor) **D. Avigad** were among the first to recognize the crucial importance of normal faulting in the exhumation of mountain belts. Prof **Abraham Gagin** pioneered cloud seeding research in Israel. His graduate student, now Professor **Rosenfeld**, followed this research line. The synergy between **Rosenfeld's** observations, **Khain's** simulations, and **Erel's** chemical and isotopic measurements positioned the Institute of Earth Sciences as a leading institution in the field of aerosol impacts on clouds, precipitation and climate. The success of present faculty is also evident from the large numbers of grants received in the last five years and the high numbers of publications (see personal Curriculum vitae and section 4.7).

Much excellent research focuses on Israel and its environment: ground water, the Dead Sea in all is aspects (tectonics, earthquakes, physical geography, and geochemistry), the Gulf of Eilat for oceanographic research, rainfall and the rain-pollution-aerosol connection, trans-boundary atmospheric pollution in the Middle East, metalliferous deposits in Timna and the Negev for non-traditional stable isotopes. Clearly, water in all its environments and forms plays a major role in our research.

The current research topics that should be mentioned are: the construction by **B. Luz** of a unique experimental system for measurement of the ratios of the three isotopes oxygen in waters, plants and ice cores; **J. Erez** and **B. Lazar'** groups work examining the biogeochemical cycle of carbon in living laboratory cultures of foraminifera and Corals and are among the first to report on the danger of ocean acidification. **C. Erlick-Haspel**'s research primarily deals with the interaction of atmospheric aerosol and cloud particles and oceanic hydrosol particles with solar radiation. She and her students were among the first to solve the long standing debate regarding what is known as the cloud absorption "anomaly". **R. Kessel** has contributed significantly to our understanding of the important role of aqueous fluids in many processes in the Earth's mantle. **A. Matmon**'s research promotes the understanding of key processes that control the shape of the Earth's surface at temporal scales varying from active processes to the cumulative effects of millions of years and spatial scales varying from the single slope to the mountain Range. He and his students dated the oldest surfaces on Earth, demonstrating the stability of landscapes in hyper-arid environment. **S. Emmanuel**'s group uses a combination of cutting edge experimental techniques, state-of-the-art modeling, and field observations to study various hydrological and petrological problems related to porosity evolution in porous media. **A. Amrani** was the first one to measure S isotope in S-specific compounds at ambient concentrations which allowed him to address one of the most important questions in climate regulation – the DMS production by marine algae. **H. Gildor** focuses on interdisciplinary problems in climate dynamics, paleoclimate, and oceanography, involving interaction between different components of the climate system. Achievement of these goals will lead to the development of fundamentally better climate models that will include more accurate representation of the ecological system and better parameterization of small-scale processes, and thus to a better capability for climate change prediction. **A. Angert** is interested in the ways that Climate Change affects the terrestrial biosphere (in particular plants and soils) and how these changes in the biosphere feedback and affect the climate system. One of the reasons for the attention that these questions draw lately is that the magnitude and sign of these feedbacks will largely determine the rate of the 21st century Global Warming. **Y. Enzel's** research focus on pre-historical, historical and modern temporal scales of climatic, hydrologic, and environmental changes and their impacts on fluvial, lacustrine, and aeolian environments and on landscape evolution, mostly in semiarid to hyperarid environments. **N. Paldor's** research focuses on the construction of new solutions to the classical Tidal Equations that were formulated by Laplace nearly 250 years ago but to date no solutions were found to this problem on a sphere. Another focus of **Pador's** research is the dynamics of the tropospheric jet stream - the strongest "river of air" in the atmosphere. The dynamics responsible for its origin and maintenance is not well known although it was first observed about 90 ago. O**. Navon** research focuses on the composition of fluids trapped in diamonds and on their role of such near solidus melts and fluids in the formation of diamonds and kimberlites with inferences to basaltic magmatism. **Navon** also studies magma vesiculation and its role in the ascent of dikes and the propagation of seismic waves through bubbly magma. The main topic of **A. Khain's** scientific activities is the investigation of clouds and cloud related phenomena like severe hail storms and hurricanes. One of the aims is an improvement of representation of convection in climate models taken into account aerosol effects on cloud dynamics and microphysics. Important part of these investigations is development of advanced cloud models for creation and

improvement of remote sensing algorithms from satellites and using advanced Doppler and polarimetric radars. **Y. Shaked's** research on the bioavailability of iron to microorganisms and the mechanisms underlying Fe-uptake have vast implications to many fields of basic and applied sciences, including ocean biogeochemistry, carbon cycling and climate research, harmful algal blooms, soil and plant research, bioremediation, pathogenesis and medicine. **H Gvirtzman** studies mechanisms of groundwater salinization, contamination and remediation. He is modeling groundwater flow and solute transport, and evaluate quantity and quality of water resources.

Table 4.1: Faculty members at IES. Academic officer = Head of the Teaching Program

STAFF	
Professors Emeriti:	Cohen, A., Ph.D
	Garfunkel, Z., Ph.D.[1]
	Heller-Kallai, L., Ph.D.
	Katz, A., Ph.D.[2]
	Kolodny, Y., Ph.D.[3]
	Luria, M. Ph.D.
	Sass, E., Ph.D.
	Sharon, D., Ph.D.
	Yaalon, D.H., Ph.D.
Professors:	Agnon, A., Ph.D.
	Avigad, D., Ph.D.
	Enzel, Y., Ph.D.
	Erel, Y., Ph.D. - Chair
	Erez, J., Ph.D. [4]
	Gvirtzman, H., Ph.D.
	Khain, A., Ph.D.
	Lazar, B., Ph.D. – Academic officer
	Luz, B., Ph.D.[5]
	Matthews, A., Ph.D. [6]
	Navon, O., Ph.D.[7]
	Paldor, N., Ph.D.
	Rosenfeld, D., Ph.D.
Associate Professors Emeriti:	Huss, A., Ph.D.
	Reches, Z., Ph.D.[2]
	Starinsky, A., Ph.D.
Associate Professors	Aharonov, E., Ph.D.
	Gildor, H., Ph.D.
	Matmon, A., Ph.D.
Senior Lecturers:	Amrani, A., Ph.D.
	Angert, A., Ph.D.
	Emmanuel, S., Ph.D.
	Haspel, C., Ph.D.
	Kessel, R., Ph.D.
Lecturers:	Rabinovich, R. Ph.D. – also in Archaeology
	Shaked, Y., Ph.D. - also at IUI in Eilat
Associate Researchers:	Pinsky, M., Ph.D.
	Ron, H., Ph.D.
	Stein, M. Ph.D. – Adjunct Professor

4.3 *Please list the leading journals in the field (including ranking, if possible).*

Table 4.2: List of leading journals in Earth Sciences.

2010 IMPACT FACTORS Earth and Planetary Sciences

Top journals:

Annual Reviews in Marine Sciences	15.000
Nature Geosciences	10.392
Reviews in Geophysics	9.358
Annual Rev Earth Planetary Sc	8.048
Earth-Science Reviews	5.833
Environmental Science & Technology	4.825
Geochimica et Cosmochimica Acta	4.101
Earth & Planetary Science Letters:	4.279
Precambrian Research:	4.116
Geology	4.026

Listed alphabetically

Journal Title	Impact Factor
Advance Water Resources	2.470
American J Science	3.045
Applied Clay Science	2.303
Applied Geochemistry	2.017
Atmospheric Chem Phys.	5.309
Atmospheric Environment	3.226
Atmospheric Research	1.597
Bull Am Meteorol Soc	5.078
Chemical Geology	3.722
Climate Past	2.821
Climatic Change	3.016
Climate Dynam.	3.843
Cold Regions Science Technology	1.488
Computers & Geosciences	1.416
Dynamics of Atmospheres and Oceans	2.674
Earth and Planetary Science Letters	4.297
Earth Science Reviews	5.833
Engineering Geology	1.442
Holocene	2.772
Geochem. Geophy. Geosy.	3.368
Geol. Society of America Bull.	3.637
Geomorphology	2.352
Geophysical Research Letters	3.505
Global Biochem Cycl.	5.263
Global Planetary Change	3.351
Gondwana Research	5.503
Icarus	3.816
International J climatology	2.479
International J Coal Geology	2.069
Journal Aerosol Science	2.192
Journal African Earth Sciences	1.186
Journal Applied Geophysics	1.185
J Atmos Sci	2.600
J Atm & Solar-Terrestrial Physics	1.579
J Climate	3.513
Journal Geochemical Exploration	2.125
Journal Geodynamics	1.197
J Geophysical Research	3.303
J Hydrology	2.514
J Metamorphic Geol.	3.418
J Paleolimnology	2.676
J Petroleum Science & Engineering	0.761
J Petrology	3.842
J Sedimentary Research	2.302
J S. American Earth Sciences	1.543
J Volcanology & Geothermal Res.	1.941
Limnology and Oceanography	3.385
Lithos	3.121
Marine Geology	2.517
Marine Micropaleontology	2.321
Ore Geology Reviews	2.079
Organic Geochemistry	2.375
Palaeogeog. Palaeoclim. Palaeoecol.	2.390
Paleoceanography	4.030
Physics Earth Planetary Interiors	2.640
Planetary Space Science	2.344
Quaternary Geochronology	3.238
Quaternary International	1.768
Quaternary Research	2.576
Quaternary Science Reviews	4.657
Remote Sensing of Environment	3.951
Rev Mineral Geochem	3.694
Rev Palaeobot. Palynology	1.985
Russian Geology Geophysics	1.051
Tectonics	3.147
Water Research	2.737
Water Resources Research	2.737

* Journal Citation Reports®, published by Thomson Reuters, 2011

4.4 *What are the research funds (in $) of the institution, faculty/school, evaluated unit/study program in each of the last five years according to the source of funding: competitive sources, government/public funds, internal funds, other*.

Table 4.3: Research funds ($) from 2005 to 2010, both at the Faculty of Natural Sciences and at the Institute of Earth Sciences. The apparent decrease in support of "competitive" grants has mostly to do with the definition of "competitive" versus "other" grants.

Faculty of Natural Sciences					
	grants: 2005-2006	**grants: 2006-2007**	**grants: 2007-2008**	**grants: 2008-2009**	**grants: 2009-2010**
Other	4,304,752	4,891,797	4,928,397	5,263,629	5,432,421
government/public	5,325,309	5,266,825	5,616,712	6,590,469	7,766,984
internal	5,517,787	5,880,071	7,367,184	7,700,853	6,840,663
Competitive	18,011,371	17,450,633	17,965,842	19,839,380	22,834,237
TOTAL	33,159,218	33,489,325	35,878,135	39,394,331	42,874,305
Institute of Earth Sciences					
	grants: 2005-2006	**grants: 2006-2007**	**grants: 2007-2008**	**grants: 2008-2009**	**grants: 2009-2010**
Other	44,725	64,875	110,337	307,029	481,615
government/public	254,599	285,876	359,550	402,422	259,490
internal	204,167	283,547	321,534	281,028	303,144
Competitive	1,598,632	1,527,350	1,003,608	970,574	1,169,896
Total	2,102,123	2,161,648	1,795,029	1,961,053	2,214,146

4.5 Please provide data on research students (master degree with thesis, doctoral degree): overall number (internal/external), sources of funding, level of funding, number of graduates (of the university, faculty/school, parent unit/study program) in each of the last five years.

Table 4.4: Research students of IES. Number of MSc and PhD students = the number of students that graduated in that year. Non IES students refer to actual number of students in 2011 (similar numbers were in all other years, and they are in addition to the MSc and PhD students of IES given in section 3.1.5).

Program		Class				
		2011	2010	2009	2008	2007
Number of M.Sc.	Geology	2	9	7	4	7
	Atmospheric Science	2	0	4	4	4
	Oceanography	2	0	2	0	2
	Faculty	167	175	129	154	144
	University	691	741	638	764	706
Funding	Internal	50%≈335,000$ (per year)				
	External	50%≈335,000$ (per year)				
Number of Ph.D.	Geology	4	1	2	1	3
	Atmospheric Science	1	0	0	0	2
	Oceanography	1	0	0	0	1
	Faculty	69	91	75	83	69
	University	350	345	297	323	307
Funding	Internal	25%≈167,500$ (per year)				
	External	75%≈502,500$ (per year)				
27 non IES PhD students adviced by IES faculty						
17 non IES M.Sc. students adviced by IES faculty						

4.6 Are faculty members required to serve as advisors of senior projects, theses and dissertations? Are there criteria for assigning advisors to different research projects?

At the HUJI there are no official senior projects because we have a three-year BSc program; however, all undergraduate students take a course entitled "*BSc Seminar in Geology/Atmospheric Sciences*." Each student chooses a topic from a list of topics in a specific area of geology or atmospheric science, and is supervised by one of the faculty members. All of our faculty members advise theses and dissertations of graduate students. There are no rigid criteria for assigning advisors for research projects as all research projects are initiated by the faculty members.

4.7 Please provide a list of publications in the last five years (only by the teaching staff of the evaluated study program) according to refereed journals, books (originals or editions), professional journals, conference proceedings, professional reports, etc.

Please see Appendix 9.

4.8 Is there a commercialization unit in the institution? Briefly describe its function: number of patents registered and where have they been registered.

Yissum Research Development Company of the Hebrew University of Jerusalem Ltd. was founded in 1964 to protect and commercialize the Hebrew University's intellectual property. Ranked among the top technology transfer companies in the world, Yissum has registered over 7,000 patents covering 2,023 inventions; has licensed out 530 technologies

and spun-off 72 companies. Products that are based on Hebrew University technologies and were commercialized by Yissum generate today over $2 Billion in annual sales. Yissum's business partners span the globe and include companies such as *Syngenta, Vilmorin, Monsanto, Novartis, Johnson & Johnson, Roche, Merck, Teva, Google, Adobe, Phillips* and many more. For further information please visit www.yissum.co.il

4.9 Please describe the research infrastructure: research laboratories, specialized equipment, budget for maintenance (level and sources of funding).

The following facilities are available and located in the Institute of Earth Sciences:

1. Stable Isotope Laboratories

The lab includes ThermoQuest Delta Plus and Delta Plus XL isotope ratio mass spectrometers, quadrupole mass spectrometers and a variety of peripheral equipment for both continuous flow and double inlet mass spectrometric studies. Capabilities include determination of stable isotope ratios of oxygen ($\delta^{17}O$ and $\delta^{18}O$), carbon and nitrogen in rocks, organic matter and dissolved gases.

Academic Director: Prof. B. Luz: 972-2-658-5224, E-mail: boaz.luz@huji.ac.il

Laboratory Manager: Dr. E. Barkan, Tel: 972-2-658-4464, E-mail: eugenib@cc.huji.ac.il

2. Electron Microprobe Laboratory

The lab has JEOL 8600 EPMA including 4 WDS detectors and Pioneer - Norvar EDS detector (133 eV), automation system and image analysis software.

Academic Director: Prof. O. Navon: 972-2-658-5549, E-mail: oded.navon@huji.ac.il

Laboratory Manager: Y. Weiss, Tel: 972-2-658-5897, E-mail: yakov.weiss@mail.huji.ac.il

3. Analytical & Clean Laboratories

Laboratory for trace and major element chemistry and radiogenic and stable isotope of the metallic elements. The facilities include a modern clean laboratory for geochemical separation featuring positive pressure air supply with HEPA filtration and entirely non-metallic construction.

Trace and major element chemical analytical equipment includes: **Agilent 7500cx ICP-MS, Perkin-Elmer Optima 3000 ICP-OES; Dionex DX-500 Ion Chromatographic** system. Isotopic measurements (Sr, Pb, U, Fe, Cu, Mo) are carried out with a **Nu Instruments MC-ICP-MS** at the **Geological Survey of Israel** through a time-sharing agreement. We are in a process of ordering a new high-resolution **MC-ICP-MS** (**Thermo – Neptune**)

Academic Director: Prof. Y. Erel: 972-2-658-6515, E-mail: yerel@vms.huji.ac.il
Laboratory Manager: Mr. O. Tirosh, Tel: 972-2-658-4719, E-mail: ofirtirosh@gmail.com

4. Laser Ablation System

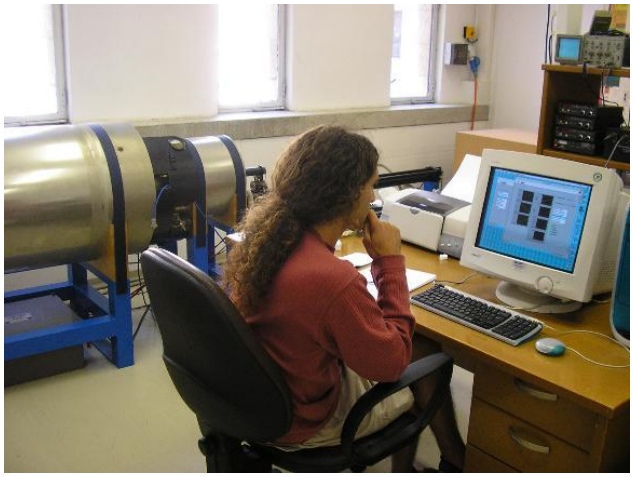
Recently we have added a **laser ablation** system (New Wave UP193-FX Excimer - ArF) to the ICP-MS. The Laser ablation transfers its photon energy directly to the sample matrix. This characteristic makes this system an ideal tool for accurate and precise analytical micro-sampling of geological and environmental materials. The coupling between the laser and the material produces an aerosol that is carried by a He stream from the sample chamber into the plasma torch of an inductively coupled plasma mass-spectrometer (ICP-MS) for analysis of multiple isotopes.

Academic Directors: Dr. R. Kessel, Tel: 972-2-658-5584, E-mail: kessel@vms.huji.ac.il and Prof. D. Avigad, Tel: 972-2-658-6468, E-mail: Avigad@vms.huji.ac.il
Laboratory Manager: Mr. O. Dvir, Tel: 972-2-658-4719, E-mail: omri.dvir@huji.mail.ac.il

5. Mineral-Spectroscopy Laboratory including (1) a Renishaw 1000 Micro-Raman spectrometer equipped with 514 nm Ar^{+} laser and 780 nm diode laser, Laica DMLM microscope with automated stage and a thermo-electrically cooled CCD detector, (2) Nicolet 740 FTIR spectrometer (mid-IR: 400-5000 cm^{-1}, using glowbar source, KBr beamsplitter and MCT detector, and near-IR: 1900-10000 cm^{-1}, halogen source, CaF_2 beamsplitter and InSb detector). A Bruker IR microscope with MCT detector (600-5000 cm^{-1}) is attached to the Nicolet spectrometer. A micro-beam and diffused reflectance attachments are also available.
Academic Director: Prof. O. Navon, Tel: 972-2-658-5549, E-mail: oded.navon@huji.ac.il

6. Biogeochemical Laboratory for culturing and experimenting with foraminifera and corals – important marine organisms in the global carbon cycle. The system includes a series of flow through culturing flasks for variable water chemistry. The coral culture facility includes a main circulating aquarium with precise physical and chemical control system. Additional equipment includes video fluorescence and spectral microscopy system, confocal microscopy system and a micro-electrode system. All these are capable of documenting and analyzing and deciphering calcification processes.
Academic Director: Prof. J. Erez, Tel: 972-2-658-4882, E-mail: erez@vms.huji.ac.il

7. Paleomagnetic Laboratory including: Shielded three axis cryogenic magnetometer SRM750 (sensitivity of 10-8 emu), w/ integrated AF coils (maximum of 200 mT). Thermal demagnetizer ASC model TD48 with capacity of 48 samples, 3-layer magnetic shield heat chamber & 5-layer cool chamber 25-800°C. The thermal demagnetizer and paleointensity oven modified from the commercial ASC-TD-48 thermal demagnetizer. Improved ASC oven with additional coils for inducing a DC magnetic field, with accuracy of ± 0.1%. The heating process was re-calibrated using advanced Watlow-series-96 temperature controllers, and a laboratory-built computer program that enables computer control of heating. The modifications provide outstanding accuracy of temperature inside the oven, with a maximum gradient of ±2°C, and a maximum overshoot of 2°C. Rock melting oven to produce synthetic slag and basalt with controlled DC field, Oxygen fugacity and cooling rate. Bartington susceptibility system MS2. ARM magnetizer 615 of 2G Enterp. integrated w/ AF coils. Impulse magnetizer ASC IM-10-30 field range of 30G to 16 KG. Magnetic particles extract line.
Laboratory Director. Dr. H. Ron, Tel: 972-2-658-4248, E-mail: hagairon@vms.huji.ac.il



8. Cosmogenic Isotope Laboratories

I. A crushing and sieving rock facility (see # 14).

II. A wet chemical laboratory for preparing samples for cosmogenic ^{10}Be and ^{26}Al analyses (mostly from quartz). This lab has three sections:

A. a quartz purification section, where crushed and sieved rock samples are etched in concentrated HCl and diluted HF in order to dissolve all minerals except quartz

B. a section where the purified quartz is totally dissolved and Al and Be hydroxides are extracted through the use of chromatographic columns

C. a section where the Al and Be hydroxides are ignited to oxides and packed in AMS targets.

III. A clean laboratory for preparing samples for cosmogenic ^{36}Cl analyses (mostly from carbonate rocks). Cl is extracted from carbonate rocks through leaching with nitric acid and is then packed in AMS targets as AgCl.

All processed samples are sent to AMS facilities for analyses. Results are integrated in landscape evolution studies since they reflect exposure ages and average erosion rates.

Academic Director: Dr. A. Matmon, Tel: 972-2-658-6703, E-mail: arimatmon@cc.huji.ac.il

9. High Temperature-High Pressure Experimental Petrology

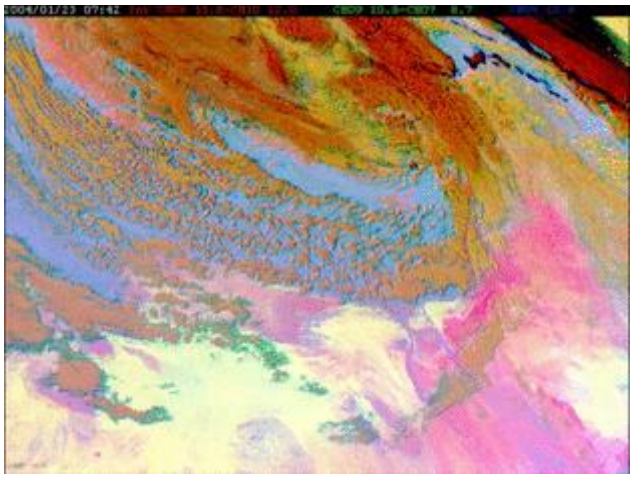
The facilities include: (1) a rocking walker-type multi-anvil with the option of having a piston cylinder stack on it. (2) a static piston cylinder. (3) rapid quench, cold-seal hydrothermal pressure vessels. (4) a 1-atm carbolite tube furnace with gas-mixing apparatus. (5) a preparation lab with drying oven, high temperature box oven, mini-lathe, drill, analytical balance, automatic grinding machine, diamond saw, and ultrasonic bathe.

Academic Director:: Dr. R. Kessel, Tel: 972-2-658-5584, E-mail: kessel@vms.huji.ac.il

10. Cloud Physics Laboratory

In our lab, we combine satellite imaging, RADAR imaging, in-situ research flights, modeling of the clouds and the environment and climate research to enhance our understanding of the different aspects of the atmosphere that influence the formation of clouds and precipitation processes

Academic Director: Prof. D. Rosenfeld, Tel: 972-2-658-5821, E-mail: daniel.rosenfeld@huji.ac.il



11. Laboratory of Numerical Modeling of Atmospheric Processes

Research group: Prof. A. Khain, Dr. M. Pinsky, Dr. A. Pokrovsky, Dr. B. Lynn. In this lab we develop and utilize advanced numerical models to enhance our understanding of a wide spectrum of atmospheric phenomena from individual clouds, to breezes, severe storms and hurricanes. The cloud models are used for development of novel methods of rain enhancement, hail suppression and hurricane mitigation. The models and approaches developed in our lab, e.g. the Hebrew University Cloud Model (HUCM), are used in many Scientific Centers in USA, Japan, Germany, Korea, etc. The computer cluster laboratory contains the following equipment: 4 SGI Dual Quad-Xeon multiprocessor computers, the 16-th and 32-th processor PC-clusters based on dual Xeon boxes and 16-th core Quad Processor Quad Core Xeon System (with 128 GB ram for analysis of large volumes of data) and other computers allowing performance the complicated calculations and theoretical studies. In addition we have a HPC (High Performance Comp.) Xeon Cluster based on Intel equipment, 20 1u Dual Xeon Server boxes, which are connected by a Giga-bit ethernet switch, one front-

end node, 19 computing nodes, and a 3-Tb Raid (Redundant Array of Inexpensive Disk's) file server for fast and reliable data storage services.
Academic Director: Prof. A. Khain, Tel: 972-2-658-5822, E-mail: Khain@vms.huji.ac.il
Laboratory Manager: H. Z. Krugliak, Tel: 972-2-658-5850, E-mail: haimk@cc.huji.ac.il

12. Computer Cluster for Simulation of Physical and Chemical Processes in Rocks
The computer lab includes a cluster of 3 MacPros, consisting each of 8 CPUs of 3.2 GHz. The MacPros are connected by a fast 1GB switch, and use the new Mac software 'XGrid', that allows flexible usage. Each MacPro is a standalone workstation that may serve a single user and at the same time is part of the cluster and may be utilized for fast parallel computations. The cluster is used to model mechanical deformation, or coupled chemical-mechanical deformation, of rocks: the physics of soil liquefaction, earthquakes, pressure solution, and landslides.
Academic Director: Prof. E. Aharonov, Tel: 972-2-658-4670, E-mail: einatah@cc.huji.ac.il

13. Climate Change - Terrestrial Biogeochemistry Laboratory
The focus of the laboratory is on the interaction between climate change and the terrestrial biosphere (mainly plants and soils). Current work in the lab emphasizes the development of the use of phosphate oxygen stable isotopes for studying climate induced changes in the phosphorous cycle. The research is conducted in two rooms.
The instrumentation lab (room 207) is equipped with an isotope ratio mass spectrometer (Sercon 20-20 IRMS), with both dual-inlet interface and continuous-flow interface connected to high temperature pyrolisys unit (for converting Ag_3PO_4 to CO), and a vacuum-oven for sample drying before measurement. In addition, this lab will be equipped soon with a custom built UVC-irradiation chamber.

The soil chemistry preparation lab (room 202) is well equipped for preparing soil phosphate for isotopic measurements and for phosphate concentration measurements. The lab

equipment includes a spectrophotometer, centrifuge, two fume hoods for wet chemistry, one small hood for preventing dust while working with soils.
Academic Director: Dr. A. Angert, Tel: 972-2-658-4758, E-mail: angert@cc.huji.ac.il

14. Atmospheric Chemistry and Air Quality Laboratory

The laboratory has been engaged in numerous air quality studies at various scales ranging from indoor air quality to the regional East Mediterranean scale. Some of the major studies performed by the AQRL including:

- Nighttime air chemistry over urban sites
- Source apportionment of particulate matter in Israel
- Trans-boundary transport and transformation of pollution from coastal areas to inland Israel
- Formation of the brown cloud over coastal area power plants
- Airborne studies investigating the transportation of sulfur and nitrogen compounds from Europe to the East Mediterranean region
- How to improve indoor air quality at the work place (university campus and high-tech industry)
- How clean is background air in rural Israel?
- Halogen radical chemistry in the Dead Sea Valley and its effects on ozone depletion

The AQRL uses two major research platforms for its research campaigns. A 12-square-meter self propelled mobile laboratory built on a chassis of a large van used for the various studies throughout Israel. The laboratory is equipped with gaseous and particulate measuring instruments as well as meteorological measuring devices. The main instrument is a Differential Optical Absorption Spectrometer (DOAS) capable of measuring sub ppb level of various atmospheric trace gases. A light twin-engine aircraft is the other research platform, utilized to investigate air quality where access is difficult or when spatial resolution is needed. Airborne air sampling has been made over many regions in Israel including Gaza and the West bank, the Dead Sea, and the coastal Mediterranean.
Academic Director: Prof. M. Luria, Tel: 972-2-658-4670, E-mail: luria@vms.huji.ac.il

15. Atmospheric Electricity Laboratory

Used for observations of transient luminous events in the atmosphere. Instrumentation includes: PC, GPS timing unit (KIWI OSD model 2), GPS antenna (Garmin 18 LVC), GPS, A/D card (CANOPUS ADVC55), ultra-sensitive video camera (WATEC 902U NTSC), lens with a 30-degree field of view, camera housing with heating unit and fan, and digital compass. Situated on the roof of the Earth Science's building.

Academic Director: Dr. C. Haspel, Tel: 972-2-658-4974, E-mail: caryn@vms.huji.ac.il

16. Laboratories for Rock Preparation and Mineral Separation

The Institute of Earth Sciences also operates a fully equipped mineral separation laboratory including various crushing, grinding and sieving machines, a Wilfley table, magnetic separator and heavy liquids.

Academic Director: Prof. D. Avigad, Tel: 972-2-658-6468, E-mail: Avigad@vms.huji.ac.il

17. Geochemical Laboratory

The Jerusalem laboratory:

1. Four-channel alpha counter for counting ^{222}Rn collected in Lucas Cells.
2. Two-channel RaDeCC system for counting ^{224}Ra and ^{223}Ra, that were adsorbed on fiber coated by Mn-Oxide. The system was recently upgraded by us for automatic purging during counting which enables counting of samples with high $^{226}Ra/^{224}Ra$ ratio.
3. Eight-channel alpha spectrometer (Octete).
4. Two-channel Rn extracting system.
5. Computerized CO_2 analyzer.
6. Microdrilling system for sampling coral material.
7. A computerized system for running cation exchange experiments on "natural" sediments.
8. Field pH meter, density meter, sampling equipment etc.

The Eilat laboratory:

1. Two flow injection analyzers for analyzing nutrients in natural waters.
2. Two titrators for DO and alkalinity.
3. TC-TN analyzer capable of measuring TON, DON and POC.
4. A container full of sampling equipment, diving equipment, etc.

Academic Director: Prof. B. Lazar, Tel: 972-2-658-6535, E-mail: boaz.lazar@huji.ac.il

18. Marine Biogeochemical Laboratory – IUI, Eilat

The laboratory at the Interuniversity Institute for Marine Sciences in Eilat (IUI) includes a trace metal clean room (iso 8) and a filtered air laboratory. Room surfaces are made of non-corrosive, acid resistant, metal-free plastic materials or wood, the walls are epoxy painted, and major precautions are taken to maintain a dust-free environment. The trace metal clean laboratory has a positive pressure air supply with HEPA filtration, and is composed of several separated working spaces with different degrees of contamination control, which serve different purposes. The filtered air laboratory is equipped with a laminar hood bench for trace metal clean and biological sterile work. The water supply to the laboratory includes ion exchange columns (DI), 1μm and 0.2μm cutoff home filters, high pressure ultra-filters with 10KD cutoff, and a Milli-Q® Ultrapure Water Purification System

(Academic A10, DDW). The analytical instrumentation includes: **UV/Vis Spectrophotometer** (Cary 50 with 100 cm path length cell), **coulter particle counter**, and an automated **flow injection system** for sub-nanomolar Fe(III) and Fe(II) determination (FeLume II).

Other available facilities at the IUI include culturing rooms and incubators, fluorometer (10 AU Turner Designs), spectrofluorometer (Cary Eclipse), FACSort (Becton-Dickinson), FIA Nutrient Analyzer, liquid scintillation counter (Beckman), and radiotracer room. A portable class 100 HEPA hood will be used in facilities that do not meet trace metal clean criteria.

Academic Director: Dr. Y. Shaked, Tel: 972-8-6360139, E-mail: yshaked@vms.huji.ac.il

19. Geophysical Fluid Dynamics Laboratory

The research activity at the Geophysical Fluid Dynamics (GFD) laboratory IES is engaged in developing new, and improving existing, software packages for studying fluid dynamics on the rotating spherical earth. These numerical tools include: a shooting algorithms for solving differential eigenvalue equations; tailoring of a Chebyshev collocation method to the shallow water equations (SWE) on the rotating spherical earth in matrix (algebraic) equations and developing simple numerical schemes for solving simple nonlinear partial differential equations that arise in the forced shallow water equations on a sphere. These methods are applied to a variety of geophysical problems. Our analytical/numerical results were fully confirmed by the experiments made in the rotating tank (13 m diameter, see figure below) at Grenoble.

Academic Director: Prof. N. Paldor, Tel: 972-2-6584924, E-mail: nathan.paldor@huji.ac.il

20. Paleontological Laboratory

The Paleontological collections are part of the National Natural Collections of the Hebrew University, hosted at Berman building:

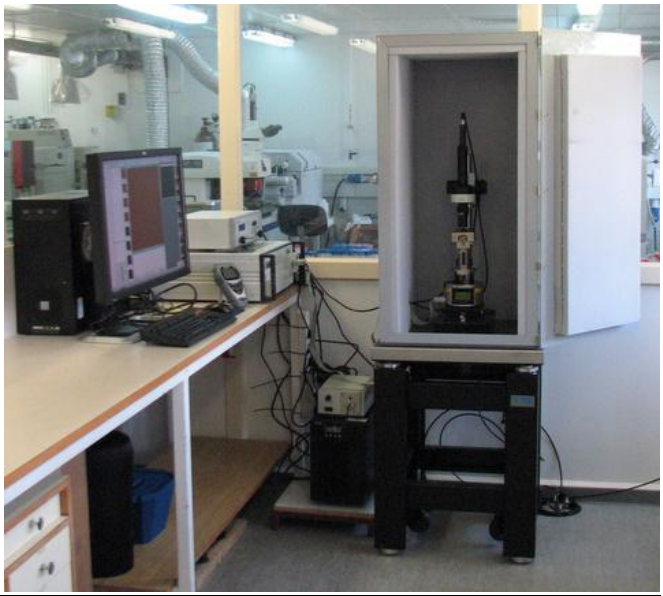
The Paleontological collections hold an impressive body of information on the fossil records of the eastern Mediterranean basin. Numerous invertebrates and vertebrates specimens from known geological localities are available for research and teaching.

The Archaeozoological collections include dozens of Quaternary sites that record regional faunal history. The specimens come from sites representing landmarks in the history of humankind in the area from more than 1 Ma years ago up to recent periods.

Laboratory Director. Dr. R. Rabinovich, Tel: 972-2-658-5784, E-mail: rivka@vms.huji.ac.il

21. Hydrogeology Laboratory

The modification of rock, soil, and sediments by geochemical reactions is a key phenomenon in many Earth systems, including carbon sequestration, hydrocarbon recovery, and contaminant transport. Primarily, our research examines reactive transport processes in geological and environmental systems by combining laboratory experiments, field observations, and numerical models. For the analysis of mineral precipitation and dissolution at the nanometer scale, the lab operates a Veeco Multimode 8 Atomic Force Microscope equipped with a temperature controller and flow through cell. In addition, optical imaging equipment, peristaltic and syringe pumps, temperature controllers, and a temperature/humidity environmental chamber is available to conduct geochemical experiments in porous media under highly controlled conditions.



Laboratory Director. Dr. S. Emmanuel, Tel: 972-2-6586875, E-mail: simonem@cc.huji.ac.il

22. Physical Oceanography and Climate Dynamics

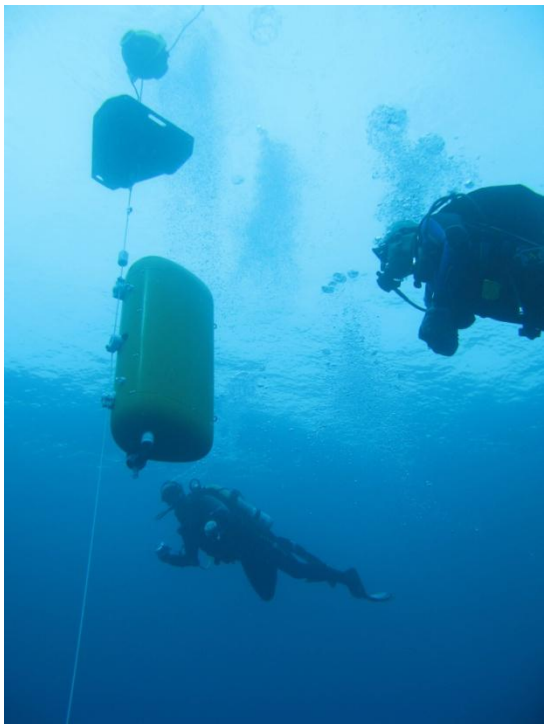
We use a combinations of field observation, numerical simulations, and theory, and to conduct research within the broad areas of:

(1) Physical oceanography
(2) Modern and/or paleo climate dynamics
(3) Interaction between biota and climate

Facilities and instruments include:

1. Network of HF radar for current measurements
2. Numerous Acoustic Doppler Current Profilers (ADCPs)

3. Mooring profiler
4. Microstructure turbulent profiler
5. Acoustic releases, CTDs, temperature logegrs.
6. Computer cluster
Academic Director: Prof. H.Gildor, Tel: 972-2-658-4393, E-mail: hezi.gildor@huji.ac.il



HF radar located at the Port of Eilat (left) and mooring profiler (right)

23. Organic Geochemistry Laboratory
The lab includes: (1) Microwave extraction system (MarsXpress, CEM) for the solvent extraction of organic samples from sediments, rocks and oil shales; (2) Gas Chromatograph coupled to quadrupole mass spectrometer (GC-MS, Agilent 7890 and 5750) for the separation and identification of individual volatile compounds; (3) Gas Chromatograph with Flame Photometric Detector (GC-FPD, Perkin Elmer Clarus500) for the separation and quantification of sulfur containing compounds; (4) Gas Chromatograph with ICP-MS interface for analysis of metal containing organic compounds (GC-ICP-MS, Perkin Elmer , Clarus500), (5) Purge and trap system (Tekmar) for the analysis of volatile and gases in water and wet soil samples in conjugation with GC-MS.
Academic Director: Dr. Alon Amrani : 972-2-658-5224, E-mail alon.amrani@mail.huji.ac.il

4.10 Please list honors, fellowships/scholarships, etc received by faculty (senior and junior).

The IES faculty members have received numerous honors outline below. It is important to mention the following: Danny Rosenfeld, the 2001 Verner Suomi Award of the American Meteorological Society (among other awards); Oded Navon, 2003 President of the International Association for Volcanology and the Chemistry of the Earth's Interior; Yehouda Enzel receiving the 2005 Geological Society of America Faruk El Baz Desert research Award; Zvi Garfunkel, 2006 recipient of the EMET* prize; Boaz Luz, 2009 recipient of the Patterson Award; Yehoshua Kolodny, 1998 Fellow of the Geochemical Society; 2010 recipient of the Israel Prize in Earth

Sciences; Alon Amrani, 2009 recipient of the Biomarker Pioneer Award of the Organic Geochemistry, and 2010 Best Paper Award by the Organic Geochemistry Division of the Geochemical Society. Additional awards are listed in Appendix 10.

* The EMET PRIZE- FOR ART, SCIENCE AND CULTURE is one of the most prestigious prizes in Israel. All Israeli Nobel laureates received the EMET prize a few years prior to their Nobel.

4.11 Please list cooperation activities by department members both in Israel and abroad.

Please see Appendix 11

4.12 Please list the major consulting activities done by faculty.

Please see Appendix 11

4.13 What is the level of synergy between research strengths and teaching needs at the various degree levels?

There are numerous examples that demonstrate the synergy between research strength and teaching at IES. The establishment of the three new programs (BSc - CAOS, MSc, PhD – Hydrology, and MSc within Geology Fossil Energy) is a prime example. As water in all environments and forms plays a major role in our research and several faulty members conduct research related to water transport in porous media and on the surface, to reactive transport of water, and to aquatic geochemistry; these aspects were included in the new program in Hydrology established two years ago. Similarly, the growing interest of our faculty members in research related to climate change led to the establishments of CAOS – a BSc program in Climate-Atmosphere-Ocean Sciences. The active research done along the Dead Sea Transform is reflected in the large number of field trips and mapping courses which take place there. Also, our teachers who work in the Gulf of Eilat are teaching field-oriented courses there, where students study basic techniques in oceanography and marine bio-geochemistry.

4.14 In summary, what are the points of strength and weakness of the research, and are you satisfied with the research outcomes of your department?

The IES is a dynamic, vibrant, and active research unit. Without any exception all our faculty members have active research groups. On average we have more than four graduate students per faculty member, including non IES students, as we have more than 100 graduate students supervised by us (see table in section 3.1.5). We have much collaboration among us and also with colleagues from other departments of HUJI, and other universities and research institutions in Israel and abroad. We have a continuous flow of visitors from abroad, including many leading figures in Earth Sciences (Appendix 12). Most of us have organized national and international meetings (Appendix 12) and all of us are regularly being invited to present our work in other universities and in scientific meetings. Our major weaknesses and strengths are:

Weaknesses:

- Over the years, the field of Earth Sciences has become more sophisticated and the need for more instrumentation and computer power has increased. This in turn requires more professional technical staff. However, this is not supported by HUJI. Instead, technical positions are continuously being cut and, as a direct result, we have a hard time maintaining our laboratories.
- The same can be said with respect to the absorption of new faculty members. The HUJI administration does not always provide sufficient funds required for the proper

absorption of new and young faculty and we have had to rely on the good will of established IES faculty members (and their budgets) to provide even the basic equipment they need.

Strengths:

- Our institute is characterized by strong internal and inter-disciplinary collaboration.
- Beyond (and due to) such professional collaboration, our faculty members are willing to share resources to ensure that the IES as a whole remains on the cutting edge. This can be seen in faculty coming forward when others need financial help for research, equipment, etc., or to share the teaching load when required. Moreover, most of the introductory-level courses and courses for non-Earth Science students are taught by the senior faculty members.
- We have a small but dedicated administrative and technical staff that helps maintain the IES and its laboratories, and this too contributes to our study programs running smoothly and efficiently.
- The IES is an active and dynamic academic unit which quickly responds to new directions and challenges in Earth Sciences, be they in Israel, the world, the sea or space.
- We have a very strong group of bright young faculty members who come from leading institutions abroad armed with the newest concepts and research tools.
- We have several promising graduate students who look set to help assure our future both at the IES and indeed in the realm of Earth Sciences.

Chapter 5 - The Self-Evaluation Process, Summary and Conclusions

*1.1. Please describe the way that the current **Self-Evaluation process** was conducted, including methods used by the parent unit and the study program in its self-evaluation process, direct and indirect participants in the process etc. What are your conclusions regarding the process and its results?*

*1.2. Describe the consolidation process of the **Self-Evaluation Report**, including its preparation and final approval (including a description of the contributions of staff members to the process).*

The current evaluation of the Institute of Earth Sciences (IES) at the Hebrew University (HUJI) is the last in a series of four processes conducted since 2005. The first evaluation was carried out by an external committee chaired by the Hebrew University ex-President H. Gutfreund. The other members of the committee were E. Stolper of Caltech, F. Morel of Princeton University, K. Emanuel of MIT, and V. Courtillot of the Institute de Physique du Globe. The Review Committee's overall evaluation was "**that the IES is in good health. Both individually and collectively, the quality and standing of the faculty is high, and several faculty members are international leaders in their disciplines. In view of these strengths, which provide a strong platform for future development, the Review Committee believes that by focusing on a few critical issues and by defining for itself distinctive areas of research, the Institute can improve its already high national and international standing**" (Appendix 1, 1b). These issues are:

1. Embark on a planning process that will map out a strategy of appointments on a ten-year time scale.
2. The HUJI should launch a review of all activities involving environmental topics.
3. The IES should maintain its commitment to the marine lab in Eilat.
4. The physical geographers now in the Department of Geography should be relocated to the IES facilities.
5. The HUJI and the IES should do as much as they can to make sure that the Geological Survey which is about to move out of its current location, move to the Givat Ram campus.
6. The overall seismo-tectonics of the Dead Sea Rift and transform fault system is one of the distinctive topics in which the IES could play a significant role.
7. Some of the same considerations discussed above in relation to the Geological Survey might also pertain to Hydrological and Meteorological Services in Israel.
8. The IES consider taking steps that would simultaneously serve to stimulate research at sub-disciplinary boundaries and to add cohesion to the Institute. The Institute should consider making a "bridging" appointment that would span two or more sub-disciplines in the geosciences. Possible specific examples include appointments in paleo-climate or geo-biology.
9. Design introductory graduate-level courses that span disciplines and involve multiple faculty members.
10. Initiate a faculty lunch seminar.
11. The IES and HUJI should launch a program of visiting scientists, both at the postdoctoral and senior scientist levels.
12. The IES insures adequate access of second and third year undergraduate and the beginning graduate students to more advanced courses in mathematics and physics.
13. The IES considers appointing a faculty mentor for shepherding the new faculty member through the system. We also strongly encourage IES to assign new faculty as light a teaching load as feasible.

As a result of these recommendations the IES conducted two internal evaluation and planning campaigns in 2006 and 2010 (Appendix 2, 3), and addressed most of the 13 points

made by the review committee. In 2006 we made a plan for the years 2006-2015 (Appendix 2) and in 2010 we re-evaluated it and made a few adjustments. It is worth noticing that so far we were able to fully comply with our hiring goals of the 2006 (and 2010) work-plan (Table 2 from Appendix 2 – see below). As stated in Appendix 3: "Comparing the four IES appointments made since 2007 with those planned in 2006 reveals that the major research interests of all new faculty members match the recommendations of the 2006 development plan for high priority recruitments. While this is encouraging, we recognize that some deviations are acceptable and such programs must be flexible and adaptable to changing conditions. In constructing the new plan, we followed the plan outlined in 2006 and the recommendations of the 2005 review committee with one exception: we can no longer assume that physical geography will be part of the IES. While we are interested in maintaining our high international status in these three fields, it is important to also allocate positions in emerging disciplines in geosciences. Based on the 2006 development plan and the expected five retirements by 2015 (Appendix 3 - Table 3) we plan to make the following appointments: one appointment in **physical atmospheric sciences**, one in **oceanography** (marine geochemist or bio-geochemist), two in **geochemistry** (preferably atmospheric chemistry and paleo-climate), and one in **geophysics** (including tectonics or magnetism). In contrast to the 2006 plan, in the current plan we do not specify the precise year in which each position will be filled as this depends primarily on the scientific merits of the possible candidates and the constraints imposed by the HU. Between 2015 and 2020 four additional faculty members are expected to retire (Appendix 3 - Table 3), two of whom are atmospheric scientists (one also has an interest in oceanography) and two are geochemists (one deals with solid earth processes and the other with oceanography and surface processes). In order to maintain our critical mass and leadership in oceanography, geochemistry, and atmospheric sciences we propose to hire two **atmospheric scientists** and two **geochemists**, one of which is also an oceanographer. In general, we opt to maintain the "balance between field-based, theoretical, and laboratory-based studies."

The 2010 process was the basis for the current evaluation process. It had a kick-start during a full-day meeting attended by all faculty members and several emeriti professors. Following the first day we conducted six-month long discussions by two committees (a research–oriented committee (eight members: A. Agnon, E. Aharonov, A. Angert, Y. Erel (chair), R. Kessel, A. Matmon, O. Navon, D. Rosenfeld), and a teaching committee (six members: A. Angert, D. Avigad, Y. Enzel, Y. Erel, C. Haspel, B. Lazar (chair)). The product of these discussions was presented to all faculty members and was followed by 3-month-long discussions and finally led to the 2010-2020 work plan (Appendix 3). Hence, we now have a 10-year (2010-2020) plan of operation which touches upon most of the aspects of the IES life. Note: Angert's appointment is also according to the 2006 plan. EA = E. Aharonov. SE = S. Emmanuel. HG = H. Gildor. In 2011 we hired a geochemist (A. Amrani)

Table 2. Development plan

Year	Retirements	New Appointments	Planet Science	Atm. Science	Oceanography	Hydrology	Surface Geology	Solid Earth	Total
2006			0.8	7.3	3.9	2.6	5.0	3.4	23
2007	Garfunkel	Angert	0.8	8.1	4.1	2.6	4.5	2.9	23
2008		Geophysics (EA)	0.8	8.1	4.1	2.6	5.0	3.4	24
2009	Cohen	Hydrology (SE)	0.3	7.6	4.1	3.6	5.0	3.4	24
2010		Atm.Science(HG)	0.3	8.6	4.1	3.6	5.0	3.4	25
2011	Luria	Paleoceanog.	0.3	7.6	5.1	3.6	5.0	3.4	25
2012	Luz	Geobiology	0.3	7.6	5.1	3.6	5.0	3.4	25
2013			0.3	7.5	4.4	3.6	5.8	3.4	25
2014	Khain	Geochemist							
	Matthews	Atm. Science.	0.3	7.5	4.4	3.5	6.1	3.2	25
2015	Dayan	Oceanography							
	Erez	Atm. Science.	0.3	7.5	4.6	3.5	5.9	3.2	25
Retirements	8		0.5	3.6	1.5	0.1	1.3	1	8
Apointments		10	0	3.8	2.2	1	2.2	0.8	10

The present report was prepared by a few members of the IES as appears on the front page. The report was circulated among all faculty members in order to obtain their remarks.

Following the current lengthy process of self evaluation and the report of the 2012 committee we will use the same mechanisms applied after the 2005 report. In addition, we decided that an evaluation process will take place every 3-5 years in order to re-examine the new work-plan and its relevance to on-going developments in Earth Sciences.

We initiated the 2010 evaluation process by asking eight questions which touched upon various aspects of IES activities and inspected the strengths, weaknesses, opportunities, and threats (SWOT) associated with their answers. These questions are:

1. What is the relevancy of the 2006 work-plan and what are the needed changes?
2. What should be the main IES research directions until 2020 (with intermediate goals for 2015)?
3. Should the IES try to establish a center of research in the direction of a "hot" topic such as global climate change?
4. What is the IES attitude towards interdisciplinary research and teaching programs, including those with other academic units within the university?
5. What should be our relationships with the Geological Survey?
6. What should be our relationships with other units at the HUJI which have overlapping fields of interest (e.g., physical geography, water and soil within the Faculty of Agriculture, Planetary Sciences with Physics)?
7. Should we unify our BSc program in atmospheric sciences, geology, climate-atmospheric science- oceanography (CAOS) into a single BSc program in earth sciences?
8. Should we try to incorporate the program of environmental studies into the IES?

Following the discussion over these questions we reinforced the goals of the IES set up in 2006:

1. To carry out **research and teaching** in Earth Sciences at the highest academic international level possible under the conditions offered in Israel and at the Hebrew University.
2. To remain the **leading academic institution in Israel** in the field of Earth Sciences and to maintain and improve its international standing.
3. To promote and lead participation of the Israeli Earth Sciences community (universities, government research institutes) in **international academic activities**.
4. To promote and influence **national and regional** Earth Sciences academic and applied activities, including **environmental issues**.
5. Within the Faculty of Science at the Hebrew University, the IES should assume responsibility for the **programs in Oceanography and Environmental Sciences.** This activity should be coordinated with other Institutes within the faculty (e.g. Life Sciences, Chemistry) and with other faculties (mainly Agriculture, Social Sciences and Law).

These goals led us to the development plan outlined in Appendix 3 and also helped us comply with the recommendations made by the 2005 evaluation committee. Below is a detailed reply to the remaining 12 recommendations:

2. The HUJI should launch a review of all activities involving environmental topics.

In 2007 the HUJI conducted a review of all aspects of Environmental topics. This review was carried out by two faculty members, one from the Faculty of Agriculture and one from the IES (Appendix 13 – in Hebrew). The authors consulted with a large number of faculty members involved in environmental research spanning from Humanities (ethics, archaeology), through Social Sciences (environmental management and politics), Law (international law), Medicine (environmental health, toxicology, epidemiology), Natural Sciences (hydrology, atmospheric sciences, ecology, oceanography, microbiology), and Agriculture (irrigation, entomology). Their report, presented to the HUJI Rector in 2007, led

to the establishment of a **graduate school in environmental studies** (Appendix 14 – in Hebrew). This program is now in an advanced stage of approval by the HUJI administration.

3. The IES should maintain its commitment to the marine lab in Eilat (IUI).

In 2005 we hired Y. Shaked jointly with the IUI, and in 2010 we hired another H. Gildor who is an oceanographer and atmospheric scientist. Five additional IES faculty members conduct research in Eilat together with members of IUI (Erez, Lazar, Luz, Agnon, Paldor, and Erel). Most of them also teach inter-university courses and jointly supervise several MSc and PhD students (see Ch. 3). The IES took a strong standpoint on the importance of maintaining the IUI under the supervision of the Hebrew University, a standpoint which was adopted by HUJI President. In addition, The IES is currently taking part in the establishment of a new inter-university center of marine research in the Mediterranean Sea. At the same time, we consider potential joint IES-IUI faculty members, subject to our development plan.

4. The physical geographers now in the Department of Geography should be relocated to the IES facilities.

This is the only recommendation which was not complied. Because of various reasons the HUJI administration decided to leave the physical geographers within the Department of Geography.

5. The HUJI and the IES should do as much as they can to make sure that the Geological Survey which is about to move out of its current location, move to the Givat Ram campus.

Indeed this was done. The IES together with the HUJI administration and the management of the Geological Survey overcame a series of political and bureaucratical obstacles so that now the Geological Survey is planning its new facility at the Safra (Givat Ram) campus, and within 3-5 years it is expected to move there. Based on the outlines in Appendix 3 we started a detailed discussion with the Geological Survey about the coordination of facilities, library, teaching by the Geological Survey scientists, and more. Already, we appointed Geological Survey researcher, Dr. Moti Stein, an adjunct professor at the Hebrew University.

6. The overall seismo-tectonics of the Dead Sea Rift and transform fault system is one of the distinctive topics in which the IES could play a significant role.

The IES has been a leader in the tectonics of the Dead Sea rift, and the benchmarks studies have inspired tectonic research elsewhere. Since the mid 1990's, we have developed earthquake geology taking advantage of the unique sediments of the Dead Sea basin, the long documented history, and the longer span of ruins often indicating earthquake damage. Since 2005 we have had several theses focusing on earthquake geology. We have also organized two symposia on seismo-tectonics of the Dead Sea rift. In 2007 we organized and hosted an international symposium honoring the work of Prof. Z. Garfunkel on the Dead Sea rift. One of our special guests was Prof. X. Le Pichon, from Ecole Normal Superior Paris and Aix, a forefather of plate-tectonics who mastered the tectonics of the Middle East among other regions in the world. The other special guest was Prof. S. Stein from North Western University, a renowned authority on seismology and its applications to tectonics. The guests were taken on field excursions and were exposed to the relevant research carried out in the IES.

Together with the GSI we co-organized an international conference of experts and a field trip entitled: The Dead Sea rift as a natural laboratory for neotectonics and paleoseismology" under the International Union for Quaternary Research (INQUA, Focus Area Paleoseismicity and Active Tectonics. February 2009). The conference started with talks by Steve Wesnousky, Geoffrey King, and Thomas Rockwell at IES. These speakers are world

authorities on seismo-tectonics in general, with considerable experience in transform faults. An outcome of the conference was a special volume of the Israel Journal of Earth Sciences honoring Prof. Raphael Freund, the first Head of IES who pioneered the research on the tectonics of the Dead Sea rift (editors: Agnon, Amit, Michetti, Hough).

Several of our faculty members (Agnon, Avigad, Enzel, Erel, Garfunkel, Gildor, Gvirtzman, Katz, Kolodny, Lazar, Luria, Matthews, Matmon, Ron, Sass, Starinsky) have ongoing projects in different part of the Dead Sea Rift. Furthermore, we nominated Dr. Stein of the Geological Survey who is a leader in Dead Sea research as an adjunct professor at the HUJI. Stein, Agnon, Enzel, Erel, Lazar, and Ron are members of a multi-national team that launched the Dead Sea Deep Drilling Project in order to study its paleo-seismic and paleo-climate records. Together with researchers from (Tel Aviv University (Z. Ben Avraham and S. Marco) we obtained funding from the Israel Science Foundation (ISF) to establish a center of excellence which will study the drilled core. The effect of earthquakes is evident in the cores that have already been opened and we foresee years of fruitful research on earthquake geology from this core. We will also continue our leadership of research on brines and other topics related to this unique tectonic setting. Other members of the IES (Agnon, Gildor, Gvirtzman) are conducting research related to the possible construction of the Red Sea – Dead Sea Conduit.

7. Some of the same considerations discussed above in relation to the Geological Survey might also pertain to Hydrological and Meteorological Services in Israel.

So far we have not moved in that direction as an Institute, although one of our senior members (H. Gvirtzman) is a board member of the Israeli Water Commission. Two years ago he initiated an MSc program in Hydrology, which he heads. The program involves faculty members from the IES (Gvirtzman, Aharonov, Emmanuel, Enzel, Erel, Haspel-Erlick, Khain, Lazar, Rosenfeld), from the Institute of Chemistry, from the Geological Survey, as well as from the Faculty of Agriculture and the Physical Geography in the Faculty of Social Sciences. Approximately 15 graduate students are currently enrolled in the program. In addition, two faculty members (Rosenfeld, Erel) serve on the committee of rain enhancement which was set up by Israeli Water Commission.

8. The IES consider taking steps that would simultaneously serve to stimulate research at sub-disciplinary boundaries and to add cohesion to the Institute. The Institute should consider making a "bridging" appointment that would span two or more sub-disciplines in the geosciences. Possible specific examples include appointments in paleo-climate or geo-biology.

Four of the eight appointments made by the IES since 2005 were "bridging" appointments. Dr. Matmon (hired in 2005) is a geologist who specialized in geomorphology and uses cosmogenic isotopes in order to quantify erosion rates and landforms stabilities. Dr. Angert (hired in 2007) is a bio-geochemist who conducts research related to climate change. Dr. Emmanuel (hired in 2009) is a hydrologist who also uses geochemical tools (e.g., stable (Fe) and radiogenic (Pb) isotopes) to study reactive transport mechanisms and rates. Professor Gildor is a physical oceanographer and atmospheric scientist who also studies climate change and ocean-atmosphere-biota interactions. One of the main strengths of the IES is that it is a very cohesive unit. Whenever there is a major task such as the absorption of a new faculty member or the establishment of a new laboratory most if not all members of the IES come forward. Also, in the past few years many of us have joined forces in the establishments of new centers of research and teaching programs (e.g., Multi-Disciplinary Center for Environmental Research, Dead Sea ISF Center, MSc program in Hydrology). At the same time we pool resources within the HUJI and with other institutions for setting up joint laboratories (e.g., the luminescence lab at the GSI and the LA-ICP-MS analytical lab in the IES). In addition, four of our recent appointments bridge between IES and other institutes

within the Faculty of Sciences, they co-advise graduate students, receive research funds and publish jointly (Shaked with life sciences, Aharonov and Gildor with physics, and Amrani with chemistry).

9. Design introductory graduate-level courses that span disciplines and involve multiple faculty members.

(1) Professor Aharonov organized a course entitled "*Introduction to Conventional and Renewable Energy*" where other faculty members co-teach (Aizenstadt from Chemistry, Amrani from Earth Sciences). (2) Professor Gildor teaches a course entitled "*Classical papers in Earth Sciences*." In this course the students read and discuss "classical" papers in all fields of Earth Sciences. Occasionally he invites other faculty members to illuminate special aspects. (3) Professors emeriti Kolodny and Garfunkel started last year a course entitled "*Selected Topics in Geology*." In the course they describe the evolution of ideas of stratigraphy and tectonics, geology of pre-Plate tectonics, catastrophism and actualism, evolution of geochronology and more. (4) Professors Erez, Lazar, and Gildor co-teach a course in Eilat named "*Research Methods in Oceanography*" which is offered to advance undergraduate and first year graduate students (this course was taught also before 2005 but it was re-organized recently). In this regard, it is important to note that during the past four years we established three new inter-disciplinary teaching programs (1) **Climate-Atmosphere-Oceanography Sciences** (CAOS) - BSc program, (2) **Hydrology** – inter-faculty MSc and PhD program (together with the Faculty of Agriculture and the Faculty of Social Sciences), and (3) **Fossil Energy** – a specialization program within the MSc in Geology.

10. Initiate a faculty lunch seminar.

Because of teaching load we could not allocate time for regular faculty lunch seminars, instead we took three steps: (1) every year 3-4 of our faculty members present their work at the IES weekly seminar. (2) Every Thursday afternoon (the HUJI is closed on Friday and Saturday) we have a "happy hour" where most faculty members and their graduate students get together, receive updates about IES and HUJI affairs and exchange ideas and information. This has been taking place since 2007. (3) A few months ago we initiated a young-faculty forum (named 50-minus Club) where the head of the institute meets with all faculty members who joined IES after 2000 (Haspel, Kessel, Matmon, Shaked, Angert, Aharonov, Emmanuel, Gildor, Amrani). In these meetings (which have the format of lunch seminars) we discuss IES and HUJI issues and one of the faculty members presents his/her research. We intend to gradually develop this meeting into a faculty lunch seminar.

11. The IES and HUJI launch a program of visiting scientists, both at the postdoctoral and senior scientist levels.

Since 2005 we initiated a series of workshops in environmental geosciences named "Kaplan Workshops" (honoring I. and H. Kaplan). The first Kaplan Workshop was dedicated to "*New Developments in Environmental Isotope Research*". It took place in the fall of 2005 and was a major success. In addition to many scholars and students from Israel we invited nine distinguished scientist from abroad, including Mark Thiemens, Malcolm McCulloch, Don DePaolo, Andres Meibom, Ariel Anbar, Joel Blum, Albert Galy, Amaelle Landais and Anton Eisenhauer. The second Kaplan Workshop was dedicated to "*Global Pollution: From Background to Contemporary Levels*". It took place in the spring of 2008 and was also a major success. Again we had several distinguished scientist from abroad, including Michael Hoffmann, Bernhard Wehrli, Spyros Pandis, James Schauer, Joel Savarino, Edward Boyle, Prasad Kasibhatla, Kon-Kee Liu, Martin B. Goldhaber, and Stephan Kraemer. The third Kaplan Workshop was dedicated to "*Challenges of the Global Water Shortage*". It took place in the spring of 2010. Again, several distinguished scientist presented their work, including

Kevin Trenberth, Graham Feingold, Bob Hecki, Walter Giger, Janet Hering, Grant Garven, and Jesus Carrera. The fourth Kaplan Workshop will be dedicated to "*Paleoceanogaphy and Paleoclimatology: New Approaches to Old Problems*" and it will take place on 4-7/3/2012. So far 12 scholars from abroad confirmed their participation (Jess Adkins, Larry Edwards, Harry Elderfield, Jean Lynch-Stieglitz, Andy Ridgwell, Gerard Roe, Eelco Rohling, Yair Rosenthal, Jeffrey P. Severinghaus, Ellen Thompson, Lonnie Thompson, Robbie Toggweiler).

Last year we established the Nadine and Fredy Hermann post-doc Fellowship program which in addition to the existing Lady Davis Fellowship of the HUJI allowed us to hire a few post-docs. We currently have five post-docs and expect to increase their number next year.

Every year we have 1-2 distinguished visitors who come for an extended visit (some through the Lady Davis Foundation Fellowship). For example, this year we expect to have Y. Kushnir of Lamont and A. Anbar of U. Arizona. We had Michael Chazan of U. Toronto and Joel D. Blum of U. Michigan in 2011, Wally Broecker of Colombia U. and Mark Thiemens of UCSD in 2010, Amos Nur of Stanford U. in 2009, Heinrich Holland of Harvard U. and Geoffrey King of Paris in 2008, Surendra Bhattacharya of PRL (India) in 2007 and David Fink of ANSTO (Australia) in 2006. We have had many more visitors who came for short periods. Many of the Lady Davis Fellows teach a course entitled "Selected topics in Geology". These include:

S. K. Bhattacharya (PRL, Ahmedabad, India), school year 2007-2008: Physical theory of the fractionation of stable isotopes

H. D. Holland (Harvard university), school year 2008-2009: Discovering the history of the atmosphere.

W. S. Broecker (Lamont Doherty Earth Observatory), school year 2010-2011: Climate Havoc Related to The Great Ocean Conveyor.

Y. Kushnir (Lamont Doherty Earth Observatory), school year 2011-2012: Climate variability and the relationship between natural variability and anthropogenic forced changes.

12. The IES insures adequate access of second and third year undergraduate and the beginning graduate students to more advanced courses in mathematics and physics.

We initiated a new course entitled: "*Introduction to Modeling in Earth Sciences*" which is required for all 2nd year undergraduates of Earth Sciences. This course reviews concepts glossed over in the first year mathematics courses and introduces, on a very practical level, the mathematics necessary for atmospheric/earth sciences students. The emphasis is on understanding the concepts and how to use them and not on formal proofs. The course also teaches basic concepts and methods for mathematical modeling of physical systems (ODEs &PDEs).

13. The IES consider appointing a faculty mentor for shepherding the new faculty member through the system. We also strongly encourage IES to assign new faculty as light a teaching load as feasible.

In 2006 the HUJI rector initiated a program of mentoring new faculty members. The mentors are asked to meet with the new faculty members to advise them about obtaining funds for research and to help them design their research strategies. One year after the new faculty member joined the HUJI his/her mentor writes an evaluation report to the Dean and to the department chair. Although it was not evaluated systematically, there is a strong feeling that this system works well and helps the new faulty members.

The IES policy is that new faculty members teach only one course on the first year at the HUJI and teach an additional new course each year, so that only after 3-4 years they reach

their full load of teaching. In order to achieve that, some of the senior faculty members teach more than a full load. Moreover, we try to allocate the introductory, populous courses to the senior faculty members.

As a result of the current evaluation process we recognize the following weaknesses and strengths which will be re-examined in future evaluation processes:

Weaknesses:

- We see a relatively high dropout rate after the first year.
- Students are taking longer to complete their degrees (undergraduate and graduate) than the university sees as the optimal duration.
- There is a lack of contact between the IES and its alumni, especially those who do not remain in academe or the general research system.
- BSc students who conduct independent research projects do not receive adequate credit for doing so (as their counterparts do in the "*Honors*" system elsewhere).
- There is a continuous movement away from the traditional bell-shaped grading curve which leads to an inflation in BSc and MSc grades.
- Over the years, the field of Earth Sciences has become more sophisticated and the need for more instrumentation and computer power has increased. This in turn requires more professional technical staff. However, this is not supported by HUJI. Instead, technical positions are continuously being cut and, as a direct result, we have a hard time maintaining our laboratories.
- The same can be said with respect to the absorption of new faculty members. The HUJI administration does not always provide sufficient funds required for the proper absorption of new and young faculty and we have had to rely on the good will of established IES faculty members (and their budgets) to provide even the basic equipment they need.

Strengths:

- We have the only Earth Sciences program in Israel offering undergraduate and graduate studies of all three geospheres (lithosphere, hydrosphere and atmosphere).
- We attract many top MSc and PhD students who graduated from other institutions in Israel (particularly Ben-Gurion University and the Technion), as well as from other HUJI units (Agriculture, Biology, Physics, Computer Science).
- Our open and informal teaching atmosphere provides the students with fast and easy access to all the teaching staff regarding a broad range of matters – from consulting to complaining.
- The students are very united and active in the IES academic life.
- From year one, students at the IES can benefit from professional advice regarding their studies and future directions.
- We encourage and supervise senior undergraduate students who wish to conduct independent research (some have even published in peer-review journals).
- A very high percentage of our graduate students (about 40%) continue on toward higher degrees.
- Graduates of IES programs comprise an important part of the academic and research staff in all institutions of higher education and major research institutes in Israel and in first-class universities abroad.
- The IES attracts a continuous flow of high-level visitors from abroad, for short and long periods of time, who are keen to take a part in our diverse activities.
- Our institute is characterized by strong internal and inter-disciplinary collaboration.
- Beyond (and due to) such professional collaboration, our faculty members are willing to share resources to ensure that the IES as a whole remains on the cutting edge. This can be seen in faculty coming forward when others need financial help for research,

equipment, etc., or to share the teaching load when required. Moreover, most of the introductory-level courses and courses for non-Earth Science students are taught by the senior faculty members.

- We have a small but dedicated administrative and technical staff that helps maintain the IES and its laboratories, and this too contributes to our study programs running smoothly and efficiently.
- The IES is an active and dynamic academic unit which quickly responds to new directions and challenges in Earth Sciences, be they in Israel, the world, the sea or space.
- We have a very strong group of bright young faculty members who come from leading institutions abroad armed with the newest concepts and research tools.
- We have several promising graduate students who look set to help assure our future both at the IES and indeed in the realm of Earth Sciences.

1.3. If a mechanism/structure has been decided upon for the future treatment of weaknesses that were highlighted by the self-evaluation activity, please specify it while referring to those within the institution who would be responsible to follow up on this activity. Please refer to the question: how do the institution and the parent unit intend to deal in the future with quality assessment and its implementation?

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.

1.4 Is the full Self-Evaluation Report accessible? If 'yes' - to whom it is accessible and to what extent?

The report was reviewed by all faculty members of IES and will be accessible to all of them, and to the HUJI administration.

Appendix list

Appendices appear only in the electronic version

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Institute of Earth Science
The Hebrew University of Jerusalem

Appendix 1

Report by Review Committee

1) Introduction

Upon the recommendation of the President, Rector, and Standing Committee of the Hebrew University, a Review Committee was established to review the research and teaching programs of the Institute of Earth Sciences (IES). The Review Committee comprises (in alphabetical order) Prof. Vincent Courtillot (Institut de Physique du Globe, Paris), Prof. Kerry Emanuel (Dept. of Earth, Atmospheric and Planetary Sciences, MIT), Prof. Hanoch Gutfreund (Hebrew University, Jerusalem, Chair), Prof. François Morel (Dept. of Geosciences, Princeton), and Prof. Edward Stolper (Div. of Geological and Planetary Sciences, Caltech). The Committee interpreted its charter to include an evaluation of the interactions of the IES with other groups or institutions, both internal and external to the University. The Committee met for three days (November 14-16, 2005), and during this time discussed a report prepared by the director and faculty of the IES; interviewed the director; met with most of the faculty individually or in small groups; met with the four untenured members of the faculty; met with a representative of the Physical Geography program; met with Dr. Benny Begin, Director of the Geological Survey; met with small groups of undergraduate students and graduate students; finally met with and presented orally its report to the President, Rector and Vice Rector.

2) Overall Assessment

The Review Committee's overall evaluation is that the IES is in good health. Both individually and collectively, the quality and standing of the faculty is high, and several faculty members are international leaders in their disciplines. The Institute is particularly strong in the broad area of geochemistry, where it has a large number of faculty members spanning low- to high-temperature geochemistry and applications to a range of important problems in oceanography, biogeochemistry, petrology, and tectonic geomorphology. In addition, the existing nucleus of faculty in the Atmospheric and Ocean Sciences program provides important opportunities for growth in important areas. Finally, the small nucleus in geophysics is both high quality and essential to the rest of the department. It is particularly notable that all faculty members IES are active and productive regardless of their career stage. Moreover, over the past five years, the Institute has been creative in making four high-quality junior appointments. It is

also notable and important for the Institute and the university as a whole that three of these junior faculty members are women.

The Review Committee judged that the Institute is intellectually rich and carries out innovative research programs. We also concluded that the Institute attracts strong students at both the undergraduate and graduate levels (a measure of its strength) and provides excellent teaching and mentoring to these students. Moreover, as the Committee talked to faculty and students, it became clear that there is a strong spirit of collegiality in IES: faculty members generally collaborate effectively with each other, and students get strong intellectual support from each other as well as from the faculty. However, there is still room for greater thematic cohesiveness, which will be discussed in section 6.

In view of these strengths, which provide a strong platform for future development, the Review Committee believes that by focusing on a few critical issues and by defining for itself distinctive areas of research, the Institute can improve its already high national and international standing.

3) Long-range Planning – Future Directions

Earth science is a diverse and complex intellectual endeavor aimed at understanding processes on and within the solid earth, oceans and atmosphere. This is an especially challenging task because the behavior of the dynamic natural earth system involves interactions between the atmosphere, oceans, solid earth, and living systems over time scales from microseconds to billions of years and on length scales from molecules to continents; and while understanding any of these components of the natural system is challenging in its own right, understanding their interactions and how they led to the history of the earth is at the very forefront of the capabilities of modern science. Moreover, study of the earth system is fundamentally interdisciplinary, involving physics, fluid dynamics, biology, traditional earth, atmospheric, and oceanic sciences, and chemistry.

Given the scale, scope, and technical expertise needed to embrace fully modern earth science, the challenge for universities is how to develop and sustain a robust and innovative program given available resources. Translated to the specific situation of the Hebrew University, the question becomes how should the IES go about trying to achieve and maintain excellence

and leadership in these difficult yet important topics given the highly competitive environment of international earth science and given its optimum size?[1]

Our committee feels strongly that the proper approach is for the Institute not to try to do everything or even necessarily to compete head-on with the rest of the world, but rather to think carefully about how to build a distinctive program that will give it a unique identity. **We specifically recommend that the IES faculty embark on a planning process that will map out a strategy of appointments and in particular that they deliberate carefully and collectively in the production of a report on their vision for the Institute on a ten-year time scale.** Such a report would include identification of areas in which future faculty appointments could or should be made and how these would contribute to what the Institute aspires to as its research and intellectual focus. Although we do not wish to specify the process by which the plan is developed, this process should be agreed upon and should include deliberations within subgroups and across the entire Institute, including as equal partners junior and senior faculty. We further urge that the Institute not simply think about replacements that would shore up existing programs and strengths, but rather think about what they want to invest in that will make the program special. If the faculty can agree upon an innovative, realistic plan, it should be supported by the administration.

We want to emphasize that in our opinion there is no single or necessarily best approach to the development of a distinctive program and that one of the Institute's challenges will be to debate and agree upon how they might do so. For example, while always insisting on high academic standards and quality, the faculty might choose a small number of innovative foci that they feel other institutions have overlooked, or they might choose to go in larger numbers into fields in which most institutions only have one or two faculty members (the current focus on geochemistry in the Institute is an example). Alternatively, there may be areas that bridge between existing strengths in the Institute that would lead to the definition of novel approaches to existing problems. Or there may be areas in which, because of existing strengths in other parts of the Hebrew University (e.g., molecular biology or chemistry), cross-disciplinary programs might thrive here better than elsewhere. Or perhaps there are external factors such as the proximity to the Israel Geological Survey that would provide significant competitive advantages around which the IES could build. Another approach, which is sometimes particularly attractive

[1] The Review Committee takes the target size of the IES to be 25 faculty members. This is based on an expectation of 22 faculty members given the current organization of the Institute, and the hope of the committee that the three faculty members in the physical geography program will be reunited with the Institute (see section 5b below).

for earth science departments, is to take advantage of a particular set of features or processes that exist locally (e.g., the Dead Sea rift zone) that give entry into a large number of important, large-scale problems in earth science; this approach also has the advantage of allowing the university to engage and serve the nation while also doing important science (especially regarding resources and hazards in the particular example of the Dead Sea rift).

There are surely other examples of how to think about and design an exciting and distinctive program, and the items in this list are not mutually exclusive. We wish neither to constrain how the faculty goes about defining an original and exciting plan, nor to restrict the fields that they might identify as most promising, and we have confidence that they can produce such a plan and will do so creatively. We do note, however, that the approach we recommend differs significantly from the one that has guided appointments in the IES over the past decade or so, which we perceive as largely opportunistic (i.e., based on current interests and the faculty's perception of a relatively small pool of candidates potentially interested in academic careers in Israel). While we do not disagree that the pool of potential candidates is small and while we commend the Institute for the high quality of its faculty and programs, **we nevertheless foresee several critical advantages of the process we advocate:**

- It will help to focus the Institute faculty on what they need in terms of resources and in particular in terms of faculty appointments. Although the pool of high-quality candidates may indeed be small, the experiences of the members of our committee from our own universities is that without some communal foci, it can in fact be difficult to identify faculty candidates, and the development of the department can be somewhat haphazard. Moreover, although patience will be necessary, as emphasized below there are actions that the Institute can take to optimize its chances to find and recruit people in fields that it has identified.
- Such a planning exercise can be a powerful vehicle for building respect and consensus within a diverse faculty. This also can help to engage the junior faculty in understanding the expectations and ambitions of the Institute and thereby to build and sustain a shared vision and a communal goal of achieving and maintaining excellence into the future. Moreover, if a plan exists, it can give the various components of the Institute confidence that even if it takes years to find just the right people to hire, there is a shared understanding that their goals will not be lost or forgotten.
- We also feel that there can be no better vehicle for engaging the administration and gaining its confidence than an interesting and exciting document that lays out the Institute's vision of its role in the university and its plans for achieving and maintaining scholarly leadership and excellence.

- We want to emphasize that once a plan has been developed, there is no need to hold too closely to it, and targets of opportunity should always be possible. On the other hand, the faculty may be surprised how after going through such an exercise, even without referring to the plan explicitly, the shared vision that has been built nevertheless provides a framework for the development of the program.
- Once the faculty has defined its priorities, it can develop various strategies for identifying and nurturing potential faculty candidates and thereby optimize its chances for achieving the goals of the plan despite the small pool of potential candidates. In addition to the ideas developed below (see section 6), we want to emphasize particularly that by identifying and nurturing students and postdocs in the targeted areas (and in particular in emerging interdisciplinary areas and encouraging students – including students from other Hebrew University institutes – to work in these areas) and encouraging appropriate IES graduates to take up postdoctoral positions that will position them to work in the targeted areas, the chances of achieving the innovative plans will be enhanced. A possible example of such interdisciplinary area is the application of the tools and concepts of molecular biology to geoscience. This could be especially important if the trend that most of the best potential faculty candidates will come from the Hebrew University continues.

4) Environmental Sciences

Environmental Sciences are a critical part of the future of IES. The Institute already has considerable activities in this area for many, and perhaps most, of the ongoing research and teaching activities of IES can, in fact, be broadly classified as "environmental". The two central and complementary questions regarding Environmental Sciences in IES are those of the coherence and quality of its own activities in this field and of its role in the concert of environmental activities at the Hebrew University.

Although much first rate Environmental Science teaching and research is being carried out by IES faculty, the committee did not get the sense that those activities were being particularly well coordinated or even yet conceived by the faculty as forming an intellectually coherent set. We believe that developing a plan for coordinating and enhancing its Environmental Sciences program - particularly its Environmental Sciences teaching program - should be an important part of the long term planning of IES.

Once a coherent internal program in Environmental Sciences is developed within IES, the Institute will be in a strong position to play a critical, probably leading role in the University-

wide programs dealing with the environment. We believe that indeed the field of Geosciences provides a natural intellectual center for environmental activities. This has been recognized de facto by the University through the choice of ISE faculty members as previous and present Directors of the Center for Environmental Research.

The Committee recommends that the University launch a review of all activities involving environmental topics, whether they be research or teaching oriented, whether they be performed in the faculties of Humanities, Law, Medicine, Agriculture or Social Sciences. This is a very relevant element for the Earth Sciences and the role they should play in this area, and is therefore in the purview of the Committee. It is actually essential both to IES development and to the University in general.

5) Relations with Groups/Institutions external to IES

As explained above, in addition to its own internal resources, the IES has several opportunities stemming from current or potential relationships with other academic and research units in Israel. In this section, we review these relationships and our perceptions of the issues and opportunities associated with maintaining and/or strengthening them.

Relations to « internal » groups

5a) The oceanographic laboratory at Eilat (IUI)

The Inter-University Institute (IUI) for Marine Sciences at Eilat is a resource that provides significant opportunities for IES. The location of IUI on the Gulf of Aqaba gives it ready access to deep (or so-called "blue") water and thus to physical, chemical, and biological conditions that are normally found only in the open ocean. The HU manages the IUI for the Israeli academic community and many of the permanent faculty members at Eilat have their faculty appointments through the Hebrew University (although at present most of these are not associated with the IES).

From the viewpoint of the IES, IUI presents opportunities for teaching and research in ocean sciences, and since they are critical for robust programs in the earth sciences and in environmental science, access and association with IUI are important components of the IES portfolio. Despite the distance between Eilat and Jerusalem, one junior faculty member will be in residence at the IUI and her laboratory facilities will be located there; in addition, several IES senior faculty also have laboratory facilities at the IUI. Although we judge that, through these interactions, the IES is well positioned to take advantage of the opportunities presented by the

IUI, there are nevertheless inevitable tensions between the IUI and the universities associated with it, including the Hebrew University. For example, the IUI rightly aspires to be a successful inter-university and multidisciplinary research center with its own research agenda, and while the IES faculty members associated with the IUI must share this goal, they nevertheless owe their primary allegiance to the Hebrew University, and the IES tends to view the Eilat facility as a field station for their ocean-related research. In addition, even within the Hebrew University, the ocean science interests of several other institutes, namely those of chemistry and of life sciences, need to be coordinated with those of IES.

Our main recommendation in this area is that the IES maintain its commitment to the IUI enterprise, since the ocean sciences are a critical element of any modern earth science program and the IUI allows the IES to participate in ocean science without having to maintain its own oceanographic institute. Through this commitment (which will manifest itself primarily in the appointment of faculty members for whom the IUI is a critical resources, and in providing adequate material and intellectual support to these faculty), the IES will have a place at the table as the future programs and management issues associated with this facility are debated. Without such a role, the programs and policies of the IUI could well drift away from needs of the earth science stakeholders in the facility. The committee also believes that it will be in the best interests of the IES and Hebrew University to resist pressures to have the leadership and management of the IUI removed to the auspices of another university rather than the Hebrew University. We urge the Institute and the central administration to support vigorously the current arrangements.

5b) Physical Geography

For historical reasons, several IES faculty members moved to the Department of Geography in the Faculty of Social Sciences on the Mt. Scopus campus in the early 1990s, and in addition one faculty member, Yehuda Enzel, moved there half-time, retaining a half-time position in IES. Around the time of this transition, Amos Frumkin was appointed to a position in the physical geography group. Since then, several of the physical geographers retired, and Uri Dayan and Efrat Morin were appointed. The current size of this group is 3.5 positions.

There are several reasons why we believe the physical geography program should move back to IES. The overriding reason is that IES is their natural intellectual home: surficial processes, hydrology, climatology, etc. – the areas of enquiry represented by the physical geography group – are unambiguously within the earth sciences, and by having the two programs separated, the Hebrew University diminishes the potential of its larger endeavors in the earth

sciences. This affects both the faculty in the development of their research programs and the students trying to span modern earth sciences in their training. We emphasize that in our view both groups are hampered by this split: the physical geography group is small and relatively isolated and they need easy access to IES students; the IES has insufficient faculty in the areas covered by the physical geography program and its students and research programs suffer accordingly. Reassembling the physical geographers and the IES into a single unit and relocating the physical geographers to the science campus would largely correct these problems.

For these reasons, the Committee strongly recommends that all the physical geographers now in the Department of Geography be moved to the faculty of science and the IES and relocated to the IES facilities. We emphasize, however, that this will need to be done with proper attention to the needs, desires, and sensitivities of the physical geographers – they must not feel that they are being moved "from pillar to post" without due regard for their professional and programmatic ambitions.

Relations to « external » groups

5c) Relationship with the Geological Survey

During our meetings with IES faculty, we learned that the Geological Survey of Israel, located in Jerusalem, with approximately 70 scientists mainly in the solid earth sciences, is considering moving to a new location. If they do move, one possibility is that the Geological Survey could move onto or adjacent to the Givat Ram campus. We were very impressed with the amount and quality of current interactions between many groups and individuals at the IES and the Geological Survey: approximately 10 MSc and 10 PhD students are working part or full time at the Survey under joint supervision of an IES faculty and a Survey scientist. This close interaction clearly benefits both groups ("the whole is greater than the sum of the parts"), and we strongly encourage continuation and even significant expansion of that collaboration. In this context, having the Survey move closer to the campus would further strengthen the ties (including development of new projects and joint seminars) and facilitate joint work. We note that the GS operates a multiple collector ICP-MS where the IES is entitled to a one day use because the HU contributed to its purchase. Access to this essential facility would improve and probably exceed the present use if it were much closer.

Although the benefits of the collaboration and the potential advantages of locating the Geological Survey on or near the Givat Ram campus are clear, we were mindful of possible political or logistical issues from the Survey's standpoint. Consequently, the Review Committee

met one evening with Dr. Benny Begin, director of the Survey. His reaction to the possibility of location of the Survey on or near the Givat Ram campus (specifically in the University's research park at the periphery of the Givat Ram Campus) was very positive. Indeed, Dr. Begin had already been proactive in promoting such a solution and obtaining support from scientists in the Survey. Most IES faculty also envision such a move as a major asset and **the Committee strongly endorses such an evolution. This is an opportunity not to be missed.** We emphasize, however, that there will likely be issues associated with optimizing the impedance match between the IES and Geological Survey, which will continue to be two distinct organizations with different missions in some respects, and the University, the IES, and the Geological Survey should define carefully the details of their relationships and interactions.

5d) Relationship with the Geophysical Institute

During our meetings, we learned that the Geophysical Institute, previously a governmental agency but recently privatized, is in danger of having to close down. The future of the Geophysical Institute is obviously not the responsibility of the HU, but the IES does exist within the framework of the geoscience resources of Israel as a whole and the fate of the Geophysical Institute would have consequences for the IES and the Hebrew University. The Geophysical Institute comprises (among other subject areas) the national array of seismic stations, facilities for seismic refraction and reflection work, and geoelectricity. A key conclusion of our committee is that the discipline of geophysics in Israel is distributed between various institutions, with sub-critical size in each one of them: And in particular, while we leave it to the IES to develop in its long-range plan its own ideas of how to build a strong and distinctive program, our committee noted that the geophysics program in the IES is particularly small (both as far as research and teaching curricula are concerned) relative to the importance of this discipline for a balanced earth science program and the specific current needs of the Institute. In this context, further weakening or even disappearance of the seismic array would both be problematic for the IES as well as a national failure.

One possibility is to find a way to provide oversight of the seismic array operated the Geophysical Institute by the IES. The data provided would be the source of numerous research projects and studies and would clearly blend with and even significantly enrich current studies of tectonics, seismicity, and paleoseismicity in and around Israel. **Moreover, the overall seismotectonics of the Dead Sea Rift and transform fault system is seen by the Committee as one of the distinctive topics in which the IES could play a significant role, and close connection to the seismic array could further enhance the IES's opportunities.**

Although we emphasized in the previous paragraph the seismic array, the other capabilities of the Geophysical Institute are also essential to proper knowledge of crustal structure in Israel, with applications ranging from oil exploration to subsurface hydrology. One possibility is that the Geophysical Institute could be associated somehow with the Geological Survey, which together with the above recommendation could turn the Jerusalem campus, with IES as a key core, into a leading, major international center of excellence in geophysics. Other reorganizations of the existing Geophysical Institute are, of course, possible and we are sensitive to the realities of major reorganizations of the sort we are rather casually suggesting. Nevertheless, from the point of view of optimizing the opportunities of the IES, the Hebrew University, and Israel for a comprehensive and cohesive program in geophysics (and in the earth sciences more broadly), we hope that discussion among the various parties can begin to see if there are creative opportunities that would benefit all.

5e) Hydrology and Meteorology

Some of the same considerations discussed above in relation to the Geophysical Institute and the Geological Survey might also pertain to Hydrological and Meteorological Services in Israel. While we are not aware of the status of these services, if an opportunity arises to re-locate one or both of them near IES, this might provide some benefit to those services and to IES, by, on the one hand, providing IES with easy access to data and services that would enhance their research and education activities, and on the other, by providing those services with access to students and to faculty expertise. We note that in some nations, such as Japan, all the traditional hydrological, seismological, oceanographic, and meteorological services are provided by a single government agency, with attendant cost savings.

6) Enhanced cohesiveness and interactions

The unusual intellectual breadth of IES is reflected in the diversity of research areas within the Institute, ranging from solid earth physics to geochemistry, biological oceanography and to the physics and dynamics of atmospheres and oceans. This affords special opportunities but at the same time requires special efforts to insure cohesion and unity of purpose.

Many of the intellectual developments in the earth sciences take place along boundaries between traditional sub-disciplines. Examples of this are too numerous to list, but one that relates to the previous section on environmental sciences is that many of the most interesting and important problems in understanding the earth's climate draw on multiple sub-disciplines within

the earth sciences. It is our sense that many examples of exciting interdisciplinary research are already in place within IES, but the opportunities that might result from even more interactions between these sub-disciplines have not yet all been realized. **Our Committee recommends that IES consider taking steps that would simultaneously serve to stimulate research at sub-disciplinary boundaries and to add cohesion to the Institute. While we do not wish to specify what such steps might be, examples might include the following:**

- When the opportunity affords, the Institute should consider making a "bridging" appointment that would span two or more sub-disciplines in the geosciences. Possible specific examples include appointments in paleoclimate or geobiology.
- Design introductory graduate-level courses that span disciplines and involve multiple faculty. One example of such a course might be a broad introduction to climate physics and chemistry. In general, curricular reform often leads to changes in research strategies.
- Initiate a faculty lunch seminar (with lunch provided by the Institute), held on a regular schedule, in which individual faculty members present their current research to the rest of the faculty. If done properly, this could become a tradition in the Institute and could bring the faculty together, both socially and intellectually.

The Committee was asked by the IES and its director about the opportunity of changing their name to "Institute of Earth and Environmental Sciences". The suggestion was considered as a valid one, and the very idea of a name change to reflect a new orientation and impetus were endorsed. But it was suggested that other options could be studied before a final decision was taken. One problem in using "Environmental Sciences" in the title of the Institute is that it might interfere with the future development of University-wide activities. The alternate name "Institute of Earth, Atmosphere and Ocean Sciences" was put forward as a possibility to be considered.

7) Visiting Program

The balance of disciplines within IES and the teaching curricula imply a heavy load on most faculty, and we identified the need for expanding courses offered in the physical and mathematical sciences, and the need for graduate students (some of whom stay in the department up to 9 years if they complete their undergraduate, MSc, and PhD degrees there, which is far from being an exception) to be offered a more complete and broader spectrum of courses. Also, a comparison of the list of potential priorities for recruitments voiced by faculty members for the coming years (ten were mentioned during meetings of the Committee with faculty members) and

the target size of the IES implies that several useful or even vital disciplines will not be fully represented within the Institute in the near future. Finally, the faculty emphasized repeatedly to our committee the difficulty of attracting non-Israeli candidates to open positions within the university, with the result that the amount of "new blood" available to enrich the Institute is not as high as the faculty would like. In order to alleviate this situation, **the Committee recommends that the IES and HU launch a program of visiting scientists, both at the post-doctoral and senior scientist levels, in order to attract top quality scientists for stays of one up to a few years but who may not necessarily (at least at the onset) be considering a permanent appointment in IES.** Such a program would publicize the programs of the IES by forming bonds with the visiting faculty that would continue after they returned to their home institutions, enhance these programs by adding diversity beyond what is offered by the permanent faculty, and bring promising young scholars to the IES who might in the long run be potential faculty members. We regard such a program of visitors as a potentially important component of carrying out the long-range plan that we hope the Institute will develop.

Funding for such a visiting program could be generated by donations in order to create (temporary) named chairs. It has been pointed out to the Committee that a promising route might be funding from foreign countries in the frame of joint chairs (or exchanges) between a foreign university and HU.

8) Teaching

The Committee was impressed with the level of and commitment to teaching within IES. In our interviews with students, they made it clear that they are happy to be part of IES and that they find the quality of teaching to be high, at both graduate and undergraduate levels. Quite a few of the students have friends and relatives associated with other departments at HU, and in the resulting comparisons, IES invariably appears to come out ahead.

However, we did pick up on two areas for potential improvement based on our conversations with the students. The first pertains both to students at the graduate and undergraduate levels. It is clear to us that many students – particularly those in geophysics and atmosphere and ocean sciences – feel that they do not receive an adequate background in physics and in associated mathematical skills. It is our impression that this problem may span several institutes at HU (e.g. chemistry) and that it stems ultimately from the fact that first-year students in the IES are directed toward a physics and mathematics curriculum for geology and chemistry students that is aimed at too low a level for the full range of IES students. We do not know the

solution to this problem, especially since the current curriculum is probably appropriate for some of the first year students, and the students do not know in advance if their interests will point them in a direction (e.g. the atmospheres and oceans program) in which the higher mathematics and physics curriculum makes sense. One possibility is that the IES could offer more advanced courses in physics and mathematics for second and third year undergraduates and the beginning graduate students; these could either be strictly remedial, or they could use pedagogy in the earth sciences to provide opportunities for students to improve their physics and math skills Alternatively, it may be that the needed courses already exist elsewhere at HU and all that is required is an effort to build them into the IES curriculum in an appropriate way.

The second issue that arose in conversations with students is a level of dissatisfaction with the fact that the undergraduate major in atmospheric sciences is only a half course. One possibility would be to upgrade this to a full major. We note that not only will this serve the students, but bringing the faculty together around the development and staffing of such an undergraduate program could be a very important component of building the coherence, commitment, and leadership in the environmental science that we feel is important for the future of the IES and the environmental sciences at Hebrew University more generally. Moreover, such a more physically and chemically based environmental science teaching program would, as we understand it, mesh well with and complement the more biologically focused undergraduate program in environmental sciences that currently exists in the university. However, it is generally recognized that graduate studies in many branches of atmospheric science and oceanography require an unusually strong background in applied mathematics, physics and/or chemistry, and perhaps biology for those going into oceanography. Many top graduate programs in these fields take most if not all of their applications from undergraduate physics, math and chemistry programs. For this reason, an alternative to a full major might be the existing or upgraded half major in atmospheric science coupled with a well-designed half major in physics, mathematics, biology or chemistry. This could provide an exceptionally strong background for those students wishing to continue into graduate school in these fields.

The Committee recommends that IES insures adequate access of second and third year undergraduate and the beginning graduate students to more advanced courses in mathematics and physics. The Committee also recommends that IES enhances its teaching program in atmospheric studies, either by elevating it into a full major or by supplementing it with a specially tailored program in physics, mathematics, chemistry and biology.

9) Junior Faculty

The Committee was impressed with the quality of recent appointments to the faculty. In conversations with junior faculty, we also came away with the impression that they are quite happy at IES. Although experiences naturally varied, most of the junior faculty found it relatively easy to adjust to academic life in the Institute; this also becomes progressively easier when there is a stream of new faculty members who can be mutually supportive, and this has indeed developed with the several recent appointments. Nevertheless, to ease the transitions of future junior faculty members, **we suggest that IES consider appointing a faculty mentor, or mentor group, responsible for shepherding the new faculty member through the system. We also strongly encourage IES to assign new faculty as light a teaching load as feasible** (while still getting them involved in teaching) and every effort should be made not to assign them to teach introductory service classes.

One further issue arose concerning overly long times required for construction of office space for new faculty members. Although perhaps only an irritant, there is obviously no excuse for this, and the Institute should continue its vigilance in this regard, and the administration of the University should send the message to the appropriate places in its management structure that this is not acceptable (and it is not a good way to build satisfaction and loyalty among new faculty members or to allow them begin their research and teaching activities efficiently).

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Institute of Earth Science
The Hebrew University of Jerusalem

Appendix 1b

Report by Review Committee
Executive Summary

The Review Committee's overall evaluation is that the IES is in good health. Both individually and collectively, the quality and standing of the faculty is high, and several faculty members are international leaders in their disciplines. In view of these strengths, which provide a strong platform for future development, the Review Committee believes that by focusing on a few critical issues and by defining for itself distinctive areas of research, the Institute can improve its already high national and international standing. The Committee specifically recommends that the IES faculty embark on a planning process that will map out a strategy of appointments and in particular that they deliberate carefully and collectively in the production of a report on their vision for the Institute on a ten-year time scale.

Environmental Sciences are a critical part of the future of ISE. The Institute already has considerable activities in this area and the two central and complementary questions are those of the coherence of its own activities in this field and of its role in the variety of such activities at the Hebrew University. The Committee recommends that the University launch a review of all activities involving environmental topics, including relevant research and teaching in all its faculties. Such a review should prove extremely useful to the University at large and help define the central role of IES in the environmental field at HU.

The committee interpreted its charter to include evaluation of the existing or potential interactions of the IES with other groups or institutions within and outside the University. In this context the Committee is making the following recommendations:

- The Committee strongly recommends that all the physical geographers now in the Department of Geography in the Faculty of Social Science be moved to the Faculty of Science and the IES and relocated to the IES facilities. We emphasize, however, that this will need to be done with proper attention to the needs, desires, and sensitivities of the physical geographers.
- The Committee recommends that the IES maintain its commitment to the IUI enterprise, since the ocean sciences are a critical element of any modern earth science program and the IUI allows the IES to participate in ocean science without having to maintain its own oceanographic institute.
- The Committee has learned about the possibility of relocating the Geological Survey to the periphery of the Givat Ram campus and it strongly endorses such an evolution and recommends that the University administration facilitates this move.
- The Committee learned that the Geophysical Institute, previously a governmental agency but recently privatized, is in the danger of having to close down. The Committee recommends that IES finds a way to provide oversight of the seismic array operated by the Geological Institute. The data provided would be the source of numerous research projects and studies. Moreover, the overall seismotectonics of the Dead Sea Rift and transform fault system is seen by the Committee as one of

the distinctive topics in which the IES could play a significant role, and close connection to the seismic array could further enhance the IES's opportunities.

The Committee recommends that IES consider taking steps that would simultaneously serve to stimulate research at sub-disciplinary boundaries and to add cohesion to the Institute. While the Committee did not wish to be too specific on what such steps might be, it proposed several options as examples.

The Committee recommends that the IES and HU launch a program of visiting scientists, both at the post-doctoral and senior scientist levels, in order to attract top quality scientists for stays of one up to a few years but who may not necessarily (at least at the onset) be considering a permanent appointment in IES. Such a program of visitors could be a potentially important component of carrying out the long-range plan that the Institute will hopefully develop.

The Committee was impressed with the level of and commitment to teaching within IES, yet, it identified two areas for potential improvement. In this context the Committee recommends that IES insures adequate access of second and third year undergraduate and the beginning graduate students to more advanced courses in mathematics and physics. The Committee also recommends that IES enhances its teaching program in atmospheric studies, either by elevating it into a full major or by supplementing it with a specially tailored program in physics, mathematics, chemistry and biology.

The Committee was impressed with the quality of recent appointments to the faculty. It suggests that that IES consider appointing a faculty mentor, or mentor group, responsible for shepherding the new faculty member through the system. It also strongly encourages IES to assign new faculty as light a teaching load as feasible (while still getting them involved in teaching) and every effort should be made not to assign them to teach introductory service classes.

In conclusion, the members of the Committee wish to point out that the meetings with faculty and students during the three days of their presence have already generated lively discussions within the IES on the topics outlined above. In this sense, the presence of the Committee has already started a positive process.

Appendix 2

The Institute of Earth Sciences – Plan for Development
May 2006

A. Background

This proposal is written following the review of the Institute of Earth Sciences (IES) by an external review committee. A thorough description of the institute and its people was prepared for this committee by the head of the Institute, Prof. Alan Matthews and is only briefly repeated here.
The review committee's overall evaluation was that the IES is in good health and that "Both individually and collectively, the quality and standing of the faculty is high, and several faculty members are international leaders in their disciplines". The committee believed that "by focusing on a few critical issues and by defining for itself distinctive area of research, the Institute can improve its already high national and international standing". It recommended that **"the IES faculty embark on a planning process that will map out a strategy of appointments" and produce "a report on their vision for the institute on a ten year time scale".** The present Proposal for Development is the institute response to that request.

In building this 10 years development plan, we accept and build on the main recommendations of the review committee:

1. The appointment of new faculty members to the IES will proceed according to this ten years development plan.
2. New tools should be developed in order to improve the recruitment of young scientists. These should include an intensive international postdoctoral program and a visiting scientistsprogram..
3. The size of the IES should be at least 25 faculty members.
4. The plan assumes that the "Physical Geography group" now situated in Mt. Scopus will join the IES.
5. The ties with other research institutes like the Marine Laboratory in Elat (operated by the IUI), the Israel Geological Survey, Israel Oceanographic and Limnologic Research and the Geophysical Survey should be intensified.
6. The teaching programs in Oceanography and in Environmental studies of the Faculty of Science should be anchored at the IES.

B. General goals set by the IES in accord with the development plan for the IES are:

1. To carry out **research and teaching** in Earth Sciences at the highest academic international level possible under the conditions offered in Israel and at the Hebrew University.
2. To remain the **leading academic institution in Israel** in the field of Earth Sciences and to maintain and improve its international standing.
3. To promote and lead participation of the Israeli Earth Sciences community (universities, government research institutes) in **international academic activities**.
4. To promote and influence **national and regional** Earth Sciences academic and applied activities, including **environmental issues**.

5. Within the Faculty of Science at the Hebrew University, the IES should assume responsibility for the **programs in Oceanography and Environmental Sciences.** This activity should be coordinated with other Institutes within the faculty (e.g. life, chemistry) and with other faculties (mainly agriculture, social and law).

C.

The present situation

The Institute of Earth Sciences was formed in 1978 by uniting the departments of Geology, Atmospheric Sciences and Physical Geography. The Department of Geology has been the dominating body within of the Institute. Over the years, the Department of Atmospheric Sciences increased its activity while new fields emerged such as oceanography and environmental sciences. About 13 years ago the physical geography group (3 scientists) left the Institute and joined the Department of Geography in the Faculty of Social Sciences in Mount Scopus campus.

During the past 10 years 7 faculty members retired but only four new members joined. This together with the leaving of the Physical geographers and the joining of one faculty member from Applied Sciences brought the number of the academic stuff members to 20, 5 positions less than the recomendation of the Parnas Committee or the present review committee.

As part of the development plan the members of the institute identified their fields of research and scientific interests, (with our assumptions for the physical geographers). The results are presented in Figure 1 and Table 1.

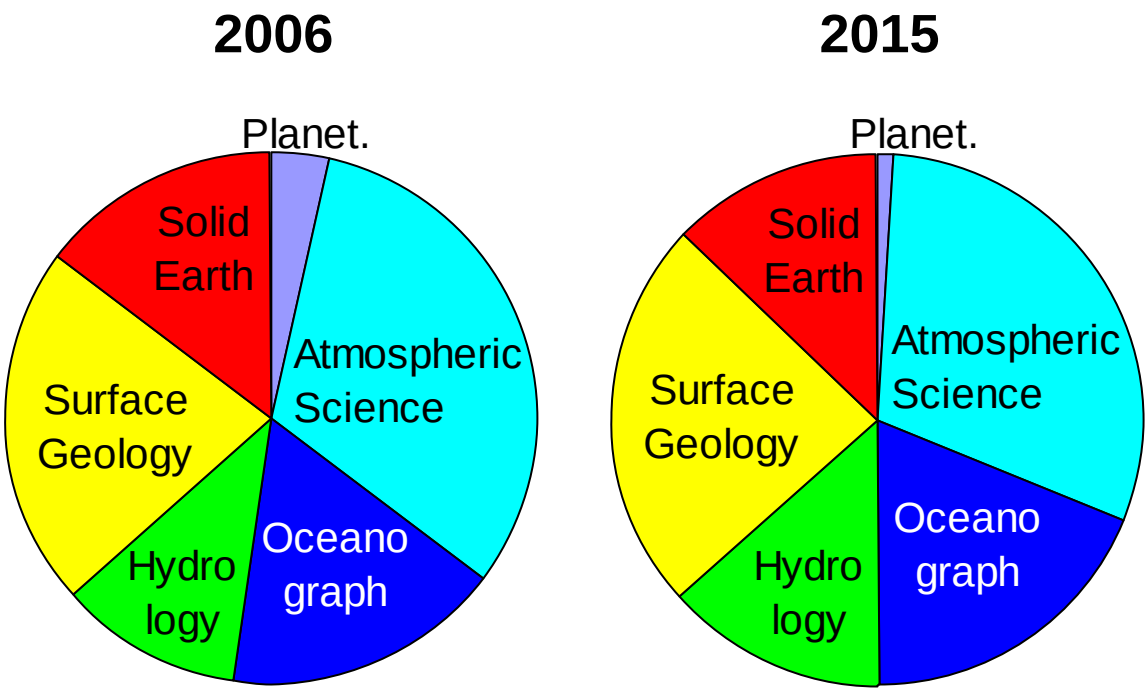

Table 1. The present division of the IES faculty.

Research Field	Name	%	Research Field	Name	%
Planetary	Cohen	50	**Hydrology**	Gvirtman	90
Science	Agnon	10	2.6 positions	Morin	50
0.8 positions	Kessel	20	6 members	Frumkin	50
				Enzel	40
Atmospheric	Dayan	100		Lazar	15
Science	Khain	100		Matthews	10
7.3 positions	Luria	100			
12 members	Rosenfeld	100	**Surface**	Matmon	80
	Erlich	90	**Geology**	Agnon	60
	Paldor	60	5.0 positions	Avigad	50
	Cohen	50	14 members	Garfunkel	50
	Erel	50		Erel	50
	Morin	40		Enzel	40
	Enzel	20		Matthews	40
	Frumkin	10		Frumkin	40
	Luz	10		Lazar	25
				Luz	20
Oceanography	Shaked	100		Erez	20
3.9 positions	Erez	80		Gvirtzman	10
7 members	Luz	70		Navon	10
	Lazar	60		Morin	10
	Paldor	40			
	Agnon	30	**Solid**	Navon	90
	Erlich	10	**Earth**	Kessel	80
			3.4 positions	Garfunkel	50
			6 members	Avigad	50
				Matthews	50
				Matmon	20

The present division of faculty among the various fields is well balanced with roughly half the faculty in atmospheric and ocean sciences and the other half in geology physical geography and hydrology. It represents the interdisciplinary nature of the IES a quality that needs maintained and strengthened. This structure is essential for the future challenges of Earth sciences both globally and locally. This includes issues of global change (e.g., warming and rising atmospheric CO_2), natural hazards (e.g.,

Earthquakes, volcanic eruptions, storms, floods and droughts), Environmental issues (e.g., ground water pollution and salination, air pollution and aquatic eutrophication). This structure was also recognized and supported by the review committee and was recently approved by the assembly of the IES faculty as the right way to plan ahead.

D. Plan for development

1. Faculty

Figure 1. compares the present situation with the planning for 2015. While preserving the proportions between the main disciplines, the new appointments will modernize the specific research fields. In constructing the plan, we followed the review committee recommendation that the number of faculty members (including the physical geography group) will be maintained at 25. We suggest recruiting new faculty members in all the present research fields except planetary sciences. In atmospheric science, the addition of Dayan and Morin and the future appointment of Amaele Landais in paleoclimate, adds to the balanced nature of this group. Future appointments will strengthen the atmospheric physics and perhaps to recruit an atmospheric chemist. In oceanography a new appointment is planned in the so far non-existent field of paleoceanography. A chemical oceanographer will be appointed towards the retirement of 2 oceanographers. In geology we plan to expand geophysics and to enter the new and emerging field of geobiology. An additional appointment in geochemistry will ensure the long run stability of the strong geochemistry group. The solid earth group is expected to decrease a little. Table 2 presents the yearly plan and the state of the various research fields during the implementation of the plan.

Table 2. Development plan

Year	Retirements	New Appointments	Planet Science	Atm. Science	Oceanography	Hydrology	Surface Geology	Solid Earth	Total
2006			0.8	7.3	3.9	2.6	5.0	3.4	23
2007	Garfunkel	Angert	0.8	8.1	4.1	2.6	4.5	2.9	23
2008		Geophysics (EA)	0.8	8.1	4.1	2.6	5.0	3.4	24
2009	Cohen	Hydrology (SE)	0.3	7.6	4.1	3.6	5.0	3.4	24
2010		Atm.Science(HG)	0.3	8.6	4.1	3.6	5.0	3.4	25
2011	Luria	Paleoceanog.	0.3	7.6	5.1	3.6	5.0	3.4	25
2012	Luz	Geobiology	0.3	7.6	5.1	3.6	5.0	3.4	25
2013			0.3	7.5	4.4	3.6	5.8	3.4	25
2014	Khain	Geochemist							
	Matthews	Atm. Science.	0.3	7.5	4.4	3.5	6.1	3.2	25
2015	Dayan	Oceanography							
	Erez	Atm. Science.	0.3	7.5	4.6	3.5	5.9	3.2	25
Retirements	8		0.5	3.6	1.5	0.1	1.3	1	8
Apointments		10	0	3.8	2.2	1	2.2	0.8	10

2. Teaching

- New program in Climate, Atmospheric and Ocean Science (CAOS), will be implemented in the next academic year

- Program in Environmental
- Teaching courses in Geography

3. Equipment

- IUI
- LA-ICP-MS
- Electron Probe
- Computers

4. Spaces

E. Actions to achieve the goals listed above:

1. **Recruitment of new staff members:** While the main criterion is and should be excellence in science, the IES should recruit new faculty according to the development plan presented below. In accordance with the recommendation of the committee, the IES will implement the following steps: 1. recruit postdoctoral fellows in the fields of interest, 2. internationally advertise the opening of faculty positions, 3. increase student interest in potential future fields by inviting visiting scientists in these respective fields several years before a position is open. 4. Implement an active Post Doctorate program, and give priority to the needed fields according to the development plan.

2. **Return of the physical geography group to the Institute:** The most important action to be implemented as soon as possible is the return of the physical geography group from the Department of Geography, at the Faculty of Social sciences, Mount Scopus, to the IES*.The reasons for this suggested merge is that it lies in the best interests of the HU and the IES. It will augment the general HU policy of joining academic units instead of dividing them, it will create the best working conditions and academic atmosphere and for the scientists involved and finally it will help the IES to promote its goals as stated above. The group includes 3 excellent scientists: Prof. Uri Dayan, Atmospheric scientist (synoptic meteorology) an important field that is missing in the IES, Prof. Amos Frumkin: Geologist and hydrologist (Chemical erosion processes and paleoclimate) will strengthen the ground water hydrology group and will help in integrating it with the geochemical and geographicl group, Dr. Efrat Morin, Physical geography (Surface hydrology atmospheric forcing). These scientists in addition to their documented achievements in science will blend perfectly with the new integrative trends that the Institute should promote. This move will strengthen the atmosphere group (Dayan and Morin), the physical geography group (Morin and Frumkin), the hydrology group (Morin and Frumkin) and will strengthen the cross disciplinary activity of the IES in paleo-climate and neo-tectonic research.

3. **Implementation of the new CAOS program**

4. **Environmental Program:** The Institute should become the home for the Environmental Science program of the Faculty of Science. Environmental issues are now in the forefront of the scientific agenda in Earth Sciences. The geosphere, hydrosphere, atmosphere and biosphere which together comprise the Environment on Earth are mainly within the field of Earth sciences. "Climate change, Global Biogeochemical Cycles, Atmospheric CO_2 increase, Global warming, Ocean acidification, Acid rain, Pollution of air and ground water, are all issues that are in the focus of the scientific community today and are rooted all over the world in institutes of Earth sciences. The education curriculum (in addition to Earth sciences) should include significant contributions from chemistry and biology, and minor out of faculty subjects (law, social, economic) which should not exceed 5-10 % of the content of the program.

*Historical comment: About 10 years ago the physical geography group (3 scientists) left the Institute and joined the department of geography in the faculty of social sciences in Mount Scopus campus. The departure of the physical geography from the IES was a mistake that needs to be corrected.

Appendix 3

Development Plan 2010 – 2020

The Institute of Earth Sciences, Faculty of Sciences, The Hebrew University of Jerusalem

September 2010

Prepared by: Y. Erel, A. Agnon, E. Aharonov, A. Angert, R. Kessel, A. Matmon, O. Navon, D. Rosenfeld

A. Background

This development plan for the Institute of Earth Sciences (IES) is a sequel of the previous plan prepared in May 2006 for the period 2006 - 2015. It is based on the same principles as the previous plan, modifies the former plan for 2010 – 2015 and proposes a new program for the period 2015 – 2020. The plan principles include (as outlined in the 2006 plan and in the recommendations of the review committee from 2005):

1. The size of the IES is planned to be 22 to 24 faculty members[1] (not including physical geography) and the appointment of new faculty members to the IES will proceed as close as possible according to the ten-year development plan.
2. New tools have been developed in order to enhance the ties of the IES with the international scientific community of Earth Sciences and improve the recruitment of young scientists. These include: (a) an international postdoctoral program (to begin next year using the Herrmann Endowment). See appendix A with a call for post-docs to be published in EOS. (b) A visiting scientists program utilizing the Lady Davis Foundation and other resources – see appendix B with names of Lady Davis and other scholars visiting the IES since 2006. (c) Kaplan Symposia aimed to expose Israeli students and scientists to the new directions in environmental geosciences, to provide them with an opportunity to present their own research, and to promote future collaborations. See appendix C which includes the programs of the three Kaplan workshops (2005, 2008, and 2010).
3. The research and teaching ties with other research institutes like the Interuniversity Institute for Marine Sciences, Elat (IUI, The H. Steinitz Marine Biology Laboratory of the HUJ) the Geological Survey of Israel (GSI), Israel Oceanographic and Limnologic Research, and the Geophysical Institute should be intensified. See appendix D for the detailed proposal for cooperation with the GSI. The cooperation with the GSI will be a model for other cooperation initiatives.
4. The teaching program in Environmental studies of the Faculty of Science and its ties with the IES are being discussed now.

B. Goals set by the IES following the development plan from 2006

1. To carry out **research and teaching** in Earth Sciences at the highest academic level possible under the conditions offered at the Hebrew University.
2. To remain the **leading academic institution in Israel** in the field of Earth Sciences and to maintain and improve its international standing.

[1] This figure is within the target range recommended by the Parnas Committee and by the 2005 review committee.

3. To promote and lead participation of the Israeli Earth Sciences community (universities, government research institutes) in **international academic activities**.
4. To promote and influence **national and regional** Earth Science academic and applied activities, including **environmental issues**.
5. Within the Faculty of Science at the Hebrew University, the IES should assume responsibility for the **program of Environmental Sciences.** This activity should be coordinated with other institutes within the faculty (e.g. life, chemistry) and with other faculties (mainly agriculture, social and law).

C. The present situation (modification of the 2006 report)

The IES was formed in 1978 by uniting the departments of Geology, Atmospheric Sciences and Physical Geography. The Department of Geology has been the dominating body within of the IES. Over the years, the Department of Atmospheric Sciences increased its activity while new fields emerged such as oceanography and environmental sciences. About 17 years ago the physical geography group (3 scientists) left the IES and joined the Department of Geography in the Faculty of Social Sciences in Mount Scopus campus.

Since 2000, seven faculty members retired and nine new members joined the IES. Currently, the academic staff includes 23 members (including one member who resides in Elat (Shaked), and one member with a joint appointment with Archaeology (Rabinovich, 0.25 position in IES). Like in 2006 the members of the IES identified their fields of research and scientific interests. The results from 2006 are presented in Table 1. The results from 2010 are presented in Table 2a, b, c.

Table 1: Research fields of the IES faculty in 2006 (excluding physical geography members as they never joined the IES).

Research Field		Name	%		Research Field	Name	%
Planetary		Cohen	50		**Hydrology**	Gvirtzman	90
	Science	Agnon	10		1.6 positions	Enzel	40
0.8 positions		Kessel	20		4 members	Lazar	15
						Matthews	10
Atmospheric		Khain	100				
Science		Luria	100		**Surface**	Matmon	80
5.8 positions		Rosenfeld	100		**Geology**	Agnon	60
	9 members	Erlick	90		4.6 positions	Avigad	50
		Paldor	60		12 members	Garfunkel	50
		Cohen	50			Erel	50
		Erel	50			Enzel	40
		Enzel	20			Matthews	40
		Luz	10			Erez	20
						Lazar	25
Oceanography		Shaked	100			Luz	20
3.9 positions		Erez	80			Gvirtzman	10
	7 members	Luz	70			Navon	10
		Lazar	60				
		Paldor	40				
		Agnon	30		**Solid**	Navon	90
		Erlich	10		**Earth**	Kessel	80
					3.4 positions	Garfunkel	50
					6 members	Avigad	50
						Matthews	50
						Matmon	20

Table 2: Research fields of the IES faculty in 2010. (**a**) According to the same categories as in 2006. (**b**) Division according to disciplines. (**c**) Division according to research methods. All figures are in %.

(a)

sum	Atm. chemistry	Climate	Meteor.	Planet. Sci.	Oceanography	Solid Earth	Hydrology	Surface Geol.	
100						80		20	Avigad
100						70	10	20	Aharonov
100					10	10		80	Agnon
100		30					30	40	Angert
100	10	70	10		10				Erlick
100						30	60	10	Emmanuel
100		20					30	50	Enzel
100	40	20						40	Erel
100		10			90				Erez
100						10	90		Gvirtzman
100		30			70				Gildor
100			100						Khain
100		40			40		20		Luz
100	70	10	20						Luria
100					50		20	30	Lazar
100		20			10	40	10	20	Matthews
100						30		70	Matmon
100						90		10	Navon
100		20	40		40				Paldor
100				30		70			Kessel
25		25							Rabinovich
100	10	20	70						Rosenfeld
100					100				Shaked
2225	**130**	**310**	**240**	**30**	**420**	**430**	**270**	**350**	**sum**

(b)

sum	Petrology Mineralogy Stratigraphy Paleontology	Geochemistry and biogeochemistry	Dynamics – fluids and gases	Dynamics – solid Earth	
100	60			40	Avigad
100				100	Aharonov
100		100			Angert
100	30		40	30	Enzel
100		100			Erel
100	10	90			Erez
100			100		Erlick
100			100		Gvirtzman
100		10	90		Gildor
100			100		Khain
100		90	10		Luz
100		60	40		Luria
100	10	90			Lazar
100	30	50	10	10	Matthews
100		20		80	Matmon
100	40	30		30	Navon
100	20		10	70	Agnon
100	10	30		60	Emmanuel
100			100		Paldor
100	80	20			Kessel
25	25				Rabinovich
100			100		Rosenfeld
100		100			Shaked
2225	**310**	**790**	**700**	**420**	**sum**

(c)

sum	Field-base observations	Theoretician/ modelist	Experimentalist	
100	80		20	Avigad
100	10	90		Aharonov
100	20	10	70	Angert
100	80	20		Enzel
100	30		70	Erel
100	30		70	Erez
100	10	90		Erlick
100	30	70		Gvirtzman
100	70	30		Gildor
100		100		Khain
100	20		80	Luz
100	75		25	Luria
100	40	30	30	Lazar
100	20	5	75	Matthews
100	75	25		Matmon
100		30	70	Navon
100	50	20	30	Agnon
100	10	50	40	Emmanuel
100		100		Paldor
100			100	Kessel
25	5		20	Rabinovich
100	80	10	10	Rosenfeld
100	50		50	Shaked
2225	**790**	**690**	**820**	**sum**

The present division of faculty members among the various fields is similar to the division in 2006 with some variations: (1) ~1 position increase in (a) hydrology, (b) atmospheric sciences and (c) solid earth. (2) ~0.5 position decline in surface geology and in planetary sciences. This composition maintains the interdisciplinary nature of the IES. As indicated in the 2006 report "this structure is essential for the future challenges of Earth Sciences both globally and locally. This includes issues of global change (e.g., warming and rising atmospheric CO_2), natural hazards (e.g., Earthquakes, volcanic eruptions, storms, floods and droughts), Environmental issues (e.g., groundwater pollution and salinization, air pollution and eutrophication of marine and aquatic systems)."

D. Plan for development

1. Faculty

Comparing the four IES appointments made since 2007 with those planed in 2006 reveals that the major research interests of all new faculty members match the recommendations of the 2006 development plan for high priority recruitments. While this is encouraging, we recognize that some deviations are acceptable and such programs must be flexible and adaptable to changing conditions. In constructing the new plan, we followed the plan outlined in 2006 and the recommendations of the 2005 review committee with one exception: we can no longer assume that physical geography will be part of the IES. In addition, the current plan takes into account the expected retirements between 2010 and 2020 (Table 3). Figure 1 presents the trend from 2010 to 2020 in the research categories (based on Table 2a) assuming no additional hires. Figure 2 does the same for the scientific disciplines presented in Table 2b. Both figures point out that some research fields are expected to have more retirements than others in the coming years. Three are noteworthy: meteorology,

geochemistry, and oceanography. While we are interested in maintaining our high international status in these three fields, it is important to also allocate positions in emerging disciplines in geosciences. Based on the 2006 development plan and the expected five retirements by 2015 (Table 3) we plan to make the following appointments: one appointment in **physical atmospheric sciences**, one in **oceanography** (marine geochemist or bio-geochemist), two in **geochemistry** (preferably atmospheric chemistry and paleo-climate), and one in **geophysics** (including tectonics or magnetism). In contrast to the 2006 plan, in the current plan we do not specify the precise year in which each position will be filled as this depends primarily on the scientific merits of the possible candidates and the constrains imposed by the HU. Between 2015 and 2020 four additional faculty members are expected to retire (Table 3), two of whom are atmospheric scientists (one also has an interest in oceanography) and two are geochemists (one deals with solid earth processes and the other with oceanography and surface processes). In order to maintain our critical mass and leadership in oceanography, geochemistry, and atmospheric sciences we propose to hire two **atmospheric scientists** and two **geochemists**, one of which is also an **oceanographer**. In general, we opt to maintain the balance between field-based, theoretical, and laboratory-based studies.

Table 3: Faculty-member retirements in the IES 2010 – 2020.

Name	Birth	Year of retirement
Luria	1943	2011
Luz	1944	2012
Erez	1946	2014
Khain	1946	2014
Matthews	1946	2015
Lazar	1947	2016
Paldor	1949	2017
Navon	1952	2020
Rosenfeld	1952	2020

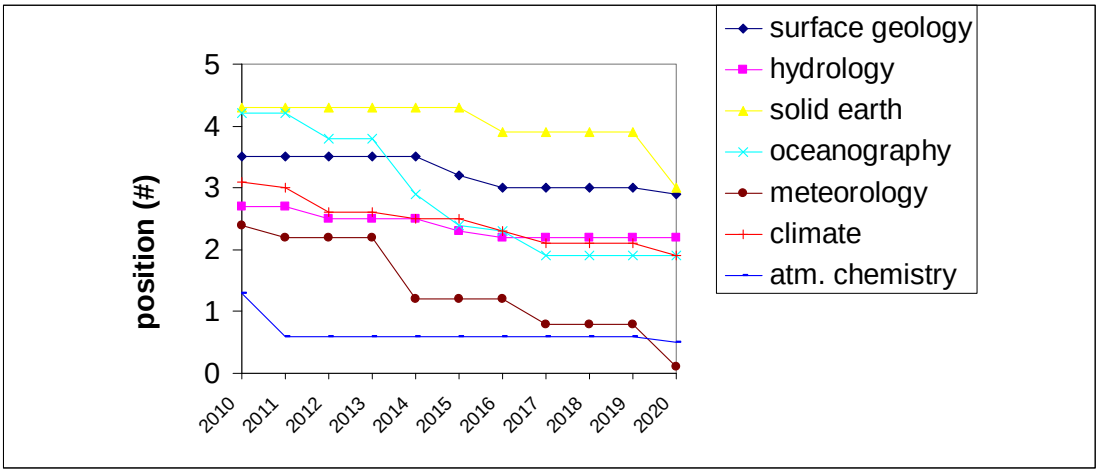

Figure 1: Changes in positions according to categories of Table 2a between 2010 and 2020 assuming no additional hires.

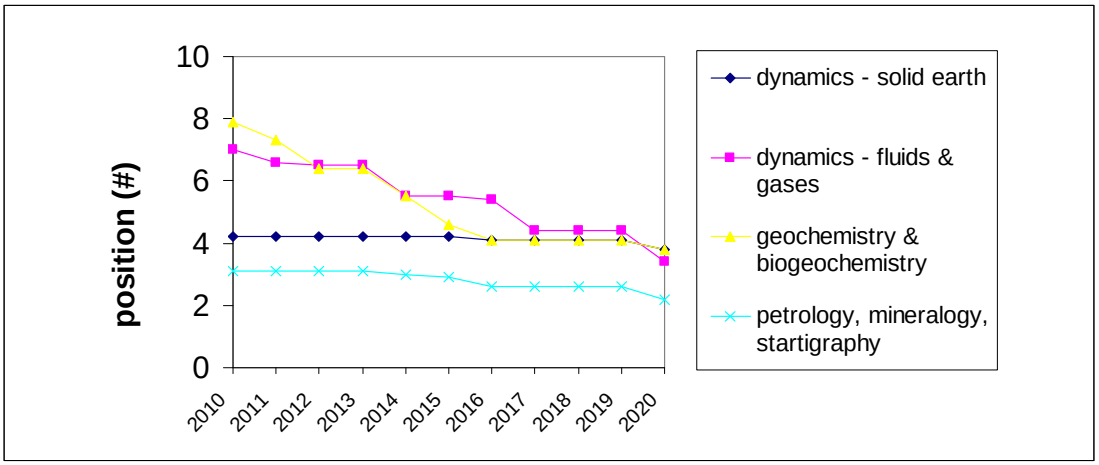

Figure 2: Changes in positions according to categories of Table 2b between 2010 and 2020 assuming no additional hires.

2. Technical and administrative staff

Recently the IES adopted a new philosophy with respect to the allocation of technical and administrative aid to faculty member. Because of the current trend at the HU where technical aid has been cut down continuously in the past 15 years we mapped the needs of the various faculty members and identified the laboratories which serve multiple faculty members. These laboratories received higher priority and were assigned technical aid. We also decided that each lab-technician will be partially supported by the faculty members who use his laboratory. Only few technical and administrative functions which have institute-wide roles will receive only HU support. The details of the future planning of the technical staff are outlined in appendix E.

3. Teaching

- The first graduates of the new program in Climate, Atmospheric and Ocean Science (CAOS) are finishing this year.
- Starting next academic year (2010 – 2011) the IES's B.Sc. program will be a single Earth Sciences curriculum including one of the two disciplines (MEGAMOT): Geology or CAOS (the graduation discipline will be indicated in the B.Sc. certificate). Both disciplines will include "HUG-RAHAV" (full curriculum) "HAD-HUGI" (single curriculum) DU-HUGI (dual curriculum) and HATIVOT (32 credits in one of the Earth Sciences disciplines).
- The future of the *Program of Environmental Sciences* and its association with the IES is being discussed now.
- Teaching courses by GSI staff – see appendix D.
- A new multi-faculty MSc program in hydrology will be launched in 2011.

4. Equipment

The three laboratories outlined below are the ones which have near-future plans for upgrading:

- Analytical geochemistry and clean laboratories – ICP-MS (purchased in 2008), LA addition for the ICP-MS (purchased in 2009), ICP-OES, AFM (purchased in 2010), Scintillation counter, IC, XRF (purchased in 2010). We have created an analytical center which serves the members of the IES (Angert, Avigad, Enzel, Erel, Erez, Kessel, Lazar, Matthews, Matmon, Navon, Shaked) as well as other HU faculty members from Chemistry (Banin, Mandler), Applied Physics (Agranat), Life Sciences (Belkin, Kaplan, Keren, Nathan), and Pharmacology (Benita). Future purchases of expensive

equipment (e.g., HR-MC-ICP-MS) to this analytical center will be part of the collaboration with the GSI (see appendix D). Less expensive equipment (e.g., ICP-OES, spectrophotometers) will be purchased using the resources of the IES as well as ISF basic equipment grants.

- Electron Probe – the current electron probe facility at the IES is more than 20 year old, and we plan to replace it with a new instrument. This also will be done in collaboration with the GSI (appendix D).
- Computers – currently, three computer clusters operate at the IES, and we plan to periodically upgrade them so the research groups which utilize these clusters can continue to perform their cutting edge research.

5. Spaces

- Laboratory – the IES is currently using almost all the space available for labs, and any future appointment relies on the remodeling of lab-space used by faculty members who are planned to retire. There is a chance that retiring faculty members will free less space than the space needed for the new faculty members, in that case we will need to add a second floor to the central wing of the IES building.
- Class rooms – The IES has one large (room 109, 175 seats), three medium (125, 126, 102, 20 to 60 seats), one microscope-dedicated class room (103) and one small conference room (the Picard room). All rooms except 103 have been or are in the process of upgrading (air-conditioning (except 109), new seats, and a lecturer podium). Room 125 which is currently being renovated will be named after the late Professor Y. Bentor, one of the most influential geologists in Israel and the mentor of many faculty members in the IES. We hope to obtain the needed funding for air-conditioning rooms 109 and 103 in the near future.
- The relocation of the library from our building to the Hermann Library will free large space on the third floor of the south wing. We are plan to initiate a discussion about the use of this space.

E. Actions to achieve the goals listed above - recruitment of new staff members

We support the following statements from the 2006 development report: "While the main criterion is and should be excellence in science, the IES should recruit new faculty according to the development plan. In accordance with the recommendation of the visiting committee, the IES will implement the following steps: 1. recruit postdoctoral fellows in the fields of interest, 2. internationally advertise the opening of faculty positions, 3. increase student interest in potential future fields by inviting visiting scientists in these respective fields several years before a position is open. 4. Implement an active Post Doctorate program, and give priority to the needed fields according to the development plan." All these steps have been implemented since 2006, except for the post-doc recruitment, which will start next year with the help of the Herrmann Endowment.

Appendix A - a call for post-docs to be published in EOS in the fall of 2010

The Institute of Earth Sciences at the Hebrew University of Jerusalem invites applications for the Nadine and Freddy Hermann post-doc Fellowships for the 2011-12 academic year in all fields of Earth Sciences. Application deadline is Dec. 31, 2010. Applications (full CV, publication list, and support letters from PhD advisors) should be submitted to yerel@vms.huji.ac.il. Applicants are encouraged to approach relevant faculty members.

Appendix B - names of visiting scientists since 2006

Lady Davis Visiting professors:
David Fink – Macquarie, Australia
Surendra Bhattacharya – India Institute of Technology, India
Geoffrey King – Inst. De Physics du Globe, Paris, Fran
Heinrich Holland – University of Pennsylvania, USA
Amos Nur – Stanford University, USA
Joel Blum – University of Michigan, USA
Michael Chazan – University of Toronto, Canada

Lady Davis Post-doctorate fellows:
Debora Bruce – City University of New York, USA
Beverly Goodman – McMaster, Canada
Kate Raphael – Geography, The Hebrew University
Seikat Sengupia – India Institute of Technology, India

Special IES guests, not supported by Lady Davis Foundation
Miriam Kastner – Scripps Institute of Oceanography, San Diego, USA
Yair Rosenthal – Rutgers University, USA
Robert Garrison – University of California, Santa Cruz, USA
Mark Thiemens – University of California, San Diego, USA
Xavier Le Pichon – Collège de France, France
Oded Aaronson – California Institute of Technology, USA
Wallace Broecker – Columbia University, USA

Appendix C - the programs of the three Kaplan workshops (2005, 2008, 2010)

1st Kaplan Workshop - New Developments in Environmental Isotope Research, September 2005

Mark Thiemens: Mass independent isotope effects: meteoritic oxygen isotopic anomalies and paleo atmospheres.

Malcolm McCulloch: **General**: coral reefs: silent sentinels of global change

Don DePaolo: **General:** Low-temperature mineral-fluid reaction rates measured with Sr, U and Ca isotopes.

Anders Meibom: New micro-analytical techniques applied to biogenic carbonates: biomineralization, corals, and geochemical effects.

Ariel Anbar: **General:** Transition metal stable isotopes

Joel Blum: General: Stable isotope geochemistry of mercury.

Albert Galy: Mg isotopic composition of biominerals: fingerprinting biological pathway of Mg involved in the precipitation of calcite dolomite and aragonite.

Amaelle Landais: Isotopic repartition of inert gasses in polar ice cores: quantitative reconstruction of past temperature and potential for dating improvement

Anton Eisenhauer: General: Isotope fractionation of divalent cations; new approaches to old problems.

Boaz Luz: Isotopic fractionations in the global oxygen cycle from the Dole effect to aquatic productivity.

2nd Kaplan Workshop - Global Pollution: From Background to Contemporary Levels, March 2008

James J. Schauer, University of Wisconsin-Madison - Source Apportionment of Carbonaceous Aerosols using Molecular Markers

Spyros Pandis, Carnegie Mellon University - Organic Aerosols in Our Atmosphere: Sources, Properties, and Impacts

Daniel Rosenfeld, the Hebrew University – The Role of Aerosols in Global Earth Energy Budgets: The Big Questions That Make Climate Predictions so Uncertain

Mike Hoffmann, Caltech – Heterogeneous Chemistry of Sulfur in the Atmosphere

Prasad Kasibhatla, Duke University – A Global View of Anthropogenic Impacts on Atmospheric Sulfate

Joel Savarino, LGGE/CNRS - Toward a New Marker of the Atmospheric Chemistry/Climate Relationship: Tracing the Ozone Isotopic Anomaly Transferred to Other Atmospheric Constituents

Bernhard Wehrli, EAWAG/ETH - Old and New Sinks in the Global Nitrogen Cycle

Jonathan Erez, The Hebrew University - Biomineralization and dissolution of $CaCO_3$ in the Oceans: A Negative Feedback Mechanism to Atmospheric CO_2 Increase

Kon-Kee Liu, National Central University, Taiwan - The role of continental margins in the global carbon cycle

Ed Boyle, MIT - Evolution of the North American Anthropogenic Lead Transient for the Past 200 Years

Martin Goldhaber, USGS - From Continents to Atoms; Environmental Geochemistry at all Scales

Stephan Kraemer, University of Vienna - Heavy Meals: Mechanisms of High Affinity Iron Acquisition in Iron-Limited Ecosystems

3rd Kaplan Workshop - Challenges of the Global Water Shortage, April 2010

Kevin E. Trenberth, NCAR, USA - Potential impacts of climate changes on precipitation

Graham Feingold, NOAA, USA - Impact of particulate air pollution on rain clouds

Efrat Morin, The Hebrew University - To know what we cannot know: Global mapping of minimal detectable precipitation trends

Bob Hecky, University of Minnesota, USA - Eutrophication of water bodies

Walter Giger, EAWAG-ETH, Switzerland - Contamination by organic pollution

Janet Hering, EAWAG-ETH, Switzerland - Contamination by inorganic pollution

Grant Garven, Tufts University, USA - Effects of Faults on Coastal Groundwater Salinity, Southern California

Jesus Carrera, Universidad Politécnica de Cataluña, Spain - Modeling of groundwater flow and reactive transport

Ronnie Ellenblum, The Hebrew University - Climate Change and the Collapse of the east-Mediterranean in the mid 11th century (A.D.)

Assaf Sukenik, Kinneret Limnological Laboratory, Israel – Monitoring the wellbeing of the Sea of Galilee

Uri Shani, Director, Israel Water Authority - Water Resources Management - Socio-Economic Perspectives

Booky Oren, Chairman, MIYA, Arison Group - Water Resources Management - Technological Perspectives

Eyal Benvenisti, Tel Aviv University, Israel - Water Resources Management - Legal Perspectives

Appendix D - proposal for cooperation with the GSI

עקרונות שיתוף פעולה בין המכון למדעי כדור הארץ, האוניברסיטה העברית והמכון הגיאולוגי של ישראל

אוקטובר 2007 (בני בגין ויגאל אראל)

כללי

מטרת המסמך הזה היא לעגן בכתובים יחסים ארוכים ופוריים של שתוף פעולה בין המכון למדעי כדה"א והמכון הגיאולוגי. בנוסף, מטרת המסמך להסדיר מספר נושאים החייבים בחינה מחודשת עקב שינויים שחלו לאחרונה באוניברסיטה העברית ובשרות הממשלתי. חלקים מהמסמך מבוססים על מסמך דומה שהוכן בפקולטה לחקלאות באוניברסיטה העברית לגבי שיתוף פעולה עם מכון וולקני.

הוראה במכון למדעי כדור הארץ על ידי חוקרי המכון הגיאולוגי

חוקרים במכון הגיאולוגי יוכלו לקבל מעמד של מורים-עמיתים באוניברסיטה העברית בדומה לחוקרי המינהל החקלאי. בכל שנה ייערך עדכון של רשימת המורים, כאשר הוספת אנשים חדשים לרשימה תיעשה על ידי הנהלת המכון הגיאולוגי בתאום עם ראש המכון וראש החוג למדעי כדור הארץ.

הדרכת תלמידי דוקטור ומוסמך על ידי חוקרי המכון הגיאולוגי

מורים-עמיתים רשאים להנחות תלמידים לתארים מתקדמים באופן עצמאי (ללא מורה שותף מהאוניברסיטה), בכפוף לאישור הדיקן. מורה עמית המעוניין בכך יעבור פרוצדורה אקדמית מלאה (הגשת תיק מקצועי, הקמת ועדה, השגת מכתבי המלצה והגשת התיק לועדת המינויים ולרקטור).

זכויות נוספות של מורים-עמיתים

1. זכאות לתואר המתאים לדרגתם במכון הגיאולוגי בצירוף המילה "עמית (Adjunct) של האוניברסיטה העברית"
2. השאלת ספרים וכתבי עת בספריות הפקולטה (כולל ספריית המכון למדעי כדור הארץ)
3. שימוש במתקני האוניברסיטה שבקמפוס גבעת רם (מרכז קוסל)
4. קבלת קוד משתמש למחשבי הפקולטה המקנה לחוקר גישה למאגרי מידע בין-לאומיים רבים, כולל ISIGLOBAL NET וירחונים מדעיים הנגישים לחוקרי האוניברסיטה.
5. על פי הוראת הנהלת האוניברסיטה זכאים מורים עמיתים לפטור חלקי משכר לימוד עבורם ועבור בני משפחותיהם בשנה בה מתבצעת ההוראה. בהיקף של 25% עבור הוראה בהיקף של עד 2 שעות שנתיות (דהיינו עד 4 שעות שבועיות בסמסטר בודד). הוראה בהיקף של בין 2 ל- 4 שעות שנתיות מזכה בפטור של 50% משכר הלימוד.

קליטות של חוקרים צעירים

הנהלות שני המכונים יתאמו ביניהן וימנעו ככל הניתן מתחרות לגבי הצעות עבודה לחוקרים צעירים.

שתוף פעולה בין הספריות

כאשר יעבור המכון הגיאולוגי לגבעת רם יערך דיון לגבי אפשרות של איחוד הספריות בהשתתפות הנהלות המכונים והנהלת ספריית הרמן (לה שייכת הספרייה של המכון למדעי כדור הארץ). בשלב הנוכחי ימשיכו שתי הספריות לתפקד בנפרד.

רכישת מכשור מעבדתי ואנליטי יקר

כאשר יעבור המכון הגיאולוגי לגבעת רם יערך דיון בין שני המכונים שמטרתו לקבוע נהלים לתאום של רכישת ציוד אנליטי יקר.

שימוש במכשור מעבדתי ואנליטי

חוקרי שני המכונים יוכלו להשתמש בציוד אנליטי בעלות מוזלת השווה לעלות של חוקרי המכון בו נמצא הציוד.

הצעה להמשך הדיון: 2010

1. פגישה מקדימה בין איתי גבריאלי ויגאל– **התקיימה ב 5.7.2010**.

2. העברת המסמך הנוכחי לאיתי גבריאלי.

3. ישיבה משותפת של הנהלת המכון הגיאולוגי ומדענים בכירים מהמכון הגיאולוגי עם קבוצה של נציגי המכון למדעי כדור הארץ (לזר, אנזל, מטמון, נבון, עגנון, אראל).

מטרת הישיבה היתה **לעדכן** לגבי הסיכום משנת 2007 (בין בגין ואראל) לאור המעבר הצפוי של המכון הגיאולוגי לגבעת רם. אחרי הפגישה ימונו צוותים שידונו בסעיפים השונים ויכינו מסמכים מפורטים יותר לגבי כל סעיף. הנושאים מופיעים כאן פעם נוספת עם עדכונים ושינויים כפי שהוסכמו על חברי המכון למדעי כדור הארץ ומהווים בסיס להתחלת הדיון המשותף עם המכון הגיאולוגי. בשלב זה, רק סעיפים 1 ו 4 זכו להתייחסות מפורטת. שאר הסעיפים יורחבו במהלך הדיון המשותף.

1. הוראה במכון למדעי כדור הארץ על ידי חוקרי המכון הגיאולוגי

מדעני המכון הגיאולוגי מחזיקים בידע ומומחיות העשויים לתרום להוראה מדעי כדור הארץ באוניברסיטה העברית ויש עניין הדדי בשילובם במערך ההוראה באוניברסיטה. חוקרים במכון הגיאולוגי שיתבקשו לכך על ידי ראש החוג למדעי כדור הארץ ויאושרו על ידי ראש המכון הגיאולוגי יוכלו, לאחר מעבר הפרוצדורה הנדרשת באוניברסיטה, ללמד קורסים במכון למדעי כדור הארץ ולקבל מעמד של **מורים-עמיתים** באוניברסיטה העברית בדומה לחוקרי המינהל החקלאי (ראו למטה). ההוראה תקבע על סמך צרכי המכון למדעי כדור הארץ. בכל שנה ייערך תאום בין ראש המכון הגיאולוגי וראש החוג למדעי כדור הארץ.
חוקרי המכון הגיאולוגי שאינם מורים-עמיתים באוניברסיטה, יוכלו ללמד קורסים באוניברסיטה על בסיס לא קבוע, על פי בקשת ראש החוג למדעי כדה״א ובאישור מנהל המכון הגיאולוגי. חוקרי המכון הגיאולוגי שאינם מורים-עמיתים באוניברסיטה, יוכלו להצטרף להדרכת תלמידים על פי בקשתו של מורה מהסגל הרגיל של המכון למדעי כדה״א; הדרכה כזו תדרוש את אישורו של מנהל המכון הגיאולוגי.

הפרוצדורה הנדרשת על מנת להתמנות **כמורה-עמית**

1. אישור ראש החוג, ראש המכון למדעי כדור הארץ, וועדת הלימודים של המכון למדעי כדור הארץ.
2. הוראה בהיקף של לפחות 3 נ״ז במשך לפחות 3 שנים לפני התחלת הפרוצדורה האקדמית.
3. מעבר פרוצדורה אקדמית מלאה (הגשת תיק מקצועי, הקמת ועדה, השגת מכתבי המלצה והגשת התיק לועדת המינויים ולרקטור).

זכויות של **מורים-עמיתים**

1. הדרכת תלמידי מוסמך באופן עצמאי (ללא מורה שותף מהאוניברסיטה).
2. זכאות לתואר המתאים לדרגתם במכון הגיאולוגי בצירוף המילה ״עמית (Adjunct) של האוניברסיטה העברית״
3. השאלת ספרים וכתבי עת בספריות הפקולטה (כולל ספריית המכון למדעי כדור הארץ)
4. שימוש במתקני האוניברסיטה שבקמפוס גבעת רם (מרכז קוסל)
5. קבלת קוד משתמש למחשבי הפקולטה המקנה לחוקר גישה למאגרי מידע בין-לאומיים רבים, כולל ISIGLOBAL NET וירחונים מדעיים הנגישים לחוקרי האוניברסיטה.
6. על פי הוראת הנהלת האוניברסיטה זכאים מורים עמיתים לפטור חלקי משכר לימוד עבורם ועבור בני משפחותיהם בשנה בה מתבצעת ההוראה. בהיקף של 25% עבור הוראה בהיקף של עד 2 שעות שנתיות (דהיינו עד 4 שעות שבועיות בסמסטר בודד). הוראה בהיקף של בין 2 ל- 4 שעות שנתיות מזכה בפטור של 50% משכר הלימוד.

2. קליטות של חוקרים צעירים

הנהלות המכונים ייידעו אחת את רעותה בעניין תכניות לקליטת מדענים חדשים, כדי לאפשר לאלה לממש את יכולתם באופן מיטבי.

3. שתוף פעולה בין הספריות

לקראת מעבר המכון הגיאולוגי לגבעת רם, והצורך בהגשת תכנית למבנה החדש של המכון הגיאולוגי, יערך דיון לגבי אפשרות של איחוד הספריות בהשתתפות הנהלות המכונים והנהלת ספריית הרמן (לה שייכת הספרייה של המכון למדעי כדור הארץ). בשלב הנוכחי ימשיכו שתי הספריות לתפקד בנפרד.

4. רכישת מכשור מעבדתי ואנליטי יקר

לקראת מעבר המכון הגיאולוגי לגבעת רם יתחיל דיון בין שני המכונים שמטרתו לקבוע נהלים לתאום של רכישת ציוד אנליטי יקר. עיקרון מנחה בדיון זה יהיה כי יש להימנע ככל האפשר ממצב שיירכש ציוד יקר שיהיה כפול בשני המכונים וימלא אותן פונקציות. ברכישת הציוד יובאו בחשבון האפשרויות הכספיות של שני הצדדים, וכן מידת הגמישות השונה בשימוש בכספים להשגת היעד של רכישת והפעלת הציוד היקר. מעבדת ה MS-ICP-MC העומדת בפני שדרוג ניכר בעתיד הקרוב תשמש כמודל אפשרי לשיתופי פעולה נוספים.

ציוד במכון הגיאולוגי

MC-ICP-MS - בדומה לשיתוף בין סטנפורד ו ה USGS לגבי הפעלת ה SHRIMP

הסכם זה יחליף את ההסכם הקיים היום לגבי השימוש ב MC-ICP-MS.

1. המכשיר יירכש על ידי המכון הגיאולוגי במידה ויש לו את כל המימון.
2. המכון למדעי כדור הארץ ישלם את חלקו (50% - כ 400 אלף דולר) במשך מספר שנים. חלק מהתשלום יעשה מכספי המכון למדעי כדור הארץ ויוכל לשמש את המכון הגיאולוגי לרכישות של חלקי חילוף, תשלום מלגות, הזמנת אורחים וכולי. חלק אחר יועבר מהאוניברסיטה ישירות למכון הגיאולוגי.
3. המכשיר ינוהל על ידי האדם המתאים ביותר מבחינה מקצועית. בשלב הראשון, ד"ר לודוויג הליץ. לאחר פרישתו ימונה האחראי על המכשיר על ידי ראשי המכון הגיאולוגי והמכון למדעי כדור הארץ במשותף.
4. השימוש במכשיר ינוהל על ידי האחראי על המכשיר על פי סידור קבוע וידוע ללא תלות בשייכות החוקר.
5. התשלום עבור השימוש השוטף יהיה מתקציבי המחקר של המשתמשים לגבי חוקרי האוניברסיטה ולפי ראות המכון הגיאולוגי לגבי חוקרי המכון הגיאולוגי. עלות השימוש תהיה אחידה לכל המשתמשים.

ציוד במכון למדעי כדוה"א

המתכונת הנזכרת מעלה תופעל במקרים עתידיים של רכישת מכשור כבד, דוגמת אלקטרון פרוב חדש, אולם בהובלה של המכון למדעי כדור הארץ והשתתפות המכון הגיאולוגי.

5. שימוש במכשור מעבדתי ואנליטי קיים

חוקרי שני המכונים יוכלו להשתמש בציוד אנליטי בשני המכונים בעלות מוזלת השווה לעלות של חוקרי המכון בו נמצא הציוד.

יש כיום מספר מעבדות שלהן יש הסכמים חתומים (LIDAR, OSL). הסכמים אלה ישמשו מודל להסכמים שיוכנו עבור כל מעבדה המצטרפת להסכם.

ציוד במכון הגיאולוגי

1. LIDAR – קיים הסכם שתוף פעולה
2. OSL – קיים הסכם שתוף פעולה
3. LA (LASER ABLATION) 213
4. מעבדה להכנת שקפים
5. מעבדות לאיזוטופים יציבים
6. מעבדה להפרדת מינרלים
7. מעבדה פוטו-גיאולוגית
8. מעבדת AMS- kappa bridge

ציוד במכון למדעי כדוה"א

1. מעבדה פלאומגנטית
2. LA (LASER ABLATION) 193

3. מיקרוסקופ קונפוקלי
4. AFM
5. מעבדת רדיום - ראדון
6. המרכז לננו-אפיון (תאום נוסף עם המרכז עצמו)
7. מעבדות לאיזוטופים יציבים
8. ראמאן ו FTIR
9. מעבדה להפרדת מינרלים

6. שימוש בבסיסי נתונים ממוחשבים – סעיף חדש

במידת האפשר ובכפוף לאילוצים חיצוניים (הוראות ממשלתיות או אוניברסיטאיות), בסיסי נתונים ממוחשבים שנבנו ע"י חוקרי שני המוסדות יוכלו לשמש את חוקרי שני המוסדות בעתיד ללא תמורה (לדוגמא: בסיס הנתונים ההידרו-גאולוגי על מערכת ה Kingdom, מערכת ה GIS, המפות הגיאולוגיות הממוחשבות).

8. שיתוף באוספים: מינרלוגי פליאונטולוגי, פטרוגרפי – סעיף חדש

Appendix E - Planning of the technical staff 2010 – 2020

תוכנית מעבדות מכוניות והנדרש לקיימן - עד 2020 לפי שנים ולפי הצרכים

שם המעבדה	שותפים	משרה מכונית כיום	הקצאת תקנים
קלסטרי מחשבים	דני, אלכס, עינת, חזי, קרין, נתן	1 (חיים צבי)	עד פרישתו של חיים צבי (2024), אחרי כן ירד ל 0.66 מכונית, 0.33 ע״י חוקרים
גאוכימית-אנליטית	יגאל, אלן, ארי, יונתן, לזר, סימון, יעלה	0.33 (אופיר תירוש)	עם פרישת חגי רון (2011) - 0.5 ; עם פרישת יקי וויס - 0.66, השאר ע״י החוקרים
איזוטופים יציבים	לוז, אלון, יונתן, לזר, אלן	1 (יבגני ברקן)	עד פרישת ברקן (2018), אחרי כן ירד ל 0.66 מכונית, 0.33 ע״י חוקרים
הכנה רטובות	ארי, אלון, דב וחוקרים שעדין לא מונו	0.0 (שונית מאזה)	0.5 משרה תוקצה עם פרישתה של ורדה ברלין (2011?). עם פרישת ברקן (2018) תעלה ל 0.66 מכונית, 0.33 ע״י חוקרים
פלאומגנטית + לחצים גבוהים	אמוץ, רונית, יהודה, ארי	50,000 ₪ (חגי רון)	עם פרישת חגי רון (2011) 16000 - לטובת אופיר תירוש, 16000 - לטובת עמרי דביר, 16000 - להוצאות נסיעה של חגי. עם פרישת סיגלוב (2018) יעלה ל 0.5 משרה
מיקרוסקופיה (פרוב ,לייזר , קונפוקלי, AFM)	דב, לזר, רונית, עודד, יונתן, סימון, עינת	0.165 (עמרי דביר)	עם פרישת חגי רון (2011) - 0.33 ; עם פרישת יקי וויס - 0.66, השאר ע״י החוקרים, עם פרישת סיגלוב (2018) - יעלה ל 1 משרה בתנאי שתשולם לשני טכנאים
אלקטרוניקה	לוז, לזר, ארז (עודד, יגאל, דני, ארי, אלון, אלן)	אנדרי פודלקו	עד 2024 – אחר כך נצטרך להחליט מה לעשות
רכב שטח	אמוץ, ארי, דב, יהודה, לוריא, חיים, ארז, לוז, עינת, לזר	יוסי שרר	
תכנות חישובי והדמיות ממוחשבות	פלדור, קרן	אנדרי סיגלוב	פורש ב 2018, אחרי פרישתו 0.66 משרה למשרות בלתי מאוישות ו 0.33 למיקרוסקופיה

<u>הערות:</u>

ורדה ברלין – 0.5 משרה מכונית. סביר שתפרוש כאשר מנחם לוריא יפרוש ב 2011, אולם זה עדין לא סופי.

2016 – פרישה של פורטנוי – יוחלף על ידי טכנאי מחשבים חדש.

1.75 תקנים פנויים
למימון : חגי (0.33 = 50,000), אופיר (0.33 משרה), עמרי (0.165), דקלה (0.75), יקי (משרה 0.5))
עם פרישת ברקן - תשתחרר 0.165 משרה, עם פרישת סיגלוב תשתחרר 0.66 משרה (שתי הפרישות ב 2018). בשלב זה, או אולי אפילו שנתיים שלוש לפני כן יש לנסות להעניק קביעות לאופיר, שונית ועמרי. אם אכן המהלך הזה יתממש יהיו בידי המכון 1.25 משרות פנויות (עם פרישת חיים צבי ב 2024 יהיו 1.58 משרות פנויות. יתכן שנפסיד 1 משרה – ראו הערה לגבי סיגלוב.

אנדרי פודלקו – פורש ב 2024, כיום עובד כשעה ביום אצל יונתן ארז ובנוסף מסייע בעיקר ללוז, לזר, ארז בפרויקטים של אוטומציה במעבדות שלהם. כמו כן, מסייע במידה פחותה יותר לאלון, יגאל, וארי. האם יש מקום לעשות שינוי בהגדרת התפקיד שלו? האם יש למסות אנשי מכון לפי העזרה בשירותיו?

ברקן – כיום עובד רק עם לוז שפורש ב 2012. עם פרישת לוז ינוהל על ידי אלון תוך שהוא ממשיך לעזור ללוז במידת הצורך ובתאום עם ראש המכון.

סיגלוב – בנוסף לנתן הוא כבר עוזר לקרין. נבדקת האפשרות שיקדים פרישתו ל 2011 במסגרת הקיצוץ שהפקולטה דורשת מאתנו.

Appendix 4

The Study Program - Table no. 1
Academic Year of Evaluation - (2011)

Framework of study: First year studies in Earth Sciences (6014).

Year in program	Semester	Course Title	#	Course Type (oblig./elective /seminar/other)	No. of Credits	Prerequisites for Admission	Weekly Teaching Hours	Weekly Exercise Hours	Weekly Laboratory Hours	No. of Students	Teaching Staff	
											Name of staff member	Employment Degree
1	1	Introduction to Oceanography	68104	Obligatory	3	-	2	1	-	78	Prof. Boaz Luz	Professor
1	1	Introduction to Climate	68105	Obligatory	4	-	3	1	-	65	Dr. Alon Angert	Senior Lecturer
1	1	The Dynamic Earth	68127	Obligatory	4	-	3	1	-	69	Dr. Ari Matmon	Senior Lecturer
1	1	General Physics - Mechanics for Chem. & Earth Students	77130	Obligatory	6	-	4	2	-	130	Prof. Jehudh Wagschal	Professor
1	1	Mathematics for Chemistry Students	80109	Obligatory	6	-	4	2	-	137	Mr. Itamar Cwik	Senior Teacher
1	2	Earth as a Planet - Introduction to Planetary Astronomy	68103	Obligatory	2	-	1	1	-	60	Prof. Ariel Cohen	Professor
1	2	Geological Excursion in the Negev	68140	Obligatory	1.5	68127	4-day field trip			44	Dr. Ari Matmon	Senior Lecturer
1	2	Physical chemistry for Pharmacy & Earth Sciences	69167	Obligatory	6	-	4	2	-	212	Dr. Danny Porath	Associate Professor
1	2	Mathematics for Chemistry Students (2)	80110	Obligatory	6	80109	4	2	-	128	Mr. Itamar Cwik	Senior Teacher
1	2	General Physics - Waves & Electricity for Chem. & Earth Students	77131	Obligatory	6	77130	4	2	-	130	Dr. Omri Gat	Senior Lecturer
1 or 2	1	JAVA for Earth Sciences	76636	Obligatory	2	-	2	-	-	40	Mr. Roie Knaanie	Teacher
1 or 2	2	MATLAB for Earth Sciences	76628	Obligatory	2	-	2	-	-	41	Mr. Roie Knaanie	Teacher
1 or 2	1 or 2	Information and Library resources: an online course	76415	Obligatory	0	-	-	-	-	32	Ms. Elinor Banhakon	Librarian
1 or 2	1 or 2	Computerized Safety Course	76222	Obligatory	0	-	-	-	-	721	-	-
Students must select one of the following during the course of their studies												
1	1	Introduction to Chemistry	69107	Elective	7	-	5	2	-	118	Prof. Silvio Biali	Professor
1	1	Int. to Pharmaceutical Chemistry & Drug Analysis	69135	Elective	6	-	4	2	-	138	Dr. Roie Yerushalmi	Senior Lecturer
Students must select one of the following during the course of their studies												
2 or 3	2	General Chemistry Lab	69115	Lab	3	-	-	-	4	102	Prof. Menachem Steinberg Prof. Shlomo Magassi	Professor (Emeritus) Professor
2 or 3	2	Physics Lab 1 for Chemistry & Earth	77150	Lab	3	-	-	-	3	29	Mr. David Shwa	Phd Student
Total					67.5		42	18	7			

Framework of study: Geology - single major (6010).
Minimum credits within the program**: 72**

Year in program	Semester	Course Title	#	Course Type (oblig./elective /seminar/other)	No. of Credits	Prerequisites for Admission	Weekly Teaching Hours	Weekly Exercise Hours	Weekly Laboratory Hours	No. of Students	Teaching Staff	
											Name of staff member	Employment Degree
2	1	Introduction to Oceanography	68104	Obligatory	3	-	2	1	-	78	Prof. Boaz Luz	Professor
2	1	Introduction to Earth Science Modeling	68355	Obligatory	2	-	3	1		21	Prof. Einat Aharonov	Associate Professor
							Half-semester course					
2	1	Introduction to Paleontology	70102	Obligatory	3	-	2	-	1	23	Prof. Jonathan Erez Dr. Rivka Rabinovich	Professor Lecturer
2	1	Summer Field Camp	70110	Obligatory / camp	4.5	68127, 68105, 68140 and 68117 or 68125 or 68128	6-day field trip			15	Prof. Oded Navon	Professor
2	1	Mineralogy and Petrology	70307	Obligatory	4	68128	2	1	2	14	Prof. Dov Avigad Prof. Matthews Alan	Professor Professor
2	1	Northern Negev – field trip	70326	Obligatory/ camp	1.5	70110	3-day field trip			16	Prof. Amotz Agnon	Professor
2	1	Basic Geological Mapping	70333	Obligatory/ camp	4	70110, 70326	5-day field trip			14	Prof. Amotz Agnon Dr. Ari Matmon	Professor Senior Lecturer
2	1	Groundwater Hydrology	70350	Obligatory	3	80109 or 80125 or 80128	2	1	-	31	Dr. Simon Emmanuel	Senior Lecturer
2	1	Introduction to Geochemical Measurements	70555	Obligatory	1	-	-	1	2	11	Prof. Boaz Lazar	Professor
							Laboratory meetings in the first 5 weeks					
2	2	Geological Mapping – Expanded	70306	Obligatory/ camp	4	70110 or 70326 or 70333	4-day field trip			12	Prof. Amotz Agnon Dr. Ari Matmon	Professor Senior Lecturer
2	2	Introduction to Geochemistry	70311	Obligatory	4	-	3	1	-	19	Prof. Boaz Lazar	Professor
2	2	Stratigraphy and Paleontology	70365	Obligatory	3	70326	2	1	-	14	Dr. Zohar Gvirtzman	Lecturer
2	2	Judea Mountains – field trip	70721	Obligatory/ camp	0.5	-	1-day field trip			14	Prof. Eytan Sass Dr. Ari Matmon	Professor (Emeritus) Senior Lecturer
2 or 3	1	Field Methods in Surface Hydrology	40730	Elective/camp	2	40701	4 one day field trips			3	Dr. Tamir Grodek	Administrative staff
2 or 3	1	Field Methods in Groundwater Hydrology	68804	Elective	3	-	4 two hour classes and 3 field days			13	Dr. Yossi Yechieli	Lecturer
2 or 3	1	Teaching Earth Sciences	70360	Elective	3	-	Personal guidance			1	Dr. Nir Orion	Associate Professor
2 or 3	1	Introduction to GIS	70511	Elective	3	-	2	1	-	28	Mr. Adi Ben-Nun	Engineer
2 or 3	1	From Cell to Organism (Basic)	72126	Elective	2	-	2	-	-	105	Dr. Ariel Chipman	Senior Lecturer
2 or 3	1	Introduction to Cell Biology	72153	Elective	3	-	3	-	-	245	Dr. Benjamin Aroeti Prof. Rachel Nechushtai	Senior Lecturer Professor

2 or 3	1	Research Methods in Oceanography	84000	Elective	4	-	5 days at IUI (Eilat)			4	Prof. Boaz Lazar Prof. Jonathan Erez	Professor Professor
2 or 3	2	Paleoceanography and Global Change	84540	Elective	2	84530 and 68127 or 89106	2	-		9	Prof. Jonathan Erez Prof. Yair Rosenthal	Professor Visitting Professor
							Several classes in Jerusalem and 6 days at IUI (Eilat)					
2 or 3	2	Biogeochemistry of the Coral Reef	84821	Elective	5	-	6 days at IUI (Eilat)			3	Prof. Boaz Lazar Prof. Jonathan Erez	Professor Professor
2 or 3	2	Geology & Geophysics of the Marine Environment	84840	Elective	3.5	70701	5 days at IUI (Eilat)			3	Prof. Amotz Agnon	Professor
2 or 3	2	Earth as a Planet – Introduction to Planetary Astronomy	68103	Elective	2	-	1	1	-	60	Prof. Ariel Cohen	Professor
2 or 3	2	Dead Sea Rift – Field Trip	70331	Elective/camp	1.5	70110 or 70326 or 70333	3-day field trip			13	Prof. Amotz Agnon	Professor
2 or 3	2	Volcanism	70547	Elective/camp	1.5	68127	3-day field trip			13	Prof. Oded Navon Dr. Ariel Heimann	Professor Lecturer
2 or 3	2	Galilee – Field Camp	70629	Elective/camp	1.5	-	2-day field trip			13	Prof. Hagai Ron	essorAdjunct Prof
2 or 3	2	Field Methods in Quaternary Research	70570	Elective/camp	5	-	6-day field trip			12	Dr. Ari Matmon Prof. Yehouda Enzel	Senior Lecturer Professor
2 or 3	2	Physics of the Earth	70701	Elective	4	-	2	2	-	9	Prof. Amotz Agnon	Professor
2 or 3	yearly	Honors Laboratory for Third Year Students	70540	Elective/ seminar	4	-	Personal guidance			-	-	-
3	1	The Geology of Israel	70316	Obligatory	2	-	2	-	-	19	Prof. Zvi Garfunkel	Professor (Emeritus)
3	1	Water Resources of Israel	70515	Obligatory	3	-	3	-	-	30	Prof. Haim Gvirtzman	Professor
3	1	Introduction to Soil Sciences	70525	Obligatory	3	-	2	1	-	13	Prof. Yigal Erel	Professor
3	1	Global Tectonics	70603	Obligatory	3	-	2	1		15	Prof. Dov Avigad	Professor
3	1	Mapping of Igneous and Metamorphic Rocks	70619	Obligatory	1.5	-	2-day field trip			14	Prof. Dov Avigad	Professor
3	1	Mt. Sedom Salt Diapir: Geology & Morphology	40327	Elective	1	70135 or 68127	Several meetings and field trips			7	Prof. Amos Frumkin	Professor
3	1	Numerical Methods in Earth Sciences	70865	Elective	3	-	2	1	-	7	Dr. Simon Emmanuel Prof. Alexander Khain	Senior Lecturer Professor
3	1	Modeling Environmental Systems	40478	Elective	3	-	2	1	-	15	Dr. Efrat Morin	Senior Lecturer
3	1	Surface Water Hydrology: Processes, Observations and Models	40701	Elective	3	-	3	-	-	13	Dr. Efrat Morin	Senior Lecturer
3	2	Structural Geology	70302	Obligatory	3.5	-	2	1	-	8	Prof. Einat Aharonov	Associate Professor
							An additional one day field trip					
3	2	Introduction to Geomorphology	70425	Obligatory	4	68127 or 70135 or 89106	3	1		16	Prof. Yehouda Enzel	Professor
							An additional 2-day field trip					
3	2	Troodos Ophiolite Field Trip, Cyprus	70670	Elective/camp	3	70306	10 days in Cyprus			2	Prof. Amotz Agnon	Professor
3	2	Ecosystem of the Red Sea	76732	Elective	5	-	10 days at IUI (Eilat)			20	Dr. Moshe Kiflawi	Lecturer
3	yearly	Departmental Research Seminar	70585	Obligatory/seminar	1	-	1	-	-	12	Prof. Boaz Lazar	Professor
3	yearly	B.Sc Students' Seminar	70691	Obligatory /	2	76410 or	2	-	-	15	Dr. Ronit Kessel	Senior Lecturer

			seminar		76415	*Meetings only in half of the second semester*					
3	yearly	Igneous Metamorphic and Sedimentary Petrography – lab 70700	Obligatory/lab	3	70307	-	-	2	7	Dr. Ronit Kessel Dr. Simon Emmanuel Dr. Alan Matthews	Senior Lecturer Senior Lecturer Professor
3	yearly	Igneous Metamorphic and Sedimentary Petrography 70702	Obligatory	6	70307	3	-	-	18	Dr. Ronit Kessel Dr. Simon Emmanuel Dr. Alan Matthews	Senior Lecturer Senior Lecturer Professor

Students must participate in at least two field trips (at least 3 credits)

From courses listed above students may select different frameworks within the program:

Framework of study: Geology – single major with complementary studies (6013) / dual major (6011)
Credits within the program: 6013, minimum 48 credits; 6011, minimum 48 credits

Obligatory courses:
Introduction to Earth Science Modeling (68355), Introduction to Paleontology (70102), Summer Field Camp (70110), Mineralogy and Petrology (70307), Northern Negev – field trip (70326), Basic Geological Mapping (70333), Introduction to Geochemistry (70311), Stratigraphy and Paleontology (70365), Judea Mountains – field trip (70721), The Geology of Israel (70316), Water Resources of Israel (70515), Global Tectonics (70603), Mapping of Igneous and Metamorphic Rocks (70619), Departmental Research Seminar (70585), B.Sc Students' Seminar (70691), Igneous Metamorphic and Sedimentary Petrography (70702)
Elective Courses (at least 3 credits):
Geological Mapping – Expanded (70306), Dead Sea Rift – Field Trip (70331), Volcanism (70547), Galilee – Field Camp (70629), Troodos Ophiolite Field Trip, Cyprus (70670), Field Methods in Quaternary Research (70570)

Framework of study: Minor in Geology (6031)
Credits within the program: 6031 minimum 32 credits.

Obligatory Courses:
Introduction to Oceanography (68104), The Dynamic Earth (68127), Earth as a Planet – Introduction to Planetary Astronomy (68103), Geological Excursion in the Negev (68140), Introduction to Paleontology (70102), Summer Field Camp (70110), Global Tectonics (70603), Structural Geology (70302), Introduction to Geochemistry (70311), Judea Mountains – field trip (70721)
Elective courses:
Mineralogy and Petrology (70307), The Geology of Israel (70316), Basic Geological Mapping (70333), Groundwater Hydrology (70350), Introduction to GIS (70511), Water Resources of Israel (70515), Introduction to Soil Sciences (70525), Mapping of Igneous and Metamorphic Rocks (70619), Stratigraphy and Paleontology (70365), Introduction to Geomorphology (70425), B.Sc. Students' Seminar (70691), Igneous Metamorphic and Sedimentary Petrography – lab (70700), Igneous Metamorphic and Sedimentary Petrography (70702)

Framework of study: Climate, Atmospheric Science and Oceanography – single major (6008).
Credits within the program**:** minimum 72 credits.

Year in program	Semester	Course Title	#	Course Type (oblig./elective /seminar/other)	No. of Credits	Prerequisites for Admission	Weekly Teaching Hours	Weekly Exercise Hours	Weekly Laboratory Hours	No. of Students	Teaching Staff	
											Name of staff member	Employment Degree
2	1	Introduction to Oceanography	68104	Obligatory	3	-	2	1	-	78	Prof. Boaz Luz	Professor
2	1	Introduction to Earth Science Modeling	68355	Obligatory	2	-	3	1		21	Prof. Einat Aharonov	Associate Professor
							Half-semester course					
2	1	Introduction to Paleontology	70102	Obligatory	3	-	2	-	1	23	Prof. Jonathan Erez Dr. Rivka Rabinovich	Professor Lecturer
2	1	Dynamic Meteorology	82301	Obligatory	4	68118	3	1	-	5	Prof. Nathan Paldor	Professor
2	1	Radiative Transfer in the Atmosphere and Introduction to Remote Sensing	82309	Obligatory	5	-	4	1	-	5	Dr. Carynelisa Erlick-Haspel	Senior Lecturer
2	1	Rain and Cloud Physics	82814	Obligatory	4	68118	2	2	-	7	Prof. Daniel Rosenfeld	Professor
2	2	Mid-latitude Synoptic Meteorology	82304	Obligatory	4	82301	2	2	-	11	Prof. Daniel Rosenfeld	Professor
2	2	Boundary Layer Meteorology	82510	Obligatory	4	-	3	1	-	5	Prof. Alexander Khain	Professor
2	2	Atmospheric Chemistry	82657	Obligatory	2	-	2	-	-	14	Dr. Erlick-Haspel Carynelisa	Senior Lecturer
Students must select at least two of the following courses												
2	2	Chemical Oceanography	84003	Elective	3	68104	2	1	-	4	Prof. Boaz Lazar	Professor
2	2	Marine Biogeochemistry	84839	Elective	2	68104	2	-	-	10	Dr. Yeala Shaked	Lecturer
							Classes for half a semester and 3 days at IUI (Eilat)					
2	2	Physical Oceanography	84831	Elective	3	68104	2	1	-	-	Prof. Nathan Paldor	Professor
2	2	Geology & Geophysics of the Marine Environment	84840	Elective	3.5	70701	5 days at IUI (Eilat)			3	Prof. Amotz Agnon	Professor
Students must select at least one course from the following courses												
2	1	Groundwater Hydrology	70350	Elective	3	80109 or 80125 or 80128	2	1	-	31	Dr. Simon Emmanuel	Senior Lecturer
2	1	Introduction to Soil Sciences	70525	Elective	3	-	2	1	-	13	Prof. Yigal Erel	Professor
2	2	Introduction to Geomorphology	70425	Elective	4	68127 or 70135 or 89106	3	1	-	16	Prof. Yehouda Enzel	Professor
2 or 3	1	Introduction to GIS	70511	Elective	3	-	2	1	-	28	Mr. Adi Ben-Nun	Engineer
2 or 3	1	Water Resources of Israel	70515	Elective	3	-	3	-	-	30	Prof. Haim Gvirtzman	Professor
2 or 3	1	From Cell to Organism (Basic)	72126	Elective	2	-	2	-	-	105	Dr. Ariel Chipman	Senior Lecturer
2 or 3	1	Introduction to Cell Biology	72153	Elective	3	-	3	-	-	245	Dr. Benjamin Aroeti Prof. Rachel Nechushtai	Senior Lecturer Professor
2 or 3	1	Mechanics and Special Relativity	77101	Elective	7	-	6	2	-	199	Prof. Nir Shaviv	Associate Professor

											Prof. Yitzchak Tuchman	Professor
2 or 3	1	Astrophysics and Life in the Universe	77210	Elective	3	-	3	-	-	89	Dr. Amri Wandel	Associate Professor
2 or 3	1	Analytical Mechanics	77303	Elective	5	80114, 77101	3	2	-	130	Prof. Jacob Bekenstein	Full Proffesor
2 or 3	1	Applied Mathematics (1)	80114	Elective	6	-	4	2	-	350	Prof. Ruth Lawrence-Naimark Dr. Miriam Bank	Associate Professor (outside teacher)
2 or 3	1	Introduction to Environmental Sciences	89309	Elective	3	-	3	-	-	25	Prof. Yigal Erel	Professor
2 or 3	2	Earth as a Planet - Introduction to Planetary Astronomy	68103	Elective	2	-	1	1	-	60	Prof. Ariel Cohen	Professor
2 or 3	2	Fundamentals of Probability and Statistical Analysis	72301	Elective	4	-	3	1	-	158	Prof. Ariel Darvasi Dr. Liran Carmel	Associate Professor Senior Lecturer
2 or 3	2	Electricity and Magnetism	77102	Elective	6	77101, 80114	4	2	-	189	Dr. Hagai Eisenberg Dr. Nadav Katz	Associate Professor Senior Lecturer
2 or 3	2	New Trends in Modern Physics	77153	Elective	2	-	2	-	-	194	Prof. Avishai Dekel	Full Proffesor
2 or 3	2	Astrophysics and Life in the Universe (B)	77211	Elective	3	77210	3	-	-		Dr. Amri Wandel	Associate Professor
2 or 3	2	Mechanics of Continua	77606	Elective	3	80157, 77102	2	1	-	75	Prof. Jacob Bekenstein	Full Proffesor
2 or 3	2	Applied Mathematics (2)	80157	Elective	6	80114	4	2	-	266	Prof. Ruth Lawrence-Naimark Dr. Yaakov Itin	Associate Professor (outside teacher)
2 or 3	2	Physics of the Earth	70701	Elective	4	-	2	2	-		Prof. Amotz Agnon	Professor
2 or 3	2	Environmental Remote Sensing	82850	Elective	3	-	2	1	-	8	Dr. Carynlisa Erlick-Haspel	Senior Lecturer
2 or 3	2	Nutrient Biogeochemistry and Uptake	84818	Elective	4	68104	6 days at IUI (Eilat)			7	Dr. Yeala Shaked	Lecturer
3	1	Climatic Changes (**S**)	82508	Obligatory	2	-	1	1	-	6	Prof. Daniel Rosenfeld	Professor
3	1	Introduction to Tropical Meteorology	82515	Obligatory	4	82301, 82304, 82510, 82814	3	1	-	6	Prof. Alexander Khain	Professor
3	1	Research Methods in Oceanography	84000	Obligatory	4	-	5 days at IUI (Eilat)			4	Prof. Boaz Lazar Prof. Jonathan Erez	Professor Professor
3	1	Modeling Environmental Systems	40478	Elective	3	-	2	1		15	Dr. Efrat Morin	Senior Lecturer
3	1	Surface Water Hydrology: Processes, Observations and Models	40701	Elective	3	-	3	-	-	13	Dr. Efrat Morin	Senior Lecturer
3	1	Topics in Physical Oceanography	76737	Elective	4	-	6 days at IUI (Eilat)			4	Dr. Yossi Ashkenazy Prof. Hezi Gildor	Lecturer Associate Professor
3	2	Paleoceanography and Global Change	84540	Obligatory	2	84530 and 68127 or 89106	2	-		9	Prof. Jonathan Erez Prof. Yair Rosenthal	Professor Vissiting Professor
							Several classes in Jerusalem and 6 days at IUI (Eilat)					
3	2	Biogeochemical Cycles and the Climate System	89703	Obligatory	3	-	2	1	-	40	Dr. Alon Angert	Senior Lecturer
3	2	Physical Processes in Atmospheric numerical models	82813	Elective	2	-	1	1	-	2	Prof. Alexander Khain	Professor
3	2	The Use of Radar in Cloud Physics	82825	Elective	2	-	1	1	-	9	Prof. Daniel Rosenfeld	Professor
3	2	Ecosystem of the Red Sea	76732	Elective	5	-	10 days at IUI (Eilat)			20	Dr. Moshe Kiflawi	Lecturer
3	yearly	Selected Topics in Atmospheric Sciences	82609	Obligatory/seminar	2	76415	2	-	-	5	Dr. Alon Angert	Senior Lecturer

3	yearly	Guided work in Climatology 82615	Seminar/Elec.	2	-	Personal guidance	-	Prof. David Sharon	Professor (Emeritus)

The service course that appears also in the Earth Sciences program is marked by bold S that follows the name of the course.

From courses listed above students may select different frameworks:

Framework of study: Atmospheric Science - single major with complementary studies (6015) / integrated dual major (6012)
Credits within the program: 6015, minimum 48 credits; 6012, minimum 48 credits

Obligatory courses:
Introduction to Earth Science Modeling (68355), Dynamic Meteorology (82301), Radiative Transfer in the Atmosphere and Introduction to Remote Sensing (82309), Rain and Cloud Physics (82814), Mid-latitude Synoptic Meteorology (82304), Boundary Layer Meteorology (82510), Climatic Changes (82508), Introduction to Tropical Meteorology (82515), Atmospheric Chemistry (82657), Biogeochemical Cycles and the Climate System (89703), Selected Topics in Atmospheric Sciences (82609)
Elective courses:
Introduction to Oceanography (68104), From Cell to Organism (Basic) (72126), Introduction to Cell Biology (72153), Analytical Mechanics (77303), Applied Mathematics (1) (80114), Earth as a Planet - Introduction to Planetary Astronomy (68103), Mechanics of Continua (77606), Environmental Remote Sensing (82850), Paleoceanography and Global Change (84540), Physical Processes in Atmospheric numerical models (82813), Guided work in Climatology (82615)

Framework of study: Minor in Atmospheric Science (6032)
Credits within the program: 6032 minimum 32 credits.

Obligatory courses:
Dynamic Meteorology (82301), Rain and Cloud Physics (82814)
Elective courses:
Introduction to Oceanography (68104), Introduction to GIS (70511), Astrophysics and Life in the Universe (77210), Equations of Mathematical Physics (77313), Radiative Transfer in the Atmosphere and Introduction to Remote Sensing (82309), Climatic Changes (82508), Introduction to Tropical Meteorology (82515), Mechanics of Continua (77606), Mid-latitude Synoptic Meteorology (82304), Boundary Layer Meteorology (82510), Atmospheric Chemistry (82657), Environmental Remote Sensing (82850), Analytical Mechanics (77303), Biogeochemical Cycles and the Climate System (89703), Physical Processes in Atmospheric numerical models (82813), The Use of Radar in Cloud Physics (82825), Guided work in Climatology (82615)

Framework of study: Minor in Oceanography (6033)
Credits within the program: 6033 minimum 32 credits.

Obligatory courses:
Introduction to Oceanography (68104)
Students must select 8 credits from the following list:
Chemical Oceanography (84003), Marine Biogeochemistry (84839), Geology & Geophysics of the Marine Environment (84840), Physical Oceanography (84831)
Elective courses:

Introduction to Paleontology (70102), Dynamic Meteorology (82301), Radiative Transfer in the Atmosphere and Introduction to Remote Sensing (82309), Ecosystem of the Red Sea (76732), Mechanics of Continua (77606), Paleoceanography and Global Change (84540), Nutrient Biogeochemistry and Uptake (84818), Biogeochemistry of the Coral Reef (84821), Research Methods in Oceanography (84000), Environmental Remote Sensing (82850)

This track also includes the following courses which do not appear in previous study programs:

Year in program	Semester	Course Title		Course Type (oblig./elective /seminar/other)	No. of Credits	Prerequisites for Admission	Weekly Teaching Hours	Weekly Exercise Hours	Weekly Laboratory Hours	No. of Students	Teaching Staff	
											Name of staff member	Employment Degree
2 or 3	1	Diving for Scientific Work	84837	Elective	0	-	One week ta IUI (Eilat)			-	Mr. Oded Ben-shaprut	Lab technician
2 or 3	1	Microbial Ecology	72501	Elective	4	72335 or 89305	4	-	-	14	Prof. Aharon Oren	Professor
2 or 3	2	Biology of the Coral Reef	84863	Elective	7	-	10 days at IUI (Eilat)			11	Dr. Dan Tchernov Dr.Maoz Fine	Lecturer Senior Lecturer
2 or 3	2	Marine Photosynthesis	76724	Elective	6	-	10 days at IUI (Eilat)			10	Dr. Dan Tchernov	Lecturer
2 or 3	2	The Geo-biology of Lake Kinnert - Study Camp	89301	Elective / camp	3	-	3-day field trip			34	Prof. Haim Gvirtzman	Professor
2 or 3	2	Dead Sea Field Camp	89400	Elective / camp	3	-	3-day field trip			19	Prof. Haim Gvirtzman	Professor
Total					23		4	-	-			

Additional set study programs:

Geology and Atmospheric Sciences – integrated dual major (8025). Minimum credits for graduating within the program: 102
Earth Science and Biology – integrated dual major (8029). Minimum credits for graduating within the program: 72
Geology and Environmental science – integrated dual major (8030). Minimum credits for graduating within the program: 72
Atmospheric Science and Environmental science – integrated dual major (8031). Minimum credits for graduating within the program: 72

M.Sc. Programs

Framework of study: M.Sc. Program in Geology (6040)
Credits within the program: 6040, minimum 32 credits.

Elective courses:
Modeling Environmental Systems (40478), Surface Water Hydrology: Processes, Observations and Models (40701), Field Methods in Surface Hydrology (40730), Field Methods in Groundwater Hydrology (68804), Teaching Earth Sciences (70360), Introduction to GIS (70511), Numerical Methods in Earth Sciences (70865), From Cell to Organism (Basic) (72126), Introduction to Cell Biology (72153), Research Methods in Oceanography (84000), Mt. Sedom Salt Diapir: Geology & Morphology (40327), Earth as a Planet - Introduction to Planetary Astronomy (68103), Dead Sea Rift - Field Trip (70331), Volcanism (70547), Galilee - Field Camp (70629), Troodos Ophiolite Field Trip, Cyprus (70670), Ecosystem of the Red Sea (76732), Paleoceanography and Global Change (84540). Biogeochemistry of the Coral Reef (84821), Geology & Geophysics of the Marine Environment (84840), Honors Laboratory for Third Year Students (70540), Research Project for M.Sc Students (70812), Field Methods in Quaternary Research (70570), Physics of the Earth (70701)

This track also includes the following courses which do not appear in previous study programs:

Year in program	Semester	Course Title		Course Type (oblig./elective /seminar/other)	No. of Credits	Prerequisites for Admission	Weekly Teaching Hours	Weekly Exercise Hours	Weekly Laboratory Hours	No. of Students	Teaching Staff	
											Name of staff member	Employment Degree
1 or 2	1	Classical Papers in Earth Sciences	84827	Elective	2	-	2	-	-	7	Prof. Hezi Gildor	Associate Professor
2	2	M.Sc Students Seminar	70820	Obligatory	2	-	2	-	-	6	Prof. Boaz Lazar	Professor
2	2	Final M.Sc Examination	74442	Obligatory	0							
2	2	M.Sc Thesis	74443	Obligatory	0							
Total					4		4	-	-			

Framework of study: M.Sc. in Atmospheric Sciences (6041).
Credits within the program: 6041, minimum 32 credits.

Obligatory courses:
Final M.Sc Examination (74442), M.Sc Thesis (74443)
Elective courses:
Surface Water Hydrology: Processes, Observations and Models (40701), Introduction to Paleontology (70102), Introduction to GIS (70511), Numerical Methods in Earth Sciences (70865), From Cell to Organism (Basic) (72126), Introduction to Cell Biology (72153), Topics in Physical Oceanography (76737), Analytical Mechanics (77303), Applied Mathematics (1) (80114), Radiative Transfer in the Atmosphere and Introduction to Remote Sensing (82309), Classical Papers in Earth Sciences (84827), Mechanics of Continua (77606), Physical Processes in Atmospheric numerical models (82813), The Use of Radar in Cloud Physics (82825), Environmental Remote Sensing (82850), Paleoceanography and Global Change (84540), Biogeochemical Cycles and the Climate System (89703), Guided work in Climatology (82615)

This track also includes the following courses which do not appear in previous study programs:

Year in program	Semester	Course Title		Course Type (oblig./elective /seminar/other)	No. of Credits	Prerequisites for Admission	Weekly Teaching Hours	Weekly Exercise Hours	Weekly Laboratory Hours	No. of Students	Teaching Staff	
											Name of staff member	Employment Degree
1 or 2	1	Fluid Dynamics: Turbulent Flow	82606	Elective	3	-	2	1	-	4	Dr. Mark Pinsky	Research Associate (KAMEA)
1 or 2	2	Mathematical Methods in Scientific Models	82833	Elective	2	-	1	1	-	3	Prof. Nathan Paldor	Professor
2	yearly	Seminar for Graduate Students	82830	Obligatory	2	-	1	-	-	4	Prof. Alexander Khain	Professor
Total					7		4	2	-			

Framework of study: M.Sc. in Oceanography (6042).
Credits within the program: 6042, minimum 32 credits.

Obligatory courses:
Introduction to Oceanography (68104), Research Methods in Oceanography (84000), Marine Biogeochemistry (84839), Chemical Oceanography (84003), Physical Oceanography (84831), Final M.Sc Examination (74442), M.Sc Thesis (74443)

Elective courses:
Introduction to Paleontology (70102), Numerical Methods in Earth Sciences (70865), Microbial Ecology (72501), Topics in Physical Oceanography (76737), Dynamic Meteorology (82301), Radiative Transfer in the Atmosphere and Introduction to Remote Sensing (82309), Classical Papers in Earth Sciences (84827), Diving for Scientific Work (84837), Stratigraphy and Paleontology (70365), Marine Photosynthesis (76724), Mechanics of Continua (77606), Environmental Remote Sensing (82850), Paleoceanography and Global Change (84540), Nutrient Biogeochemistry and Uptake (84818), Biogeochemistry of the Coral Reef (84821), Geology & Geophysics of the Marine Environment (84840), Biology of the Coral Reef (84863), The Geo-biology of Lake Kinnert - Study Camp (89301), Dead Sea Field Camp (89400)

This track also includes the following courses which do not appear in previous study programs:

Year in program	Semester	Course Title		Course Type (oblig./elective /seminar/other)	No. of Credits	Prerequisites for Admission	Weekly Teaching Hours	Weekly Exercise Hours	Weekly Laboratory Hours	No. of Students	Teaching Staff	
											Name of staff member	Employment Degree
1 or 2	1	Periodicity and Rhythmicity in Marine Ecosystems	76703	Elective	5	-	10 days at IUI (Eilat)			8	Dr. Oren Levy, Dr. Itzchak Brickner	Lecturer, Lecturer
1 or 2	1	Introduction to Physiology	72336	Elective	5	77131 or 77304	4	1	-	165	Dr. Adi Mizrahi, Prof. Idan Segev	Associate Professor, Professor
1 or 2	2	Advanced Topics in Physical Oceanography	76738	Elective	3	-	5 days at IUI (Eilat)			1	Dr. Yossi Ashkenazy, Prof. Hezi Gildor	Lecturer, Associate Professor
1 or 2	1 or 2	Workshop in Oceanography	84835	Obligatory/seminar	2	-	2	-	-	1	Prof. Nathan Paldor	Professor
2	yearly	Seminar in Oceanography	84890	Obligatory	2	-	One hour every 2 weeks			-	Prof. Boaz Lazar	Professor
Total					17		6	1	-			

Ph.D. Programs: 12 credits are mandatory. Each program is individually planned with the student's studies committee.

Our former MSc and PhD students currently holding academic and/or research positions:

Appendix 5

Universities within Israel

Bar Ilan University
Dr. Itamar Lansky (MSc - 1994, PhD – 2004)
Dr. Yishai Weinstein (MSc - 1992, PhD – 1998)
Prof. Hanoch Lavee, previous Rector, now President of Kinneret College (MSc – 1974, PhD – 1981)

Ben Gurion University
Dr. Roi Granot (MSc - 2004)
Dr. Itai Haviv (PhD - 2007)
Dr. Orit Sivan (MSc - 1997, PhD - 2003)
Dr. Yaron Katzir (MSc - 1993, PhD -1998)
Prof. Haim Tsoar (MSc -1970, PhD -1977)
Prof. Hendrik Bruins (MSc - 1978)
Prof. Jiwchar Ganor (MSc – 1986, PhD – 1992)
Prof. Yossef Hatzor (MSc - 1988)

Haifa University
Dr. Dorit Sivan (PhD - 1996)
Dr. Revital Bookman (Kantor) (MSc - 1996, PhD - 2003)
Prof. Noam Greenbaum (MSc - 1987, PhD - 1996)

IUI –Inter-university marine laboratory in Eilat
Dr. Yeala Shaked (PhD – 2002)
Yoanthan Shaked, National Monitoring Program - the Gulf of Eilat (MSc - 1997, PhD - 2002)

Ketura College
Dr. Hanan Ginat (MSc – 1989, PhD -1997)

Technion
Dr. Yael Dubovski (MSc -1996)

Tel Aviv University
Prof. Pinhas Alpert (MSc - 1972, PhD – 1980)
Prof. Shmuel Marco (MSc - 1990, PhD – 1997)
Dr. Alon Ziv (MSc - 1996)

The Hebrew University
Dr. Alon Angert (PhD – 2002)
Dr. Ari Matmon (MSc - 1995, PhD - 2001)
Dr. Efrat Morin (MSc - 1996, PhD – 2002)
Dr. Hagai Ron, (MSc - 1978, PhD -1984)
Dr. Ronit Kessel (MSc - 1995)
Dr. Ronit Nirel, Dept. of Statistics (PhD - 1993)
Dr. Simon Emmanuel (MSc - 2001)
Prof. Amos Frumkin (MSc - 1984, PhD – 1992)
Prof. Amotz Agnon (MSc - 1983)
Prof. Boaz Lazar (MSc - 1977, PhD – 1982)
Prof. Boaz Luz (MSc - 1970)
Prof. Daniel Rosenfeld (MSc - 1995, PhD - 200)
Prof. Dov Avigad (MSc - 1984, PhD – 1990)

Prof. Jonathan Erez (MSc - 1972)
Prof. Oded Navon (MSc – 1982)
Prof. Uri Dayan (MSc - 1975, PhD – 1984)
Prof. Yehouda Enzel (MSc - 1984)
Prof. Yigal Erel (MSc - 1985)

The Open University
Dr. Nurit Taitel-Goldman (MSc - 1993)
Prof. Shlomo Shoval (MSc - 1976)

Weizmann Institute
Prof. Aldo Shemesh (MSc - 1981, PhD - 1986)
Prof. Steve Weiner (MSc - 1972)
Davidson School
Dr. Ariel Heimann (MSc -1985, PhD - 1990)

Research Institutions and Government Agencies within Israel

Institute of Limnology and Oceanography
Dr. Barak Herut, director (MSc - 1988, PhD – 1992)
Dr. Jacob Silverman (PhD – 2005)

Israel Institute for Biological Research
Dr. Yizhak Feliks (MSc 1978)

Mekorot – Research group
Dr. Yoram Katz (MSc – 1977, PhD -2007)

Meteorological Service
Dr. Yoav Levi (MSc - 1992; PhD 1997)
Mr. Avner Furshban (MSc – 1997)

Ministry of Environmental Protection
Mr. Amir Zalzberger (MSc - 2006)
Mr. Avi Moshel (MSc - 1997)
Ms. Lena Levi (MSc - 2005)
Ms. Reut Rabi (MSc - 2004)

Ministry Of Infrastructure
Dr. Michael Gardosh (MSc - 1998)
Dr. Yaacov Mimran (MSc - 1969, PhD - 1971)

Nuclear Research Center, Negev
Dr. Ofra Klein-BenDavid (MSc –1999, PhD – 2006)

Science Museum in Haifa
Dr. Tal Berman (MSc – 1992, PhD – 1999)

Tahal – Research group
Dr. Dorit Matmon (MSc - 1995)

The Geological Survey of Israel
Dr. Ahuval Almogi-Labin (MSc - 1975, PhD – 1982)
Dr. Amir Sagie (MSc 1999 PhD - 2005)
Dr. Amir Sandler (MSc - 1981, PhD – 1992)

Dr. Amit Mushkin (MSc - 2001)
Dr. Amit Segev (MSc - 1976, PhD – 1986)
Dr. Amos Salomon (MSc - 1987, PhD - 1994)
Dr. Avihu Burg (MSc - 1990, PhD – 1999)
Dr. Avner Ayalon (MSc -1971, PhD - 1984)
Dr. Benjamin Begin Minister, Israel Goverment (MSc - 1969, PhD -1979)
Dr. Einat Bar-Giora Magal (MSc -2001)
Dr. Eyal Shalev (MSc - 1999)
Dr. Ezra Zilberman (MSc - 1981, PhD – 1992)
Dr. Gideon Bar (MSc - 1981, PhD – 1989)
Dr. Ittai Gavrieli, director (MSc – 1987, PhD – 1992)
Dr. Meir Abelson (MSc - 1993, PhD – 1999)
Dr. Mira Bar-Matthews (MSc - 1973, PhD – 1986)
Dr. Mordechai Stein (MSc - 1980, PhD – 1987)
Dr. Nadav Lansky (MSc - 1997, PhD - 2003)
Dr. Nadya Teutsch (MSc - 1992, PhD – 1999)
Dr. Naomi Porat (MSc - 1984, PhD – 1989)
Dr. Oded Katz (MSc 1996, PhD – 2002)
Dr. Orly Goren (MSc - 2002, PhD – 2009)
Dr. Rami Weinberger (MSc - 1992, PhD -1998)
Dr. Rani Calvo (MSc -1993, PhD - 2000)
Dr. Rivka Amit (MSc - 1982, PhD - 1990)
Dr. Shimon Ilani (MSc - 1972)
Dr. Yariv Hamiel (MSc - 1999, PhD – 2004)
Dr. Yehudit Harlavan (MSc - 1991 PhD – 1999)
Dr. Yoav Avni (MSc - 1989, PhD – 1997)
Dr. Yona Dvorkin (PhD – 2001)
Dr. Yossi Yechieli (MSc - 1987)
Dr. Zohar Gvirtzman (MSc - 1992, PhD – 1997)

Water Authority of Israel
Dr. Amir Givati (MSc - 2000, PhD – 2006)
Dr. Doron Markel (MSc - 1992, PhD – 1999)

Universities abroad

Duke University (N. Carolina)
Prof. Avner Vengosh (MSc - 1986, PhD, Jointly with ANU - 1990)

Old Dominion University
Prof Tal Ezer (MSc – 1984)

Oxford University, UK
Dr. Noam Bergman (MSc - 2000)

Rutgers University
Prof. Yair Rozenthal (MSc - 1988)

University of Alabama
Prof. Paul Aharon (MSc - 1974)

University of Main
Prof. Emanuel Boss (MSc - 1991)

UC Santa Cruz

Prof. Adina Paytan (MSc - 1989)

UC San Diego
Prof. Miriam Kastner (MSc - 1964)

University of Oklahoma
Prof. Zeev Reches (MSc -1972)

University Chapman California
Prof. Amitai Eyal_(MSc - 1991, PhD – 1996)

University British Columbia
Prof. Marwan Hassan (MSc - 1983, PhD – 1988)

University of Queensland, Australia
Dr. Gideon Rosenblum (MSc - 1999)

Research Institutions and Government Agencies outside Israel

Schlumberger Research, Columbia University
Dr. Malka Machlus (MSc - 1996)

UK Meteorological Office (Exeter)
Dr. Ron Cahana - (MSc - 1999)

USGS - Melno Park
Dr. Shaul Horowitz (MSc - 1994, PhD – 1999)

Our graduate students, currently post-docs in other institutions:

Dr Anton Vaks- University of Oxford (MSc 2001, PhD – 2008)
Dr Dan Asael- CNRS-Universite de Brest (PhD – 2010)
Dr Nathan Sheffer – University of Texas, Austin (MSc - 2003, PhD - 2009)
Dr. Adi Torfstein – Columbia University, USA (PhD – 2008)
Dr. Erez Ben Yosef - UC San Diego (MSc - 2004)
Dr. Itay Kurzon – UC San Diego (PhD – 2010)
Dr. Nicolas Waldmann - University of Bergen, Norway (MSc - 2002)
Dr. Onn Crouvi – University Arizona (MSc - 2002, PhD – 2010)
Dr. Ori Adam – TAU (PhD – 2011)

Appendix 7

Teaching Staff – Tables no. 2A-2D
Academic Year of Evaluation - (2011)

Table 2A

Senior Academic Staff Employed

Name of Staff Member			Employment Status	Part of Full time Position in the Institution		Part of Full Time Position in the Program		Additional Employment (outside the institution)			Area of Specialization	Courses taught by the staff member			Additional Tasks in Institution	No. of Students Receiving Guidance	
								Name of Employer	Part of Full Time Position			Name of Course	Weekly Hours	Total Weekly Hours for Staff member		2nd Degree	3rd Degree
First	Family	Title		Weekly Hours	Percent	Weekly Hours	Percent		Weekly Hours	Percent							
Amotz	Agnon	Dr.	Professor	10.75	179%						Earthquake geology and mechanics, mid-ocean ridge and ophiolite dynamics, paleomagnetism, sea-level change and glaciation	Northern Negev - Field Trip	1.5	21.5	Member - prize Committee Member - teaching Committee Chair – Diploma Committee (Authority for Research Students) Member – Conference Committee	2	5
												Geological Mapping-Expanded	4				
												Dead Sea Rift - Field Trip	1.5				
												Basic Geological Mapping	4				
												Troodos Ophiolite Field Trip, Cyprus	3				
												Physics of the Earth	4				
												Geology & Geophysics Of The Marine Environment	3.5				
Einat	Aharonove	Dr.	Associate Professor	2.75	46%						Geodynamics, physics of geological systems, reactive flow in porous media, fractures, earthquakes, landslides, granular media	Introduction To Modeling In Earth Sciences	2	5.5	Representative - Authority for research students	3	3
												Structural Geology	3.5				
Alon	Angert	Dr.	Senior Lecturer	5.25	66%						Terrestrial biogeochemistry, stable isotopes, remote sensing, climate-soil-vegetation interactions	Introduction To Climate	4	10.5	Member - Prizes Committee Member - Teaching Committee	3	1
												Selected Topics In Atmospheric Sciences	2				
												Guided Research In Environmental Sciences	3				
												Biogeochemical Cycles And The Climate System	1.5				
Dov	Avigad	Dr.	Professor	4.25	71%						The continental lithosphere: tectonics, petrology, chronology and environmental interactions	Mineralogy And Petrology	4	8.5		2	1
												Global Tectonics	3				
												Mapping Of Igneous And Metamorphic Rocks	1.5				
Ariel	Cohen	Dr.	Professor	1.00	17%						Astronomy and calendars, laser multiple scattering	Earth As A Planet - Introduction To Planetary Astronomy	2	2		1	1

Simon	Emmanuel	Dr.	Senior Lecturer	6.00	75%						Hydrogeology, water-rock interactions	Groundwater Hydrology	3	12	Institute's Seminar Organizer	2	
												Igneous Metamorphic And Sedimentary Petrorology	6				
												Igneous Metamorphic And Sedimentary Petrography	3				
Yehouda	Enzel	Dr.	Professor	8.00	133%						Quaternary geology and geomorphology, paleohydrology, paleoclimatology	Introduction To Geomorphology	4	16	Head - Environmental Sciences program	4	1
												Selected Environmental Topics	2				
												Teachers/Students Seminar	3				
												Environmental Sciences M.Sc Seminar	2				
												Field Methods In Quaternary Research	5				
Yigal	Erel	Dr.	Professor	5.50	92%						Isotope and environmental geochemistry	Introduction To Earth Sciences - Basic	5	11	IES HEAD Member - teaching Committee	4	2
												Introduction To Soil Sciences	3				
												Introduction To Environmental Sciences	3				
Jonathan	Erez	Dr.	Professor	7.00	117%						Experimental stable isotope and trace element studies on live foraminifera and corals. Biomineralization mechanisms and carbon isotope cycling in symbiotic marine associations. Carbon isotope fractionation in algae during photosynthesis	Introduction To Paleontology	3	14		1	4
												Research Methods In Oceanography	4				
												Paleoceanography And Global Change	2				
												Biogeochemistry Of The Coral Reef	5				
Carynelisa	Erlick-Haspel	Dr.	Senior Lecturer	5.00	83%						Atmospheric radiative transfer, radiative forcing of climate, cloud microphysics	Radiative Transfer In The Atmosphere	5	10	Head - Climate-Atmospheric Sciences-Oceanography curriculum	2	1
												Atmospheric Chemistry	2				
												Environmental Remote Sensing	3				
Zvi	Garfunkel	Dr.	Professor	2.00	33%						Geology and tectonics of Israel and the Eastern Mediterranean. Structure of orogens. Global plate motions. Thermal structure of the continental lithosphere	The Geology Of Israel	2	4		0	0
												Selected Topics In Geology	2				
Hezi	Gildor	Dr.	Associate Professor	4.50	75%						physical oceanography (ocean mixing and stirring, internal waves, density currents...), modern and paleo climate dynamics, interaction between biota and climate	Physical Oceanography	4	9			3
												Advanced Topics In Physical Oceanography	3				
												Classic Papers In Earth Sciences	2				
Haim	Gvirtzman	Dr.	Professor	5.50	92%						Ground water hydrology, Israel water resources	Hydrology Seminar	2	11	Head - Hydrology studies program	3	3
												Water Resources Of Israel	3				

												The Geo-Biology Of Lake Kinneret (Study Camp)	3				
												Dead Sea Study Camp	3				
Ronit	Kessel	Dr.	Senior Lecturer	4.00	50%						Experimental magmatic and metamorphic petrology	Igneous Metamorphic And Sedimentary Petrology	6	8	Institute's Seminar Organizer Member - Prizes committee	4	3
												Igneous Metamorphic And Sedimentary Petrography	3				
												B.Sc. Students' Seminar	2				
Alexander	Khain	Dr.	Professor	7.50	125%						Convection, clouds, turbulence, tropical cyclones, numerical modeling	Boundary Layer Meteorology	4	15		1	2
												Introduction To Tropical Meteorology	4				
												Physical Proc. In Atmospheric Numerical Models	2				
												Seminar For Graduate Students	2				
												Numerical Methods In The Earth Sciences	3				
Yehoshua	Kolodny	Dr.	Professor	1.00	17%						Chemical transport of atmospheric trace gases from natural and anthropogenic sources. Long-range transport of atmospheric pollutants. Urban air quality	Selected Topics In Geology	2	2	Committee on transfer of Psychology Dept.		
Boaz	Lazar	Dr.	Professor	10.00	167%						Marine geochemistry and chemical oceanography. Diagenesis of corals in the Gulf of Elat. Isotope geochemistry at the freshwater-seawater interface	Introduction To Geochemistry	4	20	Institute's Head of Studies Member - Prizes committee Member - Teaching Committee	2	11
												Introduction To Geochemical Measurements	1				
												Departmental Research Seminar	1				
												M.Sc. Students Seminar	2				
												Research Methods in Oceanography	2				
												Chemical Oceanography	3				
												Biogeochemistry Of The Coral Reef	5				
												Seminar In Oceanography	2				
Menachem	Luria	Dr.	Professor	0.00	0%						Chemical transport of atmospheric trace gases from natural and anthropogenic sources. Long-range transport of atmospheric pollutants. Urban air quality	Sabbatical				3	1
Boaz	Luz	Dr.	Professor	1.50	25%							Introduction To Oceanography	3	3		0	1
												Sabbatical second semester					
Ari	Matmon	Dr.	Associate	9.75	122%						Tectonic geomorphology.	The Dynamic Earth	4	19.5		6	3

			Proffesor								Cosmogenic isotope (Be, Al, Cl) dating	Geological Excursion In The Negev	2				
												Geological Mapping - Expanded	4				
												Basic Geological Mapping	4				
												Judea Mountains - Field Trip	0.5				
												Field Methods In Quaternary Research	5				
Alan	Matthews	Dr.	Professor	8.00	133%						Traditional (C, O, H) and non-traditional (Fe, Cu, Mo) stable isotope geochemistry. Experimental calibration of isotope fractionations. Metamorphic petrology and fluid-rock interactions	Introduction To Geology For Agriculture Students	4	16	Chairman of the Faculty Scholarships and Awards Committee	5	2
												Mineralogy and Petrology	4				
												Igneous Metamorphic And Sedimentary Petrography - Lab	3				
												Igneous Metamorphic And Sedimentary Petrography	2				
												Thermodynamics Of Natural Processes	3				
Oded	Navon	Dr.	Professor	6.25	104%						Diamonds, volcanology, continental crust and lithosphere	Summer Field Camp	4.5	12.5	Deputy Rector	3	3
												Introduction To Geology	4				
												Volcanism	1.5				
												Rock Tales: Planet Earth and Us	2.5				
Nathan	Paldor	Dr.	Professor	4.00	67%						Geophysical Fluid Dynamics; Jet Streams in the Atmospheres of Rotating Planets; Physical Oceanography of the Gulf of Eilat; Hamiltonian mechanics on the rotating Earth. Nonharmonic wave theory in Geophysical Fluid Dynamics	Dynamic Meteorology	4	8	Associate Dean for academic affairs The faculty of Sciences	2	3
												Mathematical Methods In Scientific Models	2				
												Workshop In Oceanography	2				
Mark	Pinsky	Dr.	Research Associate	1.50	25%						Cloud physics. Atmospheric turbulence. Cloud modeling. Signal processing. Radar meteorology	Fluid Dynamics: Turbulent Flow	3	3		0	0
Rivka	Rabinovich	Dr.	Lecturer	3.50	44%	1.5	18.75 %				Paleontology, Archaeozoology, Taphonomy, bone preservation processes	Introduction To Archaeozoology	2	7	50% Curator	2	1
												Elephant And Man - Through Biological Aspects	2				
												Introduction To Paleontology	3				
Ron	Hagai	Dr.	Research Associate	0.75	13%						Paleomagnetism and rock magnetism	Galilee - Field Trip	1.5	1.5		1	2
Daniel	Rosenfeld	Dr.	Professor	5.00	83%						Cloud and rain physics	Mid-Latitude Synoptic Meteorology	2	10		2	1
												Climatic Changes	2				

												Rain And Cloud Physics	4				
												The Use Of Radar In Cloud Physics	2				
Eytan	Sass	Dr.	Professor	0.25	4%						Geochemistry and petrology of dolomites. Solubility relations of carbonate minerals. Geochemistry of brines	Judea Mountains - Field Trip	0.5	0.5		0	0
Yeala	Shaked	Dr.	Lecturer	5.50	92%	1	12.50 %				Biogeochemistry of trace metals in the ocean	Ecosystem Of The Red Sea	5	11		4	3
												Nutrient Biogeochemistry and Uptake	4				
												Marine Biogeochemistry	2				

Table 2B
Junior Academic Staff Employed

Name of Staff Member			Employment Status	Part of Full time Position in the Institution[1]		Part of Full Time Position in the Program		Additional Employment (outside the institution)			Area of Specialization	Courses taught by the staff member			Additional Tasks in Institution
								Name of Employer	Part of Full Time Position			Name of Course	Weekly Hours	Total Weekly Hours for Staff member	
First	Family	Title		Weekly Hours	Percent	Weekly Hours	Percent		Weekly Hours	Percent					
Reuven	Blamaker	Mr.	Teaching assistant	1.125	20%						Geochemistry	Introduction To Soil Sciences	0.25	2.25	
												Introduction To Geochemical Measurements	1		
												Introduction To Geochemistry	1		
Nir	Benmoshe	Mr.	Teaching assistant	1.5	27%						Cloud microphysics	Introduction To Tropical Meteorology	1	3	
												Rain And Cloud Physics	1		
												Institute website	1		
Yuval	Burstyn	Mr.	Teaching assistant	2.5	45%						Paleoclimate in speleothems	Mapping Of Igneous And Metamorphic Rocks	1.5	2.5	
												Mineralogy And Petrology	1		
												Statigraphy And Paleontology	1		
Yair	Cohen	Mr.	Teaching assistant	3	55%						Dynamic Meteorology	Introduction To Climate	1	3	
												Dynamic Meteorology	1		
												Mathematical Methods In Scientific Models	0.5		
												Earth As A Planet - Introduction To Planetary Astronomy	0.5		
Michael	Davis	Mr.	Teaching assistant	2.5	45%						Geomorphology, cosmogenic isotope geochemistry	Introduction To Geology	1	2.5	
												Dead Sea Rift - Field Trip	1.5		
												Geological Excursion In The Negev	2		
Yair	Deleon	Mr.	Teaching assistant	2	36%						Physical Oceanography	Introduction To Climate	1	2	
												st year students1 ,Physics Tutoring	1		
												st year students1 ,Tutoring Mathmatics	1		
Yona	Geler	Ms.	Teaching assistant	2	36%						Geochemistry	Mineralogy And Petrology	1	2	
												Igneous Metamorphic And Sedimentary Petrography: Laboratory	1		
Yonathan	Goldsmith	Ms.	Teaching assistant	9	164%	7	127.27%				Geochemistry	Geological Mapping-Expanded	4	9	Teaching assistant in Archeology
												Introduction to GIS	1		
												Introduction To Geomorphology	1		

												Introduction To Oceanography	1		
												Introduction To Historical Geography and Spatial Archeology	2		
Tom	Goren	Mr.	Teaching assistant	3	55%						Cloud physics	Climatic Changes	1	3	
												Mid-Latitude Synoptic Meteorology	1		
												The Use Of Radar In Cloud Physics	1		
Hagar	Hecht	Ms.	Teaching assistant	2	36%						Paleomagnetisim	Global Tectonics	1	2	
												Introduction To Geology For Agriculture Students	1		
Yael	Kiro	Ms.	Teaching assistant	2	36%						Hydrogeochemistry	The Dynamic Earth	1	2	
												Statigraphy And Paleontology	1		
Elad	Levanon	Mr.	Teaching assistant	2	36%						Hydrology	Introduction To Geology	1	2	
												Rock Tales: Planet Earth and Us	0.5		
												Water Resources Of Israel	0.5		
Moran	Lokits	Mr.	Teaching assistant	2	36%	2	36.36%				Experimental magmatic petrology	Igneous Metamorphic And Sedimentary Petrography: Laboratory	1	2	Teaching Science Oriented Youth
												Statigraphy And Paleontology	1		
Leehi	Magaritz	Ms.	Teaching assistant	3	55%						Cloud microphysics and modeling	Radiative Transfer In The Atmosphere	1	3	
												Environmental Remote Sensing	1		
												Boundary Layer Meteorology	1		
Imri	Oz	Mr.	Teaching assistant	3	55%						Hydrology	Groundwater Hydrology	1	3	
												Geological Excursion In The Negev	2		
Nadav	Peleg	Mr.	Teaching assistant	2	36%						Hydrology	Introduction to GIS	1	2	
												Introduction To Geomorphology	1		
Yair	Rinat	Mr.	Teaching assistant	3.5	64%						Geochemistry	The Dynamic Earth	2	3.5	
												Northern Negev - Field Trip	1.5		
												Basic Geological Mapping	4		
Uri	Ryb	Mr.	Teaching assistant	5.5	100%						Geomorphology	Geological Mapping-Expanded	4	5.5	
												Introduction To Geology	1		
												Rock Tales: Planet Earth and Us	0.5		
Alon	Ronen	Mr.	Teaching assistant	2	36%						Hydrology	Introduction To Paleontology	1	2	
												Seminar assistant	0.5		
												field trips -Adminisrative organization	0.5		
Alexis	Rossenbaum	Ms.	Teaching assistant	11	200%						Statigraphy	Summer Field Camp	4.5	11	
												Northern Negev - Field Trip	1.5		
												Basic Geological Mapping	4		

												Introduction To Paleontology	1		
Ron	Shaar	Mr.	Teaching assistant	7.7	140%						Paleomagnetism	The Dynamic Earth	0.2	7.7	
												Summer Field Camp	4.5		
												Geological Excursion In The Negev	2		
												Physics of the Earth	1		
Netta	Shalev	Ms.	Teaching assistant	2	36%						Geochemistry	The Dynamic Earth	1	2	
												Introduction To Paleontology	1		
Kobby	Shpund	Mr.	Teaching assistant	1.25	23%						Aerosol Micro-Physics	Numerical Methods In The Earth Sciences	1	1.25	
												Introduction To Climate	0.25		
Shalev	Siman-tov	Mr.	Teaching assistant	3.5	64%						Fluid mechanic fractural geology	Introduction To Modeling In Earth Sciences	0.5	3.5	
												Geological Excursion In The Negev	2		
												Structural Geology	1		
Eyal	Wurgaft	Mr.	Teaching assistant	1.5	27%						Environmental Geochemistry	Introduction To Oceanography	1	1.5	
												The Ocean In The Global System	0.5		

Table 2C
Adjunct Teaching Staff - Senior

Name of Teacher			Employment Status	Yearly Teaching Units	Area of Specialization	Courses taught by the teacher	Additional Tasks in Institution
First	Family	Academic degree					
Zohar	Gvirtzman	Senior lecturer	External lecturer	3	Tectonics, Sedimentary Basins, Vertical motions, Seismic Hazard	Statigraphy And Paleontology	
Adi	Ben-Nun	B.Sc.	Technical manager of the GIS center, HUJI	3	GIS	Introduction to GIS	
Ariel	Haimman	Doctor	External lecture	1.5	Volcanology, Geochronology, tectonics	Volcanism	
Yair	Rosenthal	Professor	Tenured at Rutgers University; visiting lecturer at HBU	2	geochemistry and paleoceanography	Paleoceanography And Global Change	
Nir	Orion	Professor	External lecturer	2	Science education	Earth sciences education and teaching	Head of the teaching committee of the Science Teaching Dept. of Weizmann Ins.
Moti	Stein	Professor	external lecturer, Adjunct professor at the Hebrew University		Geochemistry, isotope geology, igneous petrology, Quaternary geology	sabbatical	supervising graduate students

Appendix 9

LIST OF PUBLICATIONS IN THE LAST FIVE YEARS

Agnon:

Edited books

1.Y. Enzel, **A. Agnon**, M. Stein, eds., New frontiers In Dead Sea paleoenvironmental Research, Geol. Soc. Amer. Spec. Paper 401, 2006.

2. Agnon, A., ed., The Jordan Rift: From Cracks to Continents (in honor of N. Schulman), Israel Journal of Earth Sciences, 55 (1)

3. A. Agnon, R. Amit, A.M. Michetti, S. Hough, eds., The Dead Sea Rift as a Natural Laboratory for Neotectonics and Paleoseismology, R. Freund Memorial Volume, Isreal J. Earth Sci. 60.

Chapters in books

1.Agnon, A.[PI], Marco, S.[PI], Migowski, C.[S], 2006, Intraclast breccia layers in laminated sequences: Recorders of paleo-earthquakes, New Frontiers In Paleoenvironmental Research, eds. Y. Enzel, A. Agnon, M. Stein, Geol. Soc. Amer. Spec. Paper 401, 195-214 {,,2,)

2.Marco, S.[PI], **Agnon, A.**[PI], Finkelstein, I.[PI], Ussishkin, D.[PI], 2006, Megiddo earthquakes, in Megiddo IV, ch. 31, pp. 569-575, E. And C. Yass Publications in Archaeology, Tel-Aviv

Refereed papers

1.Haberland, Ch., Maercklin, N., Kesten, D., Ryberg, T., Janssen, Ch., **Agnon, A.**, Weber, M., Schulze, A., Qabbani, I., El-Kelani, R., 2007. Shallow architecture of the Wadi Araba fault (Dead Sea Transform) from high-resolution seismic investigations, Tectonophys., 432, 37-50.

2.Ron H., Nowaczyk N. R., Frank U., Schwab M. J., Naumann R., Striewski B. and **Agnon A**., 2007. Greigite detected as dominating remanence carrier in Late Pleistocene sediments, Lisan formation, from Lake Kinneret (Sea of Galilee), Israel. Geophys. Jour. Int., 170, 117-131.

3.Kesten, D., Weber, M., Haberland, Ch., Janssen, Ch., **Agnon, A.**, Bartov, Y., Rabba, I., The DESERT Group, 2008. Combining satellite and seismic images to analyse the shallow structure of the Dead Sea Transform near the DESERT transect, Int J Earth Sci (Geol Rundsch), 97, 153-169.

4.Abelson, M., Almogi, A., **Agnon, A**., 2008. Control of the Iceland plume on the opening of the North Atlantic and on "greenhouse-icehouse" climate transition, Earth Palnet. Sci. Lett., 265, 33-48.

5.Ben-Yosef, E., Ron, H., Tauxe, L., Agnon, A., Genevey, A., Levy, T.E., Avner, U., Najjer, M., 2008. Application of copper slag in geomagnetic archaeointensity research, J. Geophys. Res., 113, B08101.

6.Makovsky, Y., Wunch, A., Ariely, R., Shaked, Y., Rivlin, A., Shemesh, A., Ben-Avraham, Z., **Agnon**, A., 2008. Quaternary transform kinematics constrained by sequence stratigraphy and submerged coastline features: The Gulf of Aqaba, Earth Planet. Sci. Lett., 271, 109-122.

7.Ben-Yosef, E., Tauxe, L., Ron, H., **Agnon**, **A**., Avner, U., Najjar, M., Levy, T.E., 2008. A New Approach for Geomagnetic Archaeointensity Research: Insights on

Ancient Metallurgy in the Southern Levant, J. Archaeol. Sci., 35, 2863-2879.

8. Le Beon, M., Klinger, Y., Amrat, A. Q., **Agnon**, **A**., Dorbath, L. , Baer, G., Ruegg, J-C., Charade, O., Mayyas, O., 2008. Slip rate and locking depth from GPS profiles across the southern Dead Sea Transform, J. Geophys. Res., 113, B11403, doi:10.1029/2007JB005280.

9.Neumann, F.H. , Kagan, E.J. , Stein, M., **Agnon, A**., 2009. Assessment of the effect of earthquake activity on regional vegetation — High-resolution pollen study of the Ein Feshka section, Holocene Dead Sea, Rev. Palaeobot. Palynol., 155, 42-51.

10. Weber, M., Abu-Ayyash, K., Abueladas, A., **Agnon, A**., and 65 others (DESERT Team, alphabetically ordered), 2009. Anatomy of the Dead Sea transform from lithospheric to microscopic scale, Rev. Geophys., 47, 155, 42-51.

11. Katz, A., **Agnon, A**., Marco, S., 2009. Earthquake-induced barium anomalies in the Lisan Formation, Dead Sea Rift valley, Israel, Earth Planet. Sci. Lett., doi:10.1016/j.epsl.2009.06.031.

12. Matmon, A., Katz, O., Ron, H., Shaar, R., Porat, N., **Agnon, A**., 2009. Timing of relay ramp growth and normal fault linkage, Upper Galilee, Northern Israel, Tectonics, 29, TC2016.

13. Sha'ar, R., Ron, H., Tauxe, L., Kessel, R., Agnon, A., Ben-Yosef, E., Feinberg, J.M., 2010. Testing the accuracy of absolute intensity extimates of the ancient geomagnetic field using copper slag material, Earth Planet. Sci. Lett., 290, 201-213.

14. Ebert, Y., Kessel, R., Shaar, R., **Agnon**, A., Ron, H., 2010. Petrology and rock magnetism of the gabbro of Troodos ophiolite, Phys. Earth Planet. Interiors,183, 413-220, doi:10.1016/j.pepi.2010.09.006.

15. Kagan, E., **Agnon, A**., Stein, M., Bronk Ramsey, Ch., 2010. Paleo-earthquakes as anchor points in Bayesian radiocarbon deposition models: a case study from the Dead Sea, Radiocarbon, in 52, 1018-1026.

16. Sha'ar, R., Ben-Yosef, E., Ron, H., Tauxe, L., Agnon, A., Kessel, R., 2011. Geomagnetic field intensity: How high can it get? How fast can it change? Constraints from Iron Age copper slag, Earth Planet. Sci. Lett., 301, 297-306.

17. Kagan, E., Stein, M., Agnon, A., Neumann, F., 2011. Intrabasin paleoearthquake and quiescence correlation of the late Holocene Dead Sea, J. Geophys. Res. 116, B04311, doi:10.1029/2010JB007452.

18. Deves, M., King, G.C.P., Klinger, Y., Agnon, A., 2011. Localised and distributed deformation in the lithosphere: Modelling the Dead Sea region in 3 dimensions, 308: 172–184, doi:10.1016/j.epsl.2011.05.044.

19. Braun, Y., Kagan, E., Bar-Matthews, M., Ayalon, A., **Agnon,** A**.**, 2011 Dating speleoseismites near the Dead Sea transform and the Carmel fault: clues to coupling of a plate boundary and its branch, Israel J. Earth Sci., Spec. Vol., eds. A. Agnon, R. Amit, A. Michetti, S. Hough, in press.

20. Shaked, Y., Lazar, B., Marco, S., Stein, M., **Agnon, A**., 2011. Late Holocene events that shaped the shoreline at the northern Gulf of Aqaba as recorded by a buried reef, Israel J. Earth Sci., Spec. Vol, eds. A. Agnon, R. Amit, A. Michetti, S. Hough, in press.

21. Granot, R., Meir Abelson, A., Ron, H., Lusk, W.M., and Agnon A., (2011), Direct evidence for dynamic magma supply fossilized in the lower oceanic crust, Geology, accepted July 2011.
22. Sha'ar, R., Ron, H., Tauxe, L., Agnon, A., Kessel, R., 2011. Paleomagnetic field intensity derived from non-SD: Testing the Thellier IZZI technique on MD slag and a new bootstrap procedure. Earth Planet Sci. Lett., accepted August 2011.

Aharonov:

Chapters in Edited and Refereed Books and Conference Proceedings

1. Karcz Z.[PI], Polizzotti, R.S.[PI], Ertas D.[C], Laronne Ben-Itzhak L.[S], and **Aharonov E.**[C] (2008) "Dissolution of a Stressed Calcite Crystal– High Resolution Strain Measurements and Interface Observations", in *Proceedings of the American Rock Mechanics Association Symposium. I*SBN 9781605604510, Curran Associates, Inc.
2. Makedonska N[S], L. Goren[S], D. Sparks [PI], and **E. Aharonov**[PI] (2009) "What Controls the Effective Friction of Shearing Granular Media?" in a book titled *Meso-Scale Shear Physics in Earthquake and Landslide Mechanics*. Edt. Y. Hatzor, J. Sulem and I. Vardoulakis. ISBN: 9780415475587, CRC Press.
3. Goren L[S], **E. Aharonov**[PI], and M. H. Anders[C] (2009), "Thermo-poro-mechanical effects in landslides dynamics". In a book titled -*Meso-Scale Shear Physics in Earthquake and Landslide Mechanics. Ed*. Y. Hatzor, J. Sulem and I. Vardoulakis. ISBN: 9780415475587, CRC Press.

Journal Articles

1. Goren L[S] and **Aharonov E**[PI] (2007), "Long runout landslides: the role of frictional heating", *Geophys. Res. Lett.*, 4, L07301, doi:10.1029/2006GL028895.
2. Aharonov E[C], Bouchbinder E[S], Ilyin V[T], Makedonska N [S], Procaccia I[PI], and Schupper N[C], (2007), "Direct identification of the glass transition, growing length scales and the onset of plasticity*", Europhysics Lett,* 77, Art# 56002.
3. Goren L.[S] and **Aharonov E**[PI] (2008) "On the Stability of Landslides", *Earth Planet. Sci. Lett.*, doi:10.1016/j.epsl.2008.11.002.
4. Karcz Z.[PI], **Aharonov E**[PI], Ertas D[PI], Polizzotti R[PI], and Scholz C[C] (2008) "Deformation by dissolution and plastic flow of a single crystal sodium chloride indenter: An experimental study under the confocal microscope*" J. Geophys. Res.*, 113, B04205, doi:10.1029/2006JB004630,
5. Goren L.[S], **Aharonov E**[PI], Mulugeta G[T], H A Koyi[C], and Mart Y[PI] (2008), "Ductile Deformation of passive margins: a new mechanism for subduction initiation*", J. Geophys. Res.*, 113, B08411, doi:10.1029/2005JB004179, *(highlighted by Nature Geosciences, October 2008)*
6. Aharonov E.[PI] and Katsman, R[C] (2009) "Mechanisms of stylolite formation: insights from modeling", *American J of Science*, 309, 7,607-632,
7. Katsman R.[PI], **E. Aharonov**[C] and B. Haimson [C] (2009*) "*Compaction bands induced by borehole drilling", *Acta Geotechnica*, 4, 163-176.
8. Goren L[S], **E. Aharonov**[PI], D. Spark[s C], and R. Toussain[t C] (2010) "Pore pressure evolution in deforming granular material: A general formulation and the infinitely

stiff approximation". *J. Geophys. Res. Solid Earth,* 115, B09216, doi:10.1029/2009JB007191.

9. Goren L.[S], **E. Aharonov**[PI] , M. Anders [C] (2010) "The long runout of the Heart Mountain landslide: Heating, pressurization, and carbonate decomposition". *J. Geophys. Res.,* 115, B10210, doi:10.1029/2009JB007113

10. Klar, A.[PI], **E. Aharonov** [PI], B. Kalderon-Asael[S], and O. Katz[C] (2011) "Analytical and observational relations between landslide volume and surface area", *J. Geophys. Res. Earth Surface,* doi:10.1029/2009JF001604

11. Goren L[S], **E. Aharonov**[PI], D. Sparks[PI], and R. Toussaint[C], (2011) "The Mechanical Coupling of Fluid-Filled Granular Material Under Shear", special issue on "Brittle deformation of solid and granular materials with applications to mechanics of earthquakes and faults", DOI: 10.1007/s00024-011-0320-4, *Pure and Applied Goephysics (Editors: Ben-Zion and Sammis*)

12. Makedonska N[S], D. W. Sparks[PI], **E. Aharonov**[**PI**], L. Goren[S] (2011) "Friction versus dilation revisited: insights from theoretical and numerical models", doi:10.1029/2010JB008139, *J. Geophys. Res, in Press*

13. O. Katz[PI,] J Morgan[PI] **E Aharonov**[**c**], B Dugan[c] , "Controls on the geometry of landslides: Insights from DEM computer simulations", submitted *to Geophys. Res. Letters.*

14. L. Laronne Ben-Yitzhak[S] , R Katsman[c]**, E Aharonov**[**PI**], Karcz Z.[c] and Kaduri M.[s,] Stylolite populations in Limestone: field observations and formation models", submitted to *J. Geophys. Res.*

Amrani:

Refereed papers

1. Amrani, A. , Deev , A. , Sessions, A.L, Tang, Y., Adkins, J. , Hill, R., .Moldowan, M. , Wei, Z. 2011. The sulfur-isotopic compositions of benzothiophenes and dibenzothiophenes as a proxy for thermochemical sulfate reduction Geochimica *et Cosmochimica Acta* , accepted pending corrections.

2. Amrani, A., Sessions A.L., Adkins J. 2009**.** Compound-specific $\delta^{34}S$ analysis of volatile organics by coupled - GC/ Multicollector - ICPMS. *Analytical Chemistry* 81, 9027-9034.

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7. Amrani, A., Turner, J.W. Ma, Q. Tang, Y. and Hatcher, P.G. 2007. Formation of sulfur and nitrogen cross-linked macromolecules under aqueous conditions. *Geochimica et Cosmochimica Acta 71, 4141-4160.*

Angert:
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3. Weiner, T.^{S}, Mazeh, S.^{T}, Tamburini, F.^{C}, Frossard E.^{C}, Bernasconi S. M.^{C}, Chiti T.^{C}, and **Angert, A.**^{PI}. (2011). A method for analyzing the $\delta^{18}O$ of resin-extractable soil inorganic phosphate. *Rapid Communication in Mass Spectrometry*, 25(5), 624-628. 2.83; 15/70.
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Avigad:
Book chapters
1. Stern, RJ., (PI) **Avigad, D.**, (C) Miller, N.,(C) Beyth, M., (C) (2008). From Volcanic Winter to Snowball Earth: An alternative explanation for Neoproterozoic Biosphere Stress. *Springer Solid Earth Series* "Links between Geological Processes,

Microbial Activities, and Evolution of Life". Y. Dilek, H. Furnes, K. Muehlenbachs Eds. 313-337.

Refereed papers - S denotes student, PI-principal investigator (major contribution), C-cooperating scientist

1. Katzir, Y., (PI) Garfunkel, Z., (PI) **Avigad, D**. (PI) and A. Matthews (PI) (2007). The geodynamic evolution of the Alpine orogen in the Cyclades (Aegean Sea, Greece): insights from diverse origins and modes of emplacement of ultramafic rocks. *Geological Society, London*, Special Publications 291; p. 17-40.

2. Avigad, D., (PI) Stern, R.J., (C) Beyth, M., (C) Miller, N., (C) McWilliams, M.O., (C) (2007). Detrital zircon geochronology of Cryogenian diamictites and Lower Paleozoic sandstone in Ethiopia (Tigrai): age constraints on Neoproterozoic glaciation and crustal evolution of the southern Arabian-Nubian Shield. *Precambrian Research* 154, 88-106.

3. Morag, N. (S), **Avigad, D.** (PI), Harlavan, Y., (C) McWilliams, M.O., (C) Michard, A.,(C) (2008). Rapid exhumation and mountain building in the Western Alps: detrital petrology and geochronology of Tertiary basins of SE France. *Tectonics* 27, TC2004, doi:10.1029/2007TC002142.

4. Gersman, R. (S), Ben Dor, E.(PI), Beyth, M.,(C) **Avigad, D.**, (C) Abraha, M.,(C) and A. Kibreab,(C) (2008). Mapping Hydrothermally Altered Rocks by the EO-1 Hyperion Sensor, Northern Danakil Depression, Eritrea. *International Journal of Remote Sensing* 29, 3911-3936.

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9. Avigad, D., (PI) Gvirtzman, Z., (PI) (2009). Late Neoproterozoic rise and fall of the northern Arabian-Nubian Shield: The role of lithospheric mantle delamination and subsequent thermal subsidence. *Tectonophysics* 477, 217-228 .

10. Ziv, A., (PI) Katzir, Y., (CI) Avigad, D., (CI) Garfunkel, Z., (CI) (2010). Strain development and kinematic significance of the Alpine folding on Andros (western Cyclades, Greece. *Tectonophysics* 488, 248-255.

11. Morag, N., (S) Avigad, D., (PI) Gerdes, A., (CI) Belousova, E.A, (CI) Harlavan, Y., (CI) (2011). Crustal evolution and recycling in the northern Arabian-Nubian Shield: new perspectives from zircon Lu-Hf and U-Pb systematics. *Precambrian Research* 186, 101-116.

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in a weathering profile of the Arabian-Nubian Shield. *Sedimentology*.

16. Miller, N, Avigad, D., Stern, R.J., Beyth, M, (accepted). The Tambien Group, Northern Ethiopia (Tigre). Geological Society of London, Memoir on the geological record of Neoproterozoic ice ages (IGCP 512).

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Emmanuel:

Chapters in books

1. Emmanuel, S., Ague, J. J., and Walderhaug, O., Models and measurements of porosity and permeability evolution in a sandstone formation, in *Geochemical and biogeochemical modeling in low- and high-temperature aquifers*, Editor J. Bundschuh, CRC Press, Balkema (in press).

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8. Berkowitz, B., **Emmanuel, S.**, and Scher, H. (2010) Reply to comment by V. P. Shkilev on ``Non-Fickian transport and multiple-rate mass transfer in porous media", *Water Resources Research*, 46:W10804.
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Enzel:
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13. Crouvi, O., Amit, R., Enzel, Y., Porat, N., Gillespie, A. R., and McDonald, V. E., 2009. The importance of studying primary eolian loess for reconstructing chronology, dust accretion rates and dust sources: An example from the Negev desert, Israel. **Journal of Geophysical Research-Earth Surface** 114, F02017 doi:10.1029/2008JF001083
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15. Benito, G. Rohde, R., Seely, M., Külls, C., Dahan, O., Enzel, Y., Todd, S., Botero, B., Morin, E., Grodek, T., and Roberts, C., 2010. Management of alluvial aquifers in two southern African ephemeral rivers: Implications for IWRM. **Water Resources Management** 24:641–667.
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25. Peleg, N., Morin, E., Gvirtzman, H., and Enzel, Y., in press. Changes in spring discharge as potential amplifiers of societal response to rainfall series in the eastern Mediterranean. **Climatic Change**.
26. Bacon, S. N., McDonald, E. V., Amit, R., Enzel, Y., and Crouvi, O., in press. Total suspended particulate matter (TSP) emissions at high friction velocities from landforms in the Negev Desert. **Journal of Geophysical Research-Earth Surface**.
27. Amiaz, Y., Sorek, S., Enzel, Y., and Dahan, O., in press. Pulses of salts and water from vadose zone into ground water induced by flash flood in arid channels. **Water Resources Research**.
28. Enzel, Y, Amit, R., Grodek, T, Ayalon, A., Lekach, J., Porat, N., Bierman, P., Blum, J. D., and Erel, Y., accepted. Late Quaternary depositional landforms in Nahal Yael, Israel: "Impact of climatic change on an arid watershed[1]", **Geological Society of America Bulletin**.

Erel:
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12. Erel Y. and Torrent J. (2010) Contribution of Saharan dust to Mediterranean soils assessed by sequential extraction and Pb and Sr isotopes. *Chemical Geology* 275 (2010) 19–25.
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Particualte Matter Concentrations: A Case Study Of The Day Of Atonement In Israel. *Atmospheric Environment 45*, 3325-3332, doi: 10.1016/j.atmosenv.2011.02.017.
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Erez:

Chapters in books

1. Lazar B., **Erez J.**, Silverman J., Rivlin T., Rivlin A., Dray M., , Meeder E. and Iluz D., (2008), Recent environmental changes in the chemical-biological oceanography of the Gulf of Aqaba (Eilat) in: F.D. Por Editor, *Aqaba-Eilat, the Improbable Gulf. Environment, Biodiversity and Preservation* Magnes Press, Jerusalem.
2. EREZ Jonathan, SILVERMAN Jacob, SCHNEIDER Kenneth, REYNAUD Stéphanie and ALLEMAND Denis (2011) Coral calcification under ocean acidification and global change, Part 3, 151-176, DOI: 10.1007/978-94-007-0114-4_10, *in* (Dubinsky Z and Stambler N editors), *CORAL REEFS*: *AN ECOSYSTEM IN TRANSITION* ***Ecosystems of the World,*** Springer

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2. Silverman, J., B. Lazar, and J. **Erez** (2007), Effect of aragonite saturation, temperature, and nutrients on the community calcification rate of a coral reef, **J. Geophys. Res**., 112, C05004, doi:10.1029/2006JC003770
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6. Kısakürek, B., A. Eisenhauer, F. Böhm, D. Garbe-Schönberg and J. **Erez** (2008) Controls on shell Mg/Ca and Sr/Ca in cultured planktonic foraminiferan, *Globigerinoides ruber* (white)**, Earth Planetary Science Letters** 273 260–269
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9. Shai Einbinder, Tali Mass, Eran Brokovich, Zvy Dubinsky, Jonathan **Erez**, and Dan Tchernov, (2009), Changes in morphology and diet of the coral *Stylophora pistillata* along the depth gradient **Marine Ecology Progress Series** Vol. 381: 167–174

10. Schneider K, Levy O, Dubinsky Z, and Erez J., (2009) In-Situ Diel Cycles of Photosynthesis and Calcification in Hermatypic Corals **Limnol & Oceanog.** 54(6):1995-2002

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Paldor:

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6. Shaked, Y[PI.] 2008. Iron redox dynamics in the surface waters of the Gulf of Aqaba, Red Sea. Geochimica et Cosmochimica Acta, 72: 1540-1554.
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8. Shaked, Y[PI]., Harris, R[S]., Kedem-Klein, N[S]. 2010. Hydrogen Peroxide photocycling in the Gulf of Aqaba. Environmental Science and Technology, ***44***(9): 3238–3244.

9. Saragosti, E[S]., Tchernov, D[PI]., Katsir, A[S]., **Shaked, Y**[PI]. 2010. Extracellular production and degradation of superoxide in the coral *Stylophora pistillata* and cultured *Symbiodinium* PLoS ONE 5(9): e12508. doi:10.1371/journal.pone.0012508.
10. Rubin, M[S]., Berman-Frank, I[PI]., **Shaked, Y**[PI]. 2011. Dust- and mineral-iron utilization by the marine dinitrogen-fixer *Trichodesmium* Nature Geosciences 529–534.
11. Kunzler, C[S]., Lis, H[S]. **Shaked, Y**[PI]., Keren, N[PI]. 2011. The role of reduction in iron uptake processes in a unicellular, planktonic cyanobacterium. *Environmental Microbiology and Environmental Microbiology Reports. In Press.*

Stein:

Chapters in books (peer reviewed)

1. Stein M. and Ben-Avraham Z. (2007) Mechanisms of continental crust growth **In**: Treatise on Geophysics. Eds. G. Schubert and D. Stevenson

Papers

1. Neumann F., Schölzel C., Litt T., Hense A., **Stein M.** (2007) Holocene vegetation and climate history of the northern Golan Heights (Near East) **Veget Hist Archaeobot** 16:329-346.
2. Bookman, R., Lazar, B**., Stein, M**., and G. Burr (2007). Radiocarbon dating of aragonites from the Dead Sea, Israel. **Holocene** 17:131-137.
3. Lev L., Boaretto E. Heller J., Marco S., and **Stein M**. (2007) The feasibility of using Melanopsis shells as radiocarbon chronometers, Lake Kinneret, Israel. **Radiocarbon**, 49.
4. Belmaker R., **Stein M**., Yechieli Y. and Lazar B. (2007) Controls on the radiocarbon reservoir ages in the modern Dead Sea drainage system and in the last Glacial Lake Lisan **Radiocarbon**. 49:187-1151
5. Neumann F., Kagan E., Schwab M. and **Stein M.** (2007) Palynology, sedimentology and paleoecology of the late Holocene Dead Sea. **Quat. Sci. Rev.** 26:1476- 1498.
6. Bartov Y., Enzel Y., Porat N. and **Stein M**. (2007) Evolution of sedimentary deposition in the late Pleistocene and Holocene Dead Sea basin **J. Sed Res** 77:680-692.
7. Stein M., Almogi-Labin A., Goldstein S.L. Hemleben Ch. and Starinsky A. (2007) Late Quaternary changes in desert dust inputs to the Red Sea and Gulf of Aden from 87Sr/86Sr ratios in deep-sea cores. Earth Planet Sci Lett 261:104-119.
8. Waldmann N., Starinsky A. **Stein M**. (2007) Ca-chrloride brines as paleohydrological monitors of the Dead Sea basin. **Quat. Sci. Rev**. 26: 2219-2228.
9. Belmaker R., Lazar B., Tepelyakov N., **Stein M.** and Beer J. (2008) ^{10}Be in Lake Lisan sediments - a proxy for production or climate? **Earth Planet Sci Lett**., 269: 448-457.
10. Torfstein A., Gavrieli I., Katz A., Kolodny Y. and **Stein M.** (2008) Gypsum as a monitor of the paleo-limnological–hydrological conditions in Lake Lisan and the Dead Sea. **Geochim. Cosmochim Acta**. 70: 2491-2579.

11. Halicz L., Segal I,, Fruchter N., **Stein M**. Lazar B. (2008) Strontium stable isotopes fractionate in the soil environments? **Earth Planet Sci Lett**., 272:406-411.
12. Roberts N., Jones M.D., Benkaddour A., Eastwood W.J., Filippi, M.I., Frogley M.R., Lamb H.F. , Leng M.J. , Reed J.M., **Stein M.**, Stevens L., Valero-Garces B. and Zanchetta G. (2008) Stable isotope records of Late Quaternary climate and hydrology from Mediterranean lakes: the ISOMED synthesis. **Quat. Sci. Rev**.
13. Neumann F.H. , Kagan E., **Stein M**. and Agnon A.. (2009) Assessment of the effect of earthquake activity on regional vegetation - High-resolution pollen study of the Ein Feshka section, Holocene Dead Sea. **J. of Paleobota**. 155, 42-51.
14. Hadas G., Segal I., Yoffe O. and **Stein M**. (2009) Study of Roman anchor from the Dead Sea shore. **Archaeometry**
15. Torfstein A. Haase-Schramm A., Waldmann N., Kolodny Y. and **Stein M.** (2009) U-series and oxygen isotope chronology of Lake Amora, Dead Sea basin **Geochim. Cosmochim. Acta** 73, 2603–2630.
16. Waldmann N., **Stein M**., Artiztegui D. and Starinsky A. (2009) Stratigraphy, depositional environments and level reconstruction of the last interglacial Lake Samra in the Dead Sea basin **Quat. Res**. 72, 1-15.
17. Prasad S., Negendank J. and **Stein M**. (2009) High-resolution radiocarbon reservoir age variations in palaeolake Lisan by varve counting. **Jour. of Quat. Sci**. DOI: 10.1002/jqs.1289
18. Stein M., Torfstein A., Gavrieli I. and Yechieli Y. (2010) Abrupt aridities and salt deposition in the post glacial Dead Sea and its north Atlantic connection. **Quat. Sci. Rev**. 29, 567-575.
19. Waldmann N., Torfstein A. **Stein M**. Northward intrusions of low- and mid-latitude storms across the Saharo-Arabian belt during past interglacials. **Geology**, 38:567-570.
20. Kagan E., **Stein M**., Agnon A., Bronks-Ramsey C. (2010) Paleo-earthquakes as anchor points in Bayesian radiocarbon deposition models: a case study from the Dead Sea. **Radiocarbon** (in press)
21. Kushnir Y. and **Stein M**., (2010). North Atlantic influence on 19 - 20th century rainfall in the Dead Sea watershed, teleconnections with the Sahel, and implication for Holocene climate fluctuations, Quaternary Science Reviews, XX, 1-18.
22. Kagan E., **Stein M**., Agnon A. Nuemann F., (2011). Intrabasin paleoearthquake and quiescence correlation of the late Holocene Dead Sea, JGR, 116,
23. Belmaker R., Lazar B., **Stein M.** and Beer J., Short residence time and fast transport of fine detritus in the Judean Desert – clues from 7Be in settled dust GRL (in press).
24. Lazar B, and **Stein M**. Freshwater on the route of hominids "out of Africa" revealed by U-Th in Red Sea corals. Geology (in press).
25. Stein M. Chronometry of paleo-earthquakes in the Dead Sea rift. Isr. Jr. Earth Sci. (in press).

Appendix 10

LIST OF HONORS

Agnon:
Israel Geological Society: Grader Prize, Freund Prize

Aharonov:
Deans list, Tel-Aviv University.
Magna cum Laude, Tel-Aviv University
Lamont Post-doctoral Fellowship, Lamont Doherty Earth Observatory, Columbia University, NY
Storke-Doherty Lectureship, awarded by Lamont Doherty Earth Observatory of Columbia University, NY.
American Geophysical Union Award - Excellence in refereeing
Alon Fellowship for scientists joining Israeli Academia.

Avigad:
1983- Diker-Shraga memorial prize of the Institute of Earth Sciences for excellence in studies.
1985- Peretz Grader memorial prize of the Geological Society of Israel for outstanding M.Sc. thesis.
1990- Chateaubriand post-doctoral fellowship (Ambassade de France en Israel).
1996- "Arc en Ciel" binational program (with ENS Paris).
1997 – Elected among HU excellent teachers on students questionnaire.
1998- "Poste Rouge" – CNRS (6 months, ENS Paris).
2003- Qualifie aux fonctions de Professeur des universitiés en France (section 35) (Numéro de qualification: 03135124214).
April 2009 - April 2010 – President of the Israel Geological Society.

Emmanuel:
Harry P. Kaufmann Senior Lectureship in Environmental Water Technology, The Hebrew University of Jerusalem, 2010 -- present
Golda Meir Fellowship, The Hebrew University of Jerusalem, 2010
Bateman Postdoctoral Fellowship, Yale University, 2007-2009
Dov Elad Memorial Prize, Weizmann Insitute of Science, 2007
Selim and Rachel Benin scholarship, 2004
Rieger--JNF Environmental Science scholarship, 2003 and 2004
Faculty of Science scholarship, The Hebrew University of Jerusalem, 1999 and 2000
Dean's list, The Hebrew University of Jerusalem, 1996

Enzel:
2009- Israel Geological Society, The R. Freund Award for best paper

2005- Geological Society of America, The Farouk El-Baz Desert Research Award
2008- GSA invited speaker grant
1995- Hebrew University Golda Meir Foundation- fellowship

Erel:
Graduate student fellowship Caltech 1985 - 1990
Geological Society of America student award – 1989
Citation for Excellence in Teaching at the Hebrew University of Jerusalem - 2006
The Hebrew University Rector Prize - 2007

Gildor:
2009: JSPS (Japan Society for the Promotion of Science) Fellowship for Research in Japan (short-term).
2007: Prize of the Scientific Council, Weizmann Institute.
2006: Gledden Visiting Senior Fellowships, The University of Western Australia (declined due to personal issues).
2003: The Sir Charles Clore Prize for the most outstanding researcher in the experimental sciences appointed as Senior Scientist in 2003-2004, Weizmann Institute.
2003: Awarded a travel grant (competitive) to participate in the first Dissertations Initiative for the Advancement of Climate Change Research, Puerto Rico.
2001: NOAA Postdoctoral Fellowship in Climate and Global Change.
2001: Bikura Fellowship, Israel Science Foundation.
2001: The John F. Kennedy Memorial Prize for outstanding research (highest prize for PhD work at the Weizmann Institute).
1998, 1999: Rieger Foundation, U.S.A - Fellowship for Environmental Studies.
1998: A fellowship of distinction, Weizmann Institute.
1994-1996: Fellow student of the Japanese government.
1992, 1993: Deans list, Tel-Aviv University.

Gvirtzman:

1982	Hebrew University of Jerusalem	The Rector Distinguished Student Award
1986	Weizmann Inst. of Science	Wolf Foundation Fellowship
1989	Israel Association of Hydrology	Goldshmidt Award
1989	Weizmann Inst. of Science	Dr. Chaim Weizmann Post-doctoral Fellowship
1990	Israel Geological Society	Peretz Grader Award for a young scientist
2000	Hebrew University of Jerusalem	Harry P. Kaufman Senior Lectureship in Environmental Water Technology
2003	Yad Yitzchak Ben-Zvi	Ish-Shalom Award for publishing the distinguish

		book “Israel Water Resources”
1992 - 2011	Hebrew University of Jerusalem	17 times on the Rector's list of distinguished teachers (top 10%).

Haspel:

1989-1993, Edward J. Bloustein Memorial Scholarship
1990, Certificate of Academic Achievement
1991-1993, Rutgers College Merit Scholarships
1992, Presidential Award on the State’s General Intellectual Skills Test
1992, Phi Beta Kappa National Honor Society
1992, Sigma Pi Sigma Physics Honors Society
1992, Mary Wheeler Wigner Memorial Scholarship in Physics
1992-1993, President of the Rutgers Society of Physics Students
1993, Richard T. Weidner Prize in Physics
1996-1997, Chair of the Geophysical Sciences Graduate Student Exposition
1996-1997, U.S. Environmental Protection Agency Fellowship for Graduate Environmental Education
1999, Aron and Sara Mintz Prize
2000, Golda Meir Postdoctoral Fellowship
2001, Shindel Prize
2006, 2007, ranked 1 out of 22 for teaching in the Institute of Earth Sciences
2006, 2nd Prize in the Hebrew University Faculty of Natural Sciences Poster Competition for Lerner, A., S. Sabbah, C. Erlick, and N. Shashar, The Underwater Polarization Field Outside of Snell’s Window
2006, 1st Prize for extended abstract at Ocean Optics XVIII, Montréal, Quebec for Lerner, A., C. Erlick, N. Shashar, and S. Sabbah, On the Quest for the Scattering Mechanism that Determines the Polarization Field in the Ocean
2007, Citation for Excellence in Teaching at the Hebrew University of Jerusalem
2010, Honorable Mention in the Competition for the Prize for Outstanding Immigrant Scientist from the Minister of Immigration
2011, Best Student Paper Award at the 8th Annual Meeting of the Israel Association for Aquatic Sciences for Lerner, A., S. Sabbah, C. Erlick, and N. Shashar, Navigation by Polarization in Clear and Turbid Water
2011, Course Atmospheric Chemistry ranked number 1 out of 12 in the Program in Climate, Atmosphere, and Oceanography

Kessel:

Dean’s list of the Faculty of Science, Hebrew University of Jerusalem 1991
Award for excellence in academic studies, Institute of Earth Sciences, Hebrew University of Jerusalem 1994
The T. Dicker - M. Shraga award for excellence in academic and research achievement, The Geological Society of Israel 1994
3-year G.M. Friedman Lectureship, Institute of Earth Sciences, Hebrew University of

Jerusalem 2005

Lazar:

1992 Israel Geological Society Best paper of the year award
1983 Rothschild Foundation Post Doctoral award

Matthews:

2011 Israel Academy of Sciences Committee for the rapid development of academic research programs on the Oil and gas reserves of Israel.
2008- present. Steering Committee of the Israel Taxonomy Initiative (ITI).
2008 Sabbatical Visiting Professor: University of Bristol, UK and Wisconsin-Madison, USA
2007 Keynote Lecturer on metallic stable isotopes: Goldschmidt 2007 Conference
2006- 2011 Highly-cited Scientist in Geosciences. ISI Science Citation Index
2006 Raphael Freund Prize of the Geological Society of Israel Co-Editor Special Volume of Chemical Geology *"In search of isotope biosignatures"*
2004- 2007 Geochemical Society: Clarke Medal Committee.
2007 Geochemical Society Nominations Committee
2004-2008 Editorial Board: *Geology*
2001- present Editorial Board: *Chemical Geology*
2006- present External Examiner for Ph.D and M.Sc. theses.
2005-2008 Review panel US-Israel Binational Science Foundation.

Matmon:

1999 - **The Shraga-Dicker Award**, Institute of Earth Sciences, Hebrew University, Jerusalem.
2002 - **Mendenhall Post-Doctoral Fellowship**, The U.S. Geological Survey.
2003 **- Prof. Yaacov Bentor Award** for an outstanding doctoral work on the geology of Israel and its surrounding area. Institute of Earth Sciences, Hebrew University, Jerusalem.
2011 **– R. Fruend Award,** Israel Geological Society

Rabinovich:

2005 - SYNTHESYS Project at the Museo Nacional de Ciencias Naturales (CSIC), Madrid, European Commission's Research Infrastructure, "Proboscideans in the Mediterranean during the Upper Pleistocene".
2010 - SYNTHESYS Project at the Museum für Naturkunde, Berlin (DE-TAF). "New insights from old specimens, southern Levantine fauna collections as a tool for monitoring recent changes in species distribution.

Rosenfeld:

1988-1991: **Alon Fellowship**, awarded by the Israeli Council for Higher Education.
2000: The **Raphael Freund Award** for popular writing in sciences. Awarded by the Hebrew University of Jerusalem.
2001: The **Verner Suomi Medal**, of the American Meteorological Society, "*for key contributions to remote measurement and interpretation of rainfall, cloud optical properties, and cloud microphysical properties*".
2001: The **Thunderbird Award**, of the Weather Modification Association.
2003: *Fellow* of the American Meteorological Society.
2006: The **WMO/UAE Prize** for Excellence in Weather Modification "*for contributions to world-wide WM experiments and their advocacy of the aerosol pollution/precipitation link*".
2006: **The Michael Landau Prize for Sciences**, in the area of Ecology and Environment, granted by the Israeli Mifal-Hapayis to Israeli scientists *for outstanding achievements in their field and for the advancement of science in Israel*.
2007: The **Schaefer Award**, of the Weather Modification Association "*For scientific and technological discoveries that have constituted a major contribution to the advancement of weather modification*"
2009: The **Friendship Award**, of the People's Government of China, "*in appreciation to outstanding contribution to the economic construction and society development of China*", in recognition of the cooperation on cloud-aerosol interactions impacts on

1986 Minerva doctoral stipend
1987 Fullbright postdoctoral fellowship
1987 Rotchild postdoctoral fellowship
1990 Minerva postdoctoral fellowship
1991 Friedman fellowship (first Recipient)
1993 Prof. R. Freund Award (The Geological Society of Israel)

weather modification.

Stein:

Appendix 11

COOPERATION ACTIVITIES AND CONSULTING

Agnon:

Institute de Physique du Globe, Paris: G.C.P. King; C. Jaupart; Y. Klinger
GeoForschung Zentrum, Potsdam: A. Brauer; M.H. Weber
California State University, San Diego: T. Rockwell
University of California, San Diego: L. Tauxe
Tel-Aviv University: S. Marco; Y. Goren, I Finkelstein
Geological Survey: M. Bar-Matthews, A. Ayalon; O. Katz; R. Weinberger\
Dept. Geography: R. Ellenblum; A. Frumkin
Inst. Archaeology: S. Zuckerman
Pro-bono advisor for the National Infrasructure Committee (Dead Sea Protection Program) - 2008-2009
Earthquake hazard to public Infrastructure edifices - 2010

Aharonov:

Israel: Oded Katz(GSI), Jonathan Erez (HUJI), Assaf Klar (Technion), Simon Emmenuel (HUJI), Alan Mathiews (HUJI), Amir Sagy (GSI), Jay Fineberg (HUJI), Eran Bouchbinder (Weizmann)
Abroad: Liran Goren (ETH), Joachim Methiusen (PGP Oslo U), Renaud Toussaint (Strasbourg U), David Sparks (Texas A&M Univ), Zvi Karcz (ExxonMobil, USA), Hagit Afek (Yale), Chris Scholz (Lamont), Denis Ertaz (ExxonMobil, USA)

Amrami:

Orit Sivan (BGU), Yeela Shaked (HUJI), Alex Sessions (Caltech), Jess adkins (Caltech), Yongchun Tang (PEERi), Tongwei Zhang (University of Texas), Geoff Ellis (USGS), Mike Moldowan (Stanford), Zhibin Wei (ExxonMobile), Ron Hill (Marathon Oil Company), Zeev Aizenshtat (HUJI), Ron Kien (Alabama University), Erdem Idiz (Shell), Vincent Grossi (CNRS , Lion)

Angert:

Collaboration with Sue Trumbore for the MPI-BGC (Jena) and Jeff Chambers from LBNL (Berkeley) on transport of CO_2 in the stems of tropical forest trees.
Collaboration with Menachem Mushelion from HUJI agriculture faculty on CO_2 transport in the stem of transgenic plants.
Collaboration with Federica Tamburini from ETH-Zurich on stable oxygen isotopes in soil phosphate.
Collaboration with Ami Nishri from IOLR on identifying phosphate source to Lake Kinneret.

Emmanuel:

Sebastian Geiger, Heriot Watt University
Friedhelm von Blanckenburg, Potsdam University
Sylvain Bernard, Museum national d'Histoire naturelle

Jakob Vinther, University of Texas
Ruarri Day-Stirrat, Shell
Olav Walderhaug, Statoil
Jay Ague, Yale University
Brian Berkowitz, Weizmann Institute of Science

Enzel:
Dust sources, production and deposition and the formation of loess in warm and cold deserts- w/ (Erel) R. Amit (GSI), O. Crouvi (U of Arizona), Alan Gillespie (U Wahington), E. MacDonald (Desert Research Institute).
Recharge from floods in arid ephemeral streams - w/ Gerardo Benito (CSIC, Spain), Ofer Dahan (BGU).
Flooding into Lake Eyre (Australia) and plaeoclimatology w/ Gerald Nanson and Tim Cohen (University of Wollongong)
Paleo-Dead Sea paleohydrology and paleoclimatology with (Erel, Stein, Ron, Lazar), Bauer, Goldstein
Transgressive erosion along the Dead Sea shores from lake level rise w/ Amit Mushkin (GSI)

Erel:
Paleo-climatology. Collaborators: (Enzel, Stein, Ron, Lazar - IES), Amit and Almogi (GSI), Goldstein (Colombia), Litt (U. Bohn).
Characterization and source apportions of local and foreign $PM_{2.5}$ in Israel under different synoptic conditions and the toxicity of atmospheric aerosols. Collaborators: Belkin (Life Sci, HUJI), Dayan (Geography, HUJI), and Schauer (U. Wisconsin).
Estimating cloud seeding efficiency by combining geochemical and remote sensing methods. Collaborators: (Rosenfeld, HUJI), Steinberg, Benjamini (Tel Aviv U.)
The dark side of ancient metallurgy: Measuring toxic metals in human populations to trace the impact of early industries through time. Collaborators: Levy (UCSD), Finkelstein and Goren (Tel Aviv U.).

Erez:
Anton Eisenhauer IFM-GEOMAR, Kiel Germany
Jess Adkins, Caltech, USA
Claire Rollion-Bard, CRPG, France
Ros Rickaby, Oxford, UK
Harry Elderfield, Cambridge, UK
Ken Caldeira, Carnegie Institute, USA
Heather Stoll, Oviedo Spain
Gavin Foster, Southampton, UK
Peta Clode, UWA, Perth, Australia

Gildor:

The interplay between density currents, open water convection, and internal waves (with Eric Fredj (Jerusalem College of Technology)).
Real time surface current measurements to protect the gulf of Aqaba (Eilat) against man-induced or accidental oil and other toxic spill (with Stephen Monismith (Stanford, US), Amatzia Genin (IUI, Israel), and Riyad Manasrah, (MSS, Jordan)).
Recent National Collaborators (since 2006)
Yosef Ashkenazy (BGU), Amatzia Genin, Caryn Erlick (HUJI), Yizhak Feliks (IIBR), Erick Fredj (Jerusalem College of Technology), Vered Rom-Kedar (WIS).
Recent International Collaborators (since 2006)
Dick Peltier (Toronto), Stephen Monismith (Stanford), Eli Tziperman (Harvard), Riyad Manasrha (MSS, Jordan), Mark Lawrence (MPI), Michal Kucera (Tübingen, Germany), Naomi Naik (Columbia), Francois Lekien (Université Libre de Bruxelles), Alex Kostinski (MTU), Bruce Lipphardt, Jr. (Delaware), Marcel Van der Meer, Stefan Schouten (NIOZ).

Gvirtzman:
A member in the Water Authority Board.
Research Cooperation with Dr. Yossef Yechieli, Dr. Eyal Shalev, and Dr Ittai Gavrieli, all from the Geological Survey.
Research Cooperation with Prof. Ovadia Lev from HUJI Chemistry.

Kessel:
Liquids in equilibrium with peridotite – cooperation with Dr. Thomas Pettke from the Uni. Of Bern, Switzerland and with Dr. Patrizia Fumagalli from Univ. degli Studi de Milano, Italy.
Evolution of HED meteorites – cooperation with Prof. Ed Stolper and Dr. John Beckett from GPS, Caltech.

Lazar:
1 - Moshe Shilo Minerva Center for Marine Biogeochemistry (HUJI), Z. Aizenshtat (head): cooperation with J. Erez (HUJI), A. Oren (HUJI) and B. Luz (HUJI.(
2 - ISF center "The Dead Sea borehole - The longest archive of the Levant geological and geophysical environments (climate, seismicity, magnetism)", Y. Erel (HUJI, coordinator): research project with M. stein (GSI, Israel.(
3 - IDCP, Dead Sea deep drilling project, A. Brauer (GFZ, Potsdam, Germany, coordinator): project with M. Stein (GSI, Israel) and S. Goldstein (LDEO, Palisades, USA.(
4 - Trilateral DFG TRION project, fractionation of the stable isotopes of Sr, Mg and Ca), A. Eisenhauer (IFM-GEOMAR, Kiel, Germany, coordinator): research project with M. Al-Qutob (AQU, Palestine), M. Stein (GSI, Israel), L. Halicz (GSI, Israel.(
5 - The role of groundfish activity in the marine silica cycle: research project with V. Tunnicliffe (UVIC, Canada) P. Snelgrove (Memorial University, Newfoundland,

Canada), J. Crusius (USGS, Woods Hole, USA), B. Herut (IOLR, Israel), G. Yahel (RAC, Israel.(
6 - Meteoric 10Be, 7Be and 14C in the Dead Sea drainage basin as monitors of production rate, hydrologic conditions and recycling of airborne materials: research project with M. Stein (GSI, Israel), J. Beer (EAWAG, Dübendorf, Switzerland), D. Fink (ANSTO, Lucas Heights, Australia.(
7 - Calcitic fossil reef terraces as proxies for hydrologic conditions: research project with M. Stein (GSI, Israel), A. Agnon (HUJI), joining soon S.A. Al-Rousan (MSS, Aqaba, Jordan).

Luz:
Wally Broecker, Lamont-Doherty Earth Observatory of Columbia University Palisades, New York 10964-8000 USA
Taro Takahashi, Lamont-Doherty Earth Observatory of Columbia University Palisades, New York 10964-8000 USA

4.2 Please list the major consulting activities done by faculty.

Enzel:
Tahal- the geomorphology of Nahal Zeelim alluvial fan: for the construction of a new pumping point of Dead Sea brines and a fan-crossing cannal.

Erel:
Israeli Water Commission - the committee of rain enhancement
IUED (Adam Teva VaDin), Board of Directors
IUI (Interuniversity Institute for Marine Sciences – Eilat), Board of Directors
Bloomfield Science Museum Jerusalem, Board of Directors
The Jerusalem Museum of Natural History, Chairperson academic committee

Gildor:
World Bank, Red Sea-Dead Sea Water Conveyance Study Program (as part of a consortium which includes scientists from Thetis (Italy), Marine Science Station (Aqaba), Stanford (USA), The Hebrew University, and Bar Ilan University.

Lazar:
Water and Sewage Authority: member (one out of four) in the Kinneret steering committee.
Water and Sewage Authority: consultant to the review board of the Red Sea-Dead Sea committee.
Member of the steering committee of the Kinneret Research Laboratory.
Member of the steering committee of the National Monitoring Program for the Gulf of Eilat (Aqaba).

Appendix 12

A list of seminars, conferences and workshops held by the IES or organized by IES members within the last five years (except for the weekly seminar – only last year)

Selected topics in Geology – special course at IES

S. K. Bhattacharya (PRL, Ahmedabad, India), school year 2007-2008: Physical theory of the fractionation of stable isotopes
H. D. Holland (Harvard University), school year 2008-2009: Discovering the history of the atmosphere.
W. S. Broecker (Lamont Doherty Earth Observatory), school year 2010-2011: Climate Havoc Related to The Great Ocean Conveyor.
Y. Kushnir (Lamont Doherty Earth Observatory), school year 2011-2012: Climate variability and the relationship between natural variability and anthropogenic forced changes.
Y. Rosenthal (Rutgers University), every year since 2007: Paleo-oceanography and paleo-climatology.

Every year we hold the **Bentor** Prize ceremony and invite a distinguished scientist to give a keynote lecture. Since 2007 we have had the following lecturers:
2007 – R. Garison (UCSC);
2008 – G. Steinitz (GSI);
2009 – X. LePishon (Collège de France);
2010 - W. S. Broecker (Lamont Doherty Earth Observatory);
2011 – W. Berger (Scripps).

INTAS 2007 – MUSCLE 14 (Europe) – Post OASIS conference
Hebrew University of Jerusalem
INTAS project 01-0239
LIDAR multiple scattering from clouds including spherical and non-spherical particles
Chairman: **Ariel Cohen**, INTAS 2006-2009 coordinator
28.3.2007

INTAS WORKSHOP 18.03.2009
Chairman: **Ariel Cohen**, Hebrew University
INTAS project 05-1000008-8024
Ground-based and space-borne multiple scattering Lidar returns from arbitrary oriented particles including polarization considerations and wide-angle imaging

Geological Society of America (GSA) Field Forum meeting. Co-rganizer: Dov Avigad, Samos Island (Greece). 30 participants, 2 from Israel. 2010.

Israel Geological Society annual meeting 2010. Eilot. Organizer: Dov Avigad. 120 participants from Israel.

INQUA-GLOCOPH 2009 Workshop and Field trip (Haifa-Jerusalem-Dead Sea) , 24th Oct-3rd Nov 2009. Global continental paleohydrology. Commission of INQUA. Organizer: Yehouda Enzel. 38 international and 20 Israeli participants. Many more participated in a series of lectures in IES.

2008 **Geological Society of America** annual meeting session (T-17, Honoring Prof. Dan Yaalon). Co-organizer: **Yehouda Enzel**.

2006 Short course (12 hours) in paleoflood hydrology, Engineering Department, **University of Sttutgart**. Co-organizer: **Yehouda Enzel**

The Dead Sea Transform - A Symposium Honoring the Work of **Zvi Garfunkel**, Organizer: **Amotz Agnon**, February 2007, 2 speakers from abroad, 8 from Israel.

The Dead Sea Rift as A Natural Lab of Neotectonics and Paleoseismology, Pre-workshop symposium at IES. Organizer: **Amotz Agnon**, February 2009, **INQUA**, 3 speakers from abroad

THE HEBREW UNIVERSITY OF JERUSALEM

Joint Research Conference of the Institute for Advanced Studies and the Israel Science Foundation on:
RADIUM AND RADON ISOTOPES AS ENVIRONMENTAL TRACERS - Ra-Rn3 Meeting
March 14-19, 2010

Organizers: Boaz Lazar (The Hebrew University) and **Yishai Weinstein** (Bar-Ilan University)

The Gerald M. Friedman day seminar
Organized by **Oded Navon**

ISRAEL PREPAREDNESS AND THE PUBLIC AWARENESS FOR THE NEXT LARGE EARTHQUAKE - January 25th 2007

QUANTITATIVE METHODS IN THE STUDY OF SURFICIAL PROCESSES - January 14th 2008

PLANETARY SCIENCE SEMINAR DAY - January 29th, 2009

GEOCHEMISTRY AND PHOTOCHEMISTRY - January 11th 2010

ISRAEL AND THE NATURAL GAS: EXPLORATION, PRODUCTION AND UTILIZATION - May 22nd 2011

KAPLAN WORKSHOPS (2005, 2008, 2010, 2012)

1st Kaplan Workshop - New Developments in Environmental Isotope Research, September 2005

Mark Thiemens: Mass independent isotope effects: meteoritic oxygen isotopic anomalies and paleo atmospheres.
Malcolm McCulloch: **General**: coral reefs: silent sentinels of global change
Don DePaolo: **General:** Low-temperature mineral-fluid reaction rates measured with Sr, U and Ca isotopes.
Anders Meibom: New micro-analytical techniques applied to biogenic carbonates: biomineralization, corals, and geochemical effects.
Ariel Anbar: **General:** Transition metal stable isotopes
Joel Blum: General: Stable isotope geochemistry of mercury.
Albert Galy: Mg isotopic composition of biominerals: fingerprinting biological pathway of Mg involved in the precipitation of calcite dolomite and aragonite.
Amaelle Landais: Isotopic repartition of inert gasses in polar ice cores: quantitative reconstruction of past temperature and potential for dating improvement
Anton Eisenhauer: General: Isotope fractionation of divalent cations; new approaches to old problems.
Boaz Luz: Isotopic fractionations in the global oxygen cycle from the Dole effect to aquatic productivity.

2nd Kaplan Workshop - Global Pollution: From Background to Contemporary Levels, March 2008

James J. Schauer, University of Wisconsin-Madison - Source Apportionment of Carbonaceous Aerosols using Molecular Markers
Spyros Pandis, Carnegie Mellon University - Organic Aerosols in Our Atmosphere: Sources, Properties, and Impacts
Daniel Rosenfeld, the Hebrew University – The Role of Aerosols in Global Earth Energy Budgets: The Big Questions That Make Climate Predictions so Uncertain
Mike Hoffmann, Caltech – Heterogeneous Chemistry of Sulfur in the Atmosphere
Prasad Kasibhatla, Duke University – A Global View of Anthropogenic Impacts on Atmospheric Sulfate
Joel Savarino, LGGE/CNRS - Toward a New Marker of the Atmospheric Chemistry/Climate Relationship: Tracing the Ozone Isotopic Anomaly Transferred to Other Atmospheric Constituents
Bernhard Wehrli, EAWAG/ETH - Old and New Sinks in the Global Nitrogen Cycle
Jonathan Erez, The Hebrew University - Biomineralization and dissolution of $CaCO_3$ in the Oceans: A Negative Feedback Mechanism to Atmospheric CO_2 Increase
Kon-Kee Liu, National Central University, Taiwan - The role of continental margins in the global carbon cycle
Ed Boyle, MIT - Evolution of the North American Anthropogenic Lead Transient for the Past 200 Years
Martin Goldhaber, USGS - From Continents to Atoms; Environmental Geochemistry at all Scales

Stephan Kraemer, University of Vienna - Heavy Meals: Mechanisms of High Affinity Iron Acquisition in Iron-Limited Ecosystems

3rd Kaplan Workshop - Challenges of the Global Water Shortage, April 2010

Kevin E. Trenberth, NCAR, USA - Potential impacts of climate changes on precipitation
Graham Feingold, NOAA, USA - Impact of particulate air pollution on rain clouds
Efrat Morin, The Hebrew University - To know what we cannot know: Global mapping of minimal detectable precipitation trends
Bob Hecky, University of Minnesota, USA - Eutrophication of water bodies
Walter Giger, EAWAG-ETH, Switzerland - Contamination by organic pollution
Janet Hering, EAWAG-ETH, Switzerland - Contamination by inorganic pollution
Grant Garven, Tufts University, USA - Effects of Faults on Coastal Groundwater Salinity, Southern California
Jesus Carrera, Universidad Politécnica de Cataluña, Spain - Modeling of groundwater flow and reactive transport
Ronnie Ellenblum, The Hebrew University - Climate Change and the Collapse of the east-Mediterranean in the mid 11th century (A.D.)
Assaf Sukenik, Kinneret Limnological Laboratory, Israel – Monitoring the wellbeing of the Sea of Galilee
Uri Shani, Director, Israel Water Authority - Water Resources Management - Socio-Economic Perspectives
Booky Oren, Chairman, MIYA, Arison Group - Water Resources Management - Technological Perspectives
Eyal Benvenisti, Tel Aviv University, Israel - Water Resources Management - Legal Perspectives

4th Kaplan Workshop - Recent advanced in paleoceanography and paleoclimatology, March 2012

Jess Adkins, Department of Earth and Planetary Sciences, California Institute of Technology, U.S.A.
Larry Edwards, Department of Geology & Geophysics, University of Minnesota, U.S.A.
Harry Elderfield, FRS, Godwin Laboratory for Palaeoclimate Research, University of Cambridge, UK
Jean Lynch-Stieglitz, Georgia Institute of Technology, U.S.A.
Andy Ridgwell, School of Geographical Sciences, University of Bristol, UK
Gerard Roe, Earth and Space Sciences, University of Washington, U.S.A.
Eelco Rohling, Southampton Oceanography Centre, University of Southampton,UK
Yair Rosenthal, Institute of Marine and Coastal Sciences, and Dept. of Geology, Rutgers University, U.S.A.
Jeffrey P. Severinghaus, University of California, San Diego, U.S.A.
Ellen Thompson, Department of Geography, Ohio State University, U.S.A.
Lonnie Thompson, School of Earth Sciences, Ohio State University, U.S.A.
Robbie Toggweiler, Geophysical Fluid Dynamics Laboratory, Princeton University, U.S.A.

Weekly Institute Seminar: 2010-2011

Affiliation	Speaker	Seminar Title	Date
Weizmann Institute of Science , Israel	Prof. Uzi Smilansky	Computer-assisted archaeology	13.10.2010
The Institute of Earth Sciences, The Hebrew University	Mr. Josh Steinberg	The rapid sedimentary filling of the Levant during the Late Tertiary	20.10.2010
Ben Gurion University of the Negev, Israel	Dr. Itai Haviv	Uplift and exhumation across the High Himalaya in Mt. Everest area	27.10.2010
The Institute of Earth Sciences, The Hebrew University	Mr. Navot Morag	The evolution of the Arabo-Nubian Sheild in Eilat: new evidence from Hf isotopes and U-Pb zircon dating	03.11.2010
California Institute of Technology, USA	Dr. Itai Halevy	Constraints on the Archean surface environment from mass-independent sulfur isotopes	10.11.2010
The Institute of Earth Sciences, The Hebrew University	Mr. Ron Shaar	The geomagnetic field: what magnitude can it reach and how fast can it change?	17.11.2010
The Institute of Earth Sciences, The Hebrew University	Prof. Daniel Rosenfeld	Climate radiative forcing uncertainty: the result of two large and highly uncertain opposite effects of nearly similar magnitude	24.11.2010
The Institute of Earth Sciences, The Hebrew University	Prof. Nathan Paldor	New solutions to the Laplace tide equations	29.12/2011
Racah Institute of Physics , The Hebrew University	Prof. Jay Fineberg	The dynamics of the onset of frictional slip	05/01/2011
California Institute of Technology, USA	Dr. Yochai Kaspi	The deep water cycle: experimental constraints on dehydration and melting in subduction zones	12.01.2011
The Institute of Earth Sciences, The Hebrew University	Ms. Elisa Kagan	Multi-archive paleoseismology along the Dead Sea Basin and Judean Hills	19.01.2011
Weizmann Institute of Science ,Israel	Dr. Ron Milo	Rethinking carbon fixation	16/02/2011
University of Michigan, USA	Prof. Joel Blum	Atmospheric mercury sources, reactions and mass independent isotope fractionation mechanisms	23.02.2011
University of Haifa	Dr. Uri Schattner	Filling up the shelf - a sedimentary response to the last	2.3.2011
University of Cambridge, UK	Prof. Harry Elderfield	Paleoproxies of past ocean composition: temperature, ice volume and ocean carbonate chemistry	09.03.2011
University of Toronto, Canada	Prof. Michael Chazan	Archaeology and Geology in the Kuruman Region, Northern Cape Province, South Africa	16.03.2011
FracMan Technology Group	Dr. William Dershowitz	Recent advances in discrete fracture network analysis for fractured and heterogeneous rock	30.03.2011
University of Cambridge, UK	Dr. Alexandra Turchyn	New approaches for reconstructing the oxygen isotope composition of the ocean over Earth history	13.04.2011

האוניברסיטה העברית בירושלים
The Hebrew University of Jerusalem

Appendix 13

העשייה הסביבתית (מחקר והוראה) באוניברסיטה העברית

מוגש לרקטור האוניברסיטה העברית – פרופסור חיים רבינוביץ

על ידי: פרופסור יצחק הדר ופרופסור יגאל אראל

מאי 2007

תקציר והמלצות

העשייה הסביבתית באוניברסיטה העברית מתחלקת לשני מרכיבים עיקריים: (1) הוראת הסביבה באוניברסיטה, (2) המחקר הסביבתי (עם דגש מיוחד על המחקר הרב תחומי).

הוראה:

באוניברסיטה העברית קיימות שלוש מסגרות ללימודי סביבה בפקולטות למדעי הטבע, החקלאות והחברה. בנוסף ניתנים קורסים בנושאים סביבתיים בפקולטות למשפטים ולרפואה. **בדקנו את תוכניות הלימודים והגענו למסקנות הבאות:**

באוניברסיטה העברית מגוון גדול של תוכניות וקורסים בנושאי סביבה. קורסים אלה נוגעים בהיבטים רבים ושונים של תחומי הסביבה. לאור הייחודיות של התוכניות וההבדלים ביניהן וכן בגלל המרחק בין הקמפוסים, נראה לנו, שהמסגרות הקיימות צריכות להמשיך ולהתקיים במתכונת הנוכחית, אולם כדאי להגביר את שיתוף הפעולה והקשר ביניהן. לדעתנו יש לעשות זאת בשני אופנים:

1. אחת לשנה ראוי לכנס את ראשי כל תוכניות הלימוד (טבע, חקלאות, חברה, ונציגים מהפקולטות לרפואה ולמשפטים) במשרד הרקטור על מנת להחליף דעות, לתאם תוכניות לימודים ולבחון דרכים לשיפור ההוראה ,קיום קורסים רב תחומיים ופעילויות בין פקולטאיות. בנוסף, יש לעודד את ראשי התוכניות להתכנס אחת לסמסטר לדיון משותף.
2. אחת לשנה יש לערוך כנס של יומיים בהשתתפות כל תלמידי המוסמך והדוקטור הלומדים בתוכניות השונות. מספר תלמידים מכל תוכנית ירצו על מחקריהם ושאר התלמידים יציגו פוסטרים. ארגון כנס כזה דורש השקעה כספית מצד האוניברסיטה אולם לדעתנו הוא חיוני ובעל תועלת רבה לתלמידים ולמורים.
3. בפרסומי האוניברסיטה, כגון המדריך לנרשם ואתרי האינטרנט, מומלץ להציג את מגוון התוכניות תחת הכותרת " לימודי סביבה באוניברסיטה העברית" (ראה נוסח שהיה בשעתו באתר האוניברסיטה אך אינו נמצא שם יותר.

מחקר:

באוניברסיטה העברית מתקיים בפקולטות השונות מחקר ענף במדעי הסביבה על ידי חברי סגל מתחומי דעת רבים ומגוונים בכל הפקולטות של האוניברסיטה. למרות שהמחקר המדעי יכול להתקיים בתוך הדיסציפלינה, בעיות הסביבה מתאפיינות ברב- תחומיות ובעבודה בצוותים רחבים. כלומר כדי לפתור בעיה סביבתית יש לחקור אותה מזוויות שונות תוך ניצול תחומי הדעת השונים, ובכך חוזקה של האוניברסיטה העברית המתברכת במספר רב של מיטב החוקרים ובמרב התחומים.

המלצותינו בתום המחקר הינן: המחקר האינדיבידואלי באוניברסיטה יימשך, ככל הנראה, ביוזמת חברי הסגל. **אנו ממליצים להנהלת האוניברסיטה להרחיב את פעילות המרכז הרב תחומי ובכך לעודד את המחקר הרב תחומי** לפי עקרונות שיפורטו בגוף הדו"ח וכן להשתמש בקבוצות העבודה ובמרכז כמנוף לגיוס כספי תרומות ייחודיות לאיכות הסביבה. על האוניברסיטה לנקוט בפעולות הבאות:

1. להרחיב את פעילות המרכז, אנו מציעים הקמת תתי מרכזים או קבוצות עבודה בנושאים בין תחומים שיש בהם עניין מדעי או ציבורי (הרחבה על התחומים המוצעים בגוף הדו"ח).
2. לקיים ימי עיון (4-6) בשנה. חלקם לכל חברי המרכז בנושאים כללים וחלקם לקבוצות עבודה מצומצמות.
3. להרחיב את גיוס תרומות משוחרי האוניברסיטה שהם גם שוחרי איכות הסביבה. לאור ההתעוררות לנושאי סביבה בעולם כולו, ואפילו בארצות הברית, אנו מציעים להציב את תחום הסביבה כנושא מרכזי מכיוון שיתכן ויש תורמים פוטנציאלים אשר איכות הסביבה בראש עניינן ומאידך האוניברסיטה יכולה להציג פעילות רבה ואיכותית ומספר רב של חברי סגל המתמחים בתחום.
4. להעניק מלגות לתלמידי מחקר אשר עבודתם בעלת אופי רב תחומי והנם מודרכים על ידי חברי סגל מדיסציפלינות שונות.

איכות סביבה באוניברסיטה העברית

על האוניברסיטה להטמיע את המודעות לאיכות הסביבה בחיי הקמפוס על ידי מגוון פעולות, כגון: בניה ידידותית לסביבה, חסכון באנרגיה, שתילת צמחים שדורשים פחות מים בגינות, מחזור מאורגן, ועידוד פעילות בנושאי סביבה בקרב הסטודנטים. למעשים אלה חשיבות חינוכית ממעלה ראשונה, אך הם גם עשויים למשוך לקמפוס הירושלמי סטודנטים טובים יותר.

העשייה הסביבתית (מחקר והוראה) באוניברסיטה העברית

הדו״ח מתחלק לשני חלקים: (1) הוראת הסביבה באוניברסיטה, (2) המחקר הסביבתי (עם דגש מיוחד על המחקר הרב תחומי). בכל חלק נסקור תחילה את המצב הקיים ולאחר מכן נביא מספר המלצות לשיפור.

1. לימודי סביבה באוניברסיטה העברית

באוניברסיטה העברית קיימות שלוש מסגרות ללימודי סביבה בפקולטות למדעי הטבע, החקלאות והחברה. בנוסף ניתנים קורסים בנושאים סביבתיים בפקולטות למשפטים ולרפואה. התוכנית ללימודי הסביבה בפקולטה למדעי הטבע (קמפוס על שם ספרא בגבעת רם). התוכנית מעניקה תואר בוגר (עם חוג נוסף) ותארים מתקדמים (מוסמך ודוקטור) בלימודי הסביבה. התוכנית לאיכות הסביבה ומשאבי טבע בחקלאות בפקולטה למדעי החקלאות המזון ואיכות הסביבה (קמפוס רחובות). התוכנית מעניקה תואר מוסמך וכן ניתן ללמוד במסגרת התוכנית בהיקף של חטיבת לימודים לבוגר. התוכנית לניהול, תכנון ומדיניות סביבתית בפקולטה למדעי החברה (קמפוס הר הצופים). התוכנית מעניקה תואר מוסמך וכן ניתן ללמוד במסגרת התוכנית בהיקף של חטיבת לימודים לבוגר.

1א. התכנית ללימודי הסביבה בפקולטה למדעי הטבע

השינויים החלים בסביבתנו, חלקם מעשה ידי האדם, נמצאים במוקד העניין הציבורי והמדעי בעולם ובישראל. הכרת והבנת התהליכים המעצבים את הסביבה ויחסי הגומלין בינם לבין האורגניזמים המתקיימים בה, כולל האדם, הינם מהמרתקים שבלימודי מדעי הטבע. בפקולטה למדעי הטבע מצויים מוקדי מחקר והוראה ייחודיים שיכולים לתרום רבות להכשרת כח האדם הנחוץ להתמודדות עם אתגרים אלה.

1א1. לימודי סביבה לבוגר במדעי הטבע (חוג לימודים רגיל)

התכנית מציעה לימודים במדעי הסביבה לתלמידי תואר בוגר במדעי הטבע. התכנית מתמקדת במתן השכלה בכיוון העיוני-מדעי, בתאור תפקודה של הסביבה הטבעית ויחסי הגומלין בינה לבין האדם. התלמידים נחשפים למגוון נושאים ובעיות במדעי הסביבה הבסיסיים והיישומיים, ומקבלים הכשרה להמשך לימודים בכיוון מחקרי ו/או להתמחות מעשית.

התכנית היא בהיקף של חוג מצומצם וניתן ללמוד בה בשילוב עם חוג נוסף ממדעי הטבע, או עם אחד מהחוגים הבאים: גיאוגרפיה, חינוך, כלכלה, יחסים בינלאומיים, סוציולוגיה, סטטיסטיקה ממדעי החברה והרוח או משפטים. יש להתקבל לכל אחד מהחוגים בנפרד.

מבנה הלימודים: לימודי יסוד במדעי הטבע, קורסי חובה במגוון רחב של תחומי מדעי הסביבה, וקורסי בחירה מתקדמים. בשל הבדלי הרקע בין התלמידים וריבוי האפשרויות שבפניהם, יש ליועץ התכנית תפקיד מרכזי בעיצוב תכניות הלימודים של כל תלמיד. התנגשויות בין קורסים מחייבות את התלמידים ללמוד לעיתים נושאים בסדר שונה מהרצוי. הדבר נכון במיוחד לשילובים עם חוגים מפקולטות אחרות. בכל המקרים נעשה מאמץ לבנות את תכנית הלימודים בתשומת לב על מנת להגיע לניצול מיטבי של תקופת הלימודים.

1א2. לימודי הסביבה למוסמך במדעי הטבע

מטרת התכנית למוסמך היא להקנות לתלמידיה כלים הן להבנת הסביבה הטבעית והן להתמודדות עם הבעיות המחריפות של איכות הסביבה. התכנית מציעה שלושה תחומי התמחות ועל התלמיד לבחור אחד מהם: כיוון גיאוכימי/גיאופיסי; כיוון ביולוגי/אקולוגי; כיוון יישומי.

תכנית לימודים אופיינית היא בת ארבעה סמסטרים, והיא כוללת עבודת מחקר ולימודים בהיקף של 32 נ״ז, מתוכן 12.5 נ״ז חובה וכ-12 נ״ז מתחום ההתמחות העיקרי. 8 נ״ז הנותרות נלקחות בעיקרן מתחומים אחרים במדעי הטבע, ומהפקולטות לחקלאות, למדעי החברה ולרפואה, בתיאום עם יועץ התכנית. לכל אחד מהתלמידים יש תכנית לימודים אישית המותאמת להשכלתו הקודמת ולתחומי התמחותו במסגרת המוסמך. במהלך שנת הלימודים הראשונה ממנה יו״ר התכנית ועדה מלווה לכל תלמיד. חברי הוועדה עוקבים אחר התקדמות לימודיו של התלמיד, קוראים את הצעת המחקר שלו ואת עבודת המוסמך ובוחנים אותו בבחינת המוסמך. עבודת המחקר לתואר מוסמך נעשית בהדרכתו של אחד ממורי התכנית ובאחריותו האקדמית. התלמיד מגיש עבודה זו בכתב וכן מרצה את עיקריה במסגרת סמינריון המוסמך של התכנית.

לתכנית מתקבלים תלמידים בעלי השכלה ברמת בוגר בתחומים השונים של מדעי הטבע, החקלאות וההנדסה, מאוניברסיטאות מוכרות, שממוצע ציוניהם בתואר בוגר הינו 80 לפחות. במקרים חריגים, כגון בוגרי תכנית ארבע שנתית, יו"ר התכנית רשאי לקבלם בציון ממוצע נמוך מ-80 (אך לא נמוך מדרישות הקבלה בפקולטה). מועמדים החסרים רקע מתאים בקורסי יסוד במדעי הסביבה מחויבים, במידת הצורך, בקורסים משלימים כתנאי מוקדם לקבלתם לתכנית. הערכת תלמידים: הציון הסופי לתואר נקבע על פי הצעת המחקר (10%), עבודת הגמר (30%), הציון המשוקלל בקורסים (40%) וציון בחינת המוסמך (20%).

<u>1א3. מספרי תלמידים בתוכנית ללימודי סביבה בפקולטה למדעי הטבע</u>

בתוכנית ללימודי סביבה לומדים כ 100 תלמידים, ונראה כי מספר הבוגרים יציב, אולם יש ירידה של שליש עד חצי ממספר התלמידים (נשירה) במהלך התואר. בנוסף, קיימת מגמה של ירידה במספר תלמידי המוסמך בעיקר בשנתיים האחרונות (טבלה 1).

טבלה 1: מספר תלמידים בתוכנית ללימודי סביבה במדעי הטבע בארבע השנים האחרונות.

תואר בוגר	תשס"ד	תשס"ה	תשס"ו	תשס"ז
שנה א'	41	46	40	48
שנה ב'	32	21	36	27
שנה ג'	22	29	21	38
סה"כ	95	96	97	113
מוסמך				
	תשס"ד	תשס"ה	תשס"ו	תשס"ז
שנה א'	9*	15	9*	6
שנה ב'	22	16**	14	15**
סה"כ	31	31	23	22-23

* = תלמידים שהתחילו בסמסטר א, ** = כולל גם תלמידים שהתחילו בסמסטר ב' בשנה הקודמת

1ב. התוכנית לאיכות הסביבה ומשאבי טבע בחקלאות

אחד האתגרים העומדים בפני האנושות במאה הבאה הוא להמשיך ולספק מזון לאוכלוסיה הגדלה של העולם, תוך כדי שמירה על משאבי הטבע ותוך כדי הגנה על הסביבה והאקלים. בחקלאות של היום יש לפעמים קונפליקט בין משימות מרכזיות אלו. זו למעשה הדילמה העומדת בפני החקלאות, הוראת מדעי החקלאות ברמה אקדמית והמחקר החקלאי המודרני. בפקולטה לחקלאות שלש תוכניות לימודים בתחום, שתיים בבוגר וחוג מוסמך.

<u>1ב1. החקלאות ואיכות הסביבה (חטיבת לימודים בבוגר)</u>

חטיבת לימודים זו משותפת ללומדים בחוגים: הגנת הצומח, מדעי הקרקע והמים, מדעי בעלי החיים, ביוכימיה ומדעי המזון והחוג לכלכלה חקלאית ומינהל בחקלאות. מטרת החטיבה להכשיר בוגרים להתמודד עם הבעיות הנוצרות מהזיהום ההולך וגדל של הסביבה, בעיקר מההיבטים של הפגיעה בחקלאות והחקלאות כמפגע. התחומים הנלמדים בתוכנית רבים ומגוונים כגון: מניעת פגיעה באיכות המים והקרקע כתוצאה משימוש בחומרי הדברה ודשנים, מחזור פסולת מוצקה ויישומה בחקלאות, שימוש במים מושבים, וצמצום השימוש בחומרי הדברה למיניהם. כן נחקרות דרכים לצמצום שאריות חומרי הדברה במזון, כלכלת משאבי טבע וסביבה, מבלי לפגוע בחקלאות ובכושר הייצור שלה. בתוכנית משתתפים כ 20 תלמידים מידי שנה.

<u>1ב2. שמירת טבע ומנהל שטחים פתוחים (כ- 25% מהלימודים לתואר בוגר)</u> תוכנית זו חדשה, ופועלת מזה שלש שנים.

מטרת התכנית היא להקנות לתלמידים את הידע בביולוגיה ואקולוגיה, ביחד עם הכלים להתמחות באקולוגיה יישומית ושיקומית, עם דגש על שמירת השונות הביולוגית. בתכנית גם מסלול ייחודי להתמחות ביערנות. התכנית מכשירה חוקרים ואנשי מקצוע החסרים היום בגופים המטפלים בשטחים פתוחים, כגון קרן קיימת לישראל, רשות הטבע והגנים, משרדי איכות הסביבה והחקלאות, מועצות אזוריות, עיריות וגופים מהסקטור הפרטי העוסקים בתכנון סביבתי. הלימודים בתוכנית מוצעים בשילוב עם החוגים הבאים: מדעי הצמח בחקלאות, הגנת הצומח ומדעי בעלי החיים. התוכנית כוללת לימודי יסוד חובה כלליים במדעי הטבע ובחקלאות, לימודי חובה באקולוגיה וניהול יער, שטחי מרעה טבעי ושמורות טבע, וקורסי בחירה במגוון רב של נושאים בשמירת טבע ואיכות סביבה

<u>31ב. איכות הסביבה ומשאבי טבע בחקלאות (חוג מוסמך)</u>

החוג לאיכות הסביבה ומשאבי טבע בחקלאות מחבר חברי סגל מתחומי החקלאות השונים העוסקים ומלמדים בנושאי איכות סביבה. תוכנית הלימודים מגוונת ומציעה קורסים בנושאי הקשורים לאקולוגיה, זיהום קרקע ומים, חומרי הדברה וכלכלת משאבי טבע וסביבה. נושאי עבודות הגמר קשורים באופן מובהק לתחומי איכות ושמירת הסביבה .

תלמידי החוג עוסקים בלימוד היבטים שונים ובהתמחות בבעיות חקלאות וסביבה כגון: ממשק בר-קיימא של שטחים פתוחים (מרעה, יער), הדברה ביולוגית של מזיקים ומחלות נוף של צמחים ושל קרקע, תהליכי זיהום קרקעות במתכות כבדות, השקיה בקולחין, טיהור מי קולחין על ידי החדרתם לקרקע, זיהום מים עיליים על ידי מעבר חומרי דישון והדברה מגוף הקרקע לנגר עילי, מחזור פסולת חקלאית ועירונית ולימוד תהליך הקומפוסטציה, שימושים חקלאיים באפר פחם מתחנות כו`ח, תהליכי זרימה והסעות מזהמים במי תהום, פיזור מזהמים ממקורות שונים באטמוספרה, הפחתת החלחול של קוטלי עשבים אל מי התהום על ידי קשירתם לחרסיות, פרוק מזהמים סביבתיים על ידי מיקרואורגניזמים, טיפול בשפכי מחלבות, טיפול בקרקעות או בגופי מים מזוהמים במתכות כבדות בעזרת צמחים, הקטנת זיהום הכנרת בזרחן, תהליכי זיהום מי תהום סביב אתרי סילוק פסולת, פיתוח שיטות חליפיות לחיטוי קרקע במתיל ברומיד. בחוג כ-40 תלמידים.

<u>1ג. התוכנית לניהול, תכנון ומדיניות סביבתית בפקולטה למדעי החברה (חוג מוסמך)</u>

התוכנית מוצעת על ידי המחלקה לגיאוגרפיה כלימודי מוסמך במסגרת הפקולטה למדעי החברה. מטרת התכנית להכשיר חוקרים ובעלי מקצוע מתחומים שונים להתמודד עם בעיות סביבתיות. לשם כך, התכנית מדגישה את הצורך בהסתכלות והערכה רב-תחומית, תוך התמקדות בהיבטים של מדעי החברה. הקורסים והסדנאות הנכללים בתכנית מיועדים להמחיש לתלמידים את מורכבות הנושא הסביבתי, את הצורך בשילוב רב-תחומי בטיפול בבעיות קיימות וכן את הדרכים האפשריות למניעת היווצרות בעיות עתידיות. בתוך כך, נחשפים תלמידי התכנית לפרויקטים עכשוויים בעלי משמעות סביבתית אשר עליהם מתדיינים העוסקים בסביבה בישראל ובעולם.

התכנית מיועדת לבעלי תואר בוגר מחוגים אחרים בפקולטה למדעי החברה ולתלמידי פקולטות אחרות המתעניינים בנושאי מדיניות הסביבה והעומדים בדרישות הקבלה ללימודי מוסמך בפקולטה למדעי החברה. תלמידים המבקשים להירשם לתכנית במסגרת לימודי מוסמך בגיאוגרפיה ואינם בעלי תואר בוגר בגיאוגרפיה, מחויבים בלימודי השלמה הנקבעים לכל תלמיד בתיאום עם מרכז ההתמחות. ניתן להשתתף בלימודי ההשלמה בשנה הראשונה כחלק מלימודי המוסמך, באישור מרכז התכנית. תלמידי ההתמחות מחויבים כדרישת קדם בקורס "יסודות המינהל הציבורי (56303)" אשר אינו נכלל במספר נ"ז לתואר. בנוסף, התכנית כוללת קורסי יסוד שהינם בבחינת קורסי חובה וקורסי בחירה. ניתן לקחת קורסי בחירה מעבר למצוין ברשימת קורסי הבחירה של ההתמחות באישור מרכז התכנית. משך הלימודים שנתיים. ניתן לפצל את תקופת הלימודים בהתאם לנהלים המקובלים. תכנית ההתמחות כוללת 23 נקודות זכות (נ"ז) במסלול המחקרי ובמסלול הלא מחקרי. מתוך מניין נקודות אלו נכללות 12 נ"ז לכל היותר במסגרת לימודי הבחירה בחוג העיקרי. יש לכתוב עבודה סמינריונית אחת לכל הפחות בנושא סביבתי. במקרה שהעבודה לא נכתבה במסגרת סמינר סביבתי יש לקבל אישור גם ממרכז ההתמחות. הלימודים מתנהלים בשלושה מסלולים:

א. מסלול מחקרי מיועד להעמיק ולהרחיב את ידיעותיו של התלמיד ולפתח את כושרו המחקרי, על ידי ביצוע עבודת גמר. תלמיד הלומד במסלול מחקרי מציע במהלך לימודיו נושא לעבודה וכן מדריך לעבודה זו.

ב. מסלול לא מחקרי נועד להרחיב ולהעמיק את הידע בתחום איכות הסביבה הן בכיוון מקצועי והן בכיוון עיוני. במסלול זה אין עבודת גמר, אך מספר הקורסים גדול יותר ומבנה הבחינות שונה. תכנית הלימודים של כל תלמיד תקבע לפי הפקולטה בה הוא לומד, ובאישור היועץ האישי.

ג. מסלול אישי הפתוח לתלמידים מצטיינים ומתקיים במסלול המחקרי בלבד. מסלול זה מאפשר בניית תכנית אישית לתלמיד לפי שאיפותיו, בכפיפות לאישור היועץ וועדת ההוראה של הפקולטה.

כ 30 תלמידים לומדים בכל המסלולים של התוכנית

1ד. לימודי סביבה בפקולטה לרפואה

במסגרת ביה"ס לבריאות הציבור בפקולטה לרפואה נלמדים הנושאים הבאים הקשורים לסביבה:

1. בריאות הציבור בראי הסביבה הגלובלית
2. פיתוח קהילתי לקידום בריאות
3. אפידמיולוגיה קהילתית וסביבתית
4. מבוא לבריאות העובד והסביבה

כמו כן ניתנים מספר קורסים בפיסיולוגיה שלהם נגיעה לנושאי סביבה (פיסיולוגיה של עקות חום). מספר התלמידים הלומדים קורסים אלה הוא כ 120.

1ה. לימודי סביבה בפקולטה למשפטים

במסגרת הפקולטה למשפטים ניתנים הקורסים הבאים:

1. הגנת הסביבה בישראל
2. דיני סביבה
3. סדנא בין תחומית לבעיות סביבה
4. החוק הבינלאומי הסביבתי

כ- 40 תלמידים משתתפים בקורסים השונים.

1ו. המלצות

כפי שניתן לראות יש באוניברסיטה העברית מגוון גדול של תוכניות וקורסים בנושאי סביבה. קורסים אלה נוגעים בהיבטים רבים ושונים של תחומי הסביבה. לאור הייחודיות של התוכניות וההבדלים ביניהן וכן בגלל המרחק בין הקמפוסים, נראה לנו, שהמסגרות הקיימות צריכות להמשיך ולהתקיים במתכונת הנוכחית, אולם כדאי להגביר את שיתוף הפעולה והקשר ביניהן. לדעתנו יש לעשות זאת בשני אופנים:

1. אחת לשנה ראוי לכנס את ראשי כל תוכניות הלימוד (טבע, חקלאות, חברה, ונציגים מהפקולטות לרפואה ולמשפטים) במשרד הרקטור על מנת להחליף דעות, לתאם תוכניות לימודים ולבחון דרכים לשיפור ההוראה ,קיום קורסים רב תחומיים ופעילויות בין פקולטאיות. בנוסף, יש לעודד את ראשי התוכניות להתכנס אחת לסמסטר לדיון משותף.

2. אחת לשנה יש לערוך כנס של יומיים בהשתתפות כל תלמידי המוסמך והדוקטור הלומדים בתוכניות השונות. מספר תלמידים מכל תוכנית ירצו על מחקריהם ושאר התלמידים יציגו פוסטרים. ארגון כנס כזה דורש השקעה כספית מצד האוניברסיטה אולם לדעתנו הוא חיוני ובעל תועלת רבה לתלמידים ולמורים.

3. בפרסומי האוניברסיטה, כגון המדריך לנרשם ואתרי האינטרנט, מומלץ להציג את מגוון התוכניות תחת הכותרת " לימודי סביבה באוניברסיטה העברית" (ראה נוסח שהיה בשעתו באתר האוניברסיטה אך אינו נמצא שם יותר.

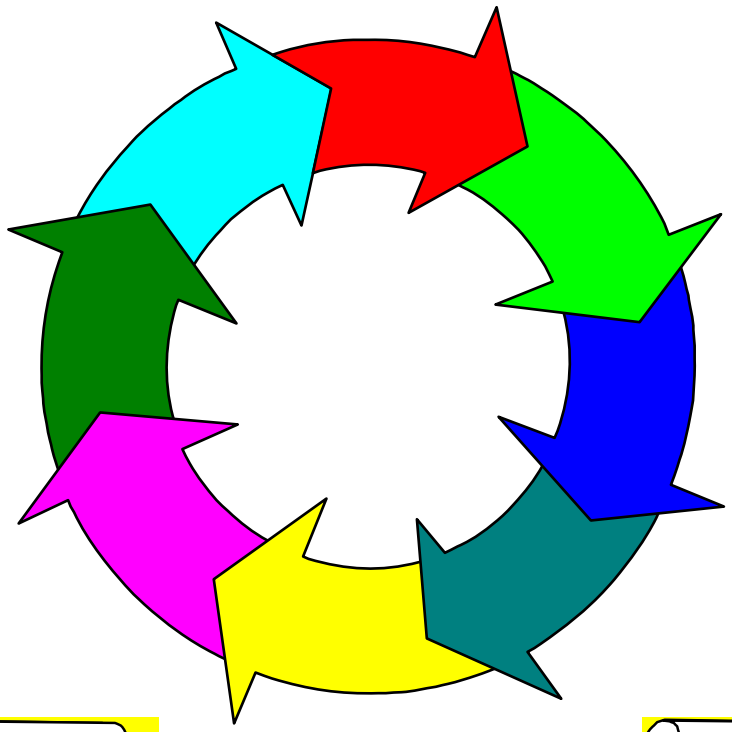
לימודי סביבה באוניברסיטה העברית

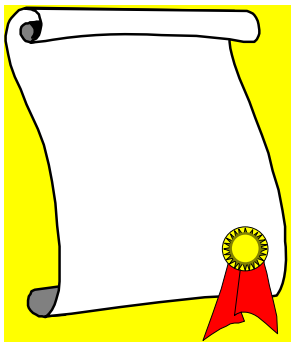
באוניברסיטה העברית קיימות שלוש מסגרות ללימודי סביבה:

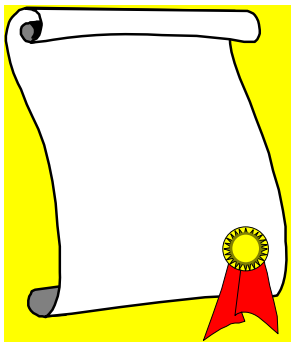
1. התוכנית ללימודי הסביבה בפקולטה למדעי הטבע (קמפוס על שם ספרא בגבעת רם). התוכנית מעניקה תואר בוגר (עם חוג נוסף) ותארים מתקדמים (מוסמך ודוקטור) בלימודי הסביבה.

2. התוכנית לאיכות הסביבה ומשאבי טבע בחקלאות בפקולטה למדעי החקלאות המזון ואיכות הסביבה (קמפוס רחובות). התוכנית מעניקה תואר מוסמך וכן ניתן ללמוד במסגרת התוכנית בהיקף של חטיבת לימודים לבוגר.

3. התוכנית לניהול, תכנון ומדיניות סביבתית (Environmental Management Planning & Policy) בפקולטה למדעי החברה (קמפוס הר הצופים). התוכנית מעניקה תואר מוסמך וכן ניתן ללמוד במסגרת התוכנית בהיקף של חטיבת לימודים לבוגר.







2. המחקר הסביבתי באוניברסיטה העברית

באוניברסיטה העברית מתקיים בפקולטות השונות מחקר ענף במדעי הסביבה על ידי חברי סגל מתחומי דעת רבים ומגוונים על פי החלוקה הבאה: בפקולטה למדעי הטבע כ-35 חברי סגל, בפקולטה למדעי החקלאות המזון ואיכות הסביבה כ-30 , בפקולטה למדעי החברה כ –10, בפקולטה לרפואה כ- 5 ובפקולטה למשפטים שלושה ובפקולטה למדעי הרוח חברי סגל בודדים.

רבים מהמחקרים הינם ממוקדים בתחום מסוים כגון: אקולוגיה, גיאולוגיה, מדעי אטמוספרה, הידרולוגיה, גיאוכימיה, מדעי הקרקע, מיקרוביולוגיה, מדעי הצמח, טוקסיקולוגיה, פיסיולוגיה,אוקיאנוגרפיה,גנטיקה, מדעי בעלי חיים, אנטומולוגיה, כלכלה, גיאוגרפיה, מדעי המדינה, משפטים וארכיאולוגיה.

למרות שהמחקר המדעי יכול להתקיים בתוך הדיסציפלינה, בעיות הסביבה מתאפיינות ברב- תחומיות ובעבודה בצוותים רחבים. כלומר כדי לפתור בעיה סביבתית יש לחקור אותה מזוויות שונות תוך ניצול תחומי הדעת השונים, ובכך חוזקה של האוניברסיטה העברית המתברכת במספר רב של מיטב החוקרים ובמרב התחומים.

2א. המרכז הרב תחומי למחקרי סביבה

מתוך הכרה בצורך בגישה רב תחומית במחקרי סביבה הוקם ב -2002 "המרכז הרב תחומי למחקרי סביבה" ששם לו למטרה:

1. לקדם מחקר רב תחומי במדעי הסביבה באוניברסיטה העברית בכיוונים אלו:
   - לפתח הבנה עמוקה של תהליכים ולזהות אינדיקטורים של שינויים סביבתיים ברמה המקומית אזורית וגלובלית (כדוגמה: מגון ביולוגי, שינוי אקלים)
   - ללמוד את השפעת הפעילות האנושית על גורמי סביבה כגון קרקע מים,אויר.
   - לחקור את יחסי הגומלין בין חברה וסביבה
   - לתכנן כלים חדשים ושיטות המערבים טכנולוגיה,משפט, כלכלה ותכנון כדי להתמודד עם סיכונים סביבתיים
   - לעודד מחקרים אזוריים ובין לאומיים.
2. להקים בסיס ידע ומונחים לסייע למקבלי החלטות בנושאי סביבה
3. לקדם חינוך סביבתי ומודעות בין חברי הסגל והסטודנטים באוניברסיטה העברית.

2א1. ימי עיון וכנסים של המרכז

מאז הקמתו ערך המרכז מספר לא מבוטל של כנסים, חלקם לחוקרים ולתלמידיהם וחלקם לקהל הרחב בשיתוף עם גורמים חוץ-אוניברסיטאיים. להלן רשימה חלקית של הכנסים:

מחקרי סביבה באוניברסיטה העברית: יום עיון עבור אנשי המשרד לאיכות הסביבה
כנס הכרות: המרכז הרב-תחומי למחקרי סביבה
יום עיון בנושא קונפליקטים סביבתיים: כלובי הדגים והשפעתם על המערכת האקולוגית בראש מפרץ אילת
זיהום קרקעות: דרכי מניעה וטיפול (בשיתוף האגודה הישראלית לאקולוגיה ואיכות הסביבה)
השפעות סביבתיות ואקלימיות של זיהום אוויר
משאבי המים של ישראל: בעיות ופתרונות
נושאים נבחרים בבעיות סביבה I – בשיתוף מכון ואן ליר
נושאים נבחרים בבעיות סביבה II – בשיתוף מכון ירושלים לחקר ישראל
תחזית מקורות האנרגי לעשור הבא והשפעתם על פליטות גזי חממה: השלכות הסכם קיוטו על ישראל

2א. יעוץ מקצועי לקרנות הרשות בשיפוט הצעות מחקר

מאז הקמת המרכז הקריטריון להגשת הצעות היה שיתוף פעולה בין חוקרים מפקולטות שונות או תחומי דעת שונים. הוגשו הצעות מחקר רבות אשר רק הטובות שבהן זכו למימון. פרופסור חיים גבירצמן, שעמד בראש המרכז ב 3 השנים האחרונות, בדק את האימפקט של המחקרים שמומנו במהלך פעילות מרכז. השאלה שנשאלה היתה: האם התקציב שהקרן הפנימית השקיעה (seed money) הניב תוצאות שבאמצעותן הוגשו הצעות מחקר נוספות והתקבלו תקציבי מחקר מקרנות חיצוניות? מדד זה, כמו יתר המדדים, מסייע בהליך קבלת ההחלטה האם על האוניברסיטה להמשיך ולהשקיע בקרונות אלו. להלן התוצאות:

<u>רינג - שנת 2000:</u>

1. פרופ' יגאל אראל, פרופ' מנחם לוריא, ופרופ' יצחק מרר: זיהום אוויר באמצעות אירוסולים.
   המחקר הביא לקבלת תקציבים נוספים:
   פרופ' יגאל אראל: 2002-2005, הקרן הלאומית למדע, 140,000 $.
   פרופ' יגאל אראל: 2002-2004, המשרד לאיכות הסביבה, 50,000 $.
   פרופ' מנחם לוריא ופרופ' יצחק מרר: 2003-2006, USAID-MERC, 250,000 $.

2. פרופ' מיכל הורוביץ, וד"ר מליאת טריינין: אבולוציה של התאקלמות לחום.
   המחקר הביא לקבלת תקציב נוסף:
   פרופ' מיכל הורוביץ: 2001-2003, הקרן הלאומית למדע, 70,000 $.

3. פרופ' מיכה אשר, ופרופ' אילן סלומון: הקטנת פליטת CO_2 לאטמוספרה.
   אין עבודת המשך.

<u>דויטש – שנת 2000:</u>

4. פרופ' חיים גבירצמן, ופרופ' עמוס פרומקין: מי התהום במדבר יהודה.
   המחקר הביא לקבלת תקציבים נוספים:
   פרופ' חיים גבירצמן, ופרופ' עמוס פרומקין: 2004-2006, נציבות המים, 30,000 $.
   פרופ' חיים גבירצמן: 2004-2007, נציבות המים, 90,000 $.
   פרופ' עמוס פרומקין: 2003-2005, מו"פ ים המלח, 36,000 $.

5. ד"ר יאפ ואן-ריין, ופרופ' עמוס נוסינוביץ: סילוק חנקן ממים מזוהמים.
   המחקר הביא לרישום פטנט ועדין לא הסתיים.

<u>רינג - שנת 2001:</u>

6. פרופ' נתן פלדור, ופרופ' יצחק מרר: מודל להסעת זיהום אוויר.
   המחקר הביא לקבלת תקציב נוסף:
   פרופ' יצחק מרר: קרן איטלקית, 2004-2005, 70,000 $.

7. פרופ' יצחק הדר, ופרופ' שמשון בלקין: נטרול רעלנים באמצעות פטריות.
   אין עבודת המשך.

<u>דויטש – שנת 2001:</u>

8. פרופ' יונתן ארז, ופרופ' יהודה כהן: חמצון סולפיד בכימוקלינה בכינרת.
   הוגשה הצעת מחקר ל DFG, אך נדחתה, ואין עבודת המשך.

9. ד"ר בני חפץ, ופרופ' זאב אייזנשטט: תהליכים של מזהמים אורגניים במים.
   הוגשה הצעת מחקר ל BSF, אך נדחתה, וממתינים לתשובות נוספות.

<u>רינג - שנת 2002:</u>

10. פרופ' יהודה אנזל, פרופ' חיים גבירצמן, ופרופ' אורי דיין: תדירות שנות הבצורת.

המחקר הביא לקבלת תקציב נוסף:
פרופ' יהודה אנזל: 2002-2004, הקרן הלאומית למדע, 60,000 $.

11. פרופ' מיכל הורוביץ, וד"ר מליאת טריינין: התאקלמות לחום של תולעים ויונקים.
המחקר הביא לקבלת תקציב נוסף:
פרופ' מיכל הורוביץ: 2003-2006, הקרן הלאומית למדע, 130,000 $.

<u>דויטש – שנת 2002:</u>

12. פרופ' שמעון מאיק, ופרופ' אורי שני: עמידות יבולים בתנאי עקת מליחות.
אין עבודת המשך.

<u>רינג - שנת 2003:</u>

13. פרופ' ברנרד גרין, ופרופ' דניאל מנדלר: פתוח חיישנים אלקטרו-כימיים.
הוגשה הצעת מחקר ל BSF, אך נדחתה, ואין עבודת המשך.

14. פרופ' בועז לזר, ופרופ' אנטון פוסט: הפיטופלנקטון במחזור החנקן.
הוגשה הצעה ל DFG וממתינה לתשובה.

15. פרופ' אברהם סטרינסקי, ופרופ' נעמה ענבר-גורן: פלאו-סביבה של עמק החולה.
המחקר הביא לקבלת תקציב נוסף:
פרופ' נעמה ענבר-גורן: 2005-2006, קרן ארכיאולוגית, 5,000 $.

המסקנה העיקרית העולה מן הבדיקה היא שקרנות המרכז שלנו, למחקרי הסביבה, יצרו שיתופי פעולה פוריים בין חוקרים מדיסציפלינות שונות, והביאו לאוניברסיטה לא רק חידושים מדעיים אלא אף תקציבי מחקר מקרנות חיצוניות, הגדולים באופן משמעותי מהכספים הראשוניים שהושקעו.

2ב. המלצות

המחקר האינדיבידואלי באוניברסיטה יימשך, ככל הנראה, ביוזמת חברי הסגל. **אנו ממליצים להנהלת האוניברסיטה להרחיב את פעילות המרכז הרב תחומי ובכך לעודד את המחקר הרב תחומי** לפי עקרונות שיפורטו בהמשך וכן להשתמש בקבוצות העבודה ובמרכז כמנוף לגיוס כספי תרומות ייחודיות לאיכות הסביבה. על האוניברסיטה לנקוט בפעולות הבאות:

1. להרחיב את פעילות המרכז:
אנו מציעים הקמת תתי מרכזים או קבוצות עבודה בנושאים בין תחומים שיש בהם עניין מדעי או ציבורי. כדוגמה:

פיתוח כלים לניטור סביבתי
פיתוח בסיסי נתונים סביבתיים
אפקטים סביבתיים ובריאותיים של זיהום אויר: זיהום חוצה גבולות
שיתוף פעולה סביבתי במזרח התיכון
תחבורה בת קיימא
זיהום קרקע ומים: מתכות
זיהום קרקע ומים: מזהמים אורגאניים
שימוש באיזוטופים למחקר סביבתי
ניהול משאבי מי תהום משותפים
הפחתת שימוש בחומרי הדברה
טיהור מים והשקיה בקולחים
שימור חופים וים
תגובות חברתיות, סביבתיות והידרולוגיות לשינויי אקלים
זיהוי ואנליזה של הפלורה והפאונה ותבניות של מגוון ביולוגי.
חקר המדבור
מגוון אוכלוסיות מיקרוביאליות.

בכל הנושאים הללו מומחים ידועי שם באוניברסיטה וניתן לבנות קבוצות עבודה כאמור.

2. לקיים ימי עיון (4-6) בשנה. חלקם לכל חברי המרכז בנושאים כללים וחלקם לקבוצות עבודה מצומצמות.

3. להרחיב את גיוס תרומות משוחרי האוניברסיטה שהם גם שוחרי איכות הסביבה. לאור ההתעוררות לנושאי סביבה בעולם כולו, ואפילו בארצות הברית, אנו מציעים להציב את תחום הסביבה כנושא מרכזי מכיוון שיתכן ויש תורמים פוטנציאלים אשר איכות הסביבה בראש עניינן ומאידך האוניברסיטה יכולה להציג פעילות רבה ואיכותית ומספר רב של חברי סגל המתמחים בתחום.

4. להעניק מלגות לתלמידי מחקר אשר עבודתם בעלת אופי רב תחומי והנם מודרכים על ידי חברי סגל מדיסציפלינות שונות.

5. בנוסף, על האוניברסיטה להטמיע את המודעות לאיכות הסביבה בחיי הקמפוס על ידי מגוון פעולות, כגון: חסכון באנרגיה, שתילת צמחים שדורשים פחות מים בגינות, מחזור מאורגן, ועידוד פעילות בנושאי סביבה בקרב הסטודנטים. למעשים אלה חשיבות חינוכית ממעלה ראשונה, אך הם גם עשויים למשוך לקמפוס הירושלמי סטודנטים טובים יותר.

הבהרות בעקבות שאלות הרקטור

1. אחוז הנשירה מהתוכנית בלימודי הבוגר הוא מאד גבוה. האם יש הסברים לנשירה הזו והגורמים לה? היש נתונים לגבי הרקע הלימודי של הנושרים?

רוב הנשירה היא במהלך ובסוף שנה א/ של הבוגר. באפן כללי יש מעט מאד חשיפה ללימודי סביבה בשנה א'. רוב הלימודים כוללים קורסי יסוד ובנוסף יש 4 ימי סיור של התוכנית לסביבה. רוב הנושרים מתחלקים ל 2 קבוצות: (1) כאלה שלא ידעו עד כמה לימודי מדעי הטבע מודגשים בתוכנית (מתמטיקה, פיסיקה, כימיה) והם עוברים לחוגים במדעי החברה והרוח. (2) תלמידים המעדיפים להתמקד בחוג השני שלהם, בעיקר ביולוגיה.

2. היש הסבר לירידה המשמעותית במספר הנרשמים לתואר מוסמך (6 בתשס"ז)?

ההסבר העיקרי הוא מחסור בתקציב למלגות.

3. בתגובתה לדו"ח ועדת הניטור של מדעי כדור הארץ דיווחה הדיקן – מונה שורק – על תוכנית לימודים חדשה לתואר בוגר במדעי הסביבה בראשה פרופ' פלדור, המתמקדת בלימודי אקלים, אטמוספרה ואוקיינוסים, שתחל בשנת הלימודים הבאה. האם נלקח בחשבון?

התוכנית החדשה שבראשות נתן פלדור ניתנת במסגרת המכון למדעי כדור הארץ ומתבססת על קורסים קיימים. מטרתה ליצור מסגרת אטרקטיבית בתחומים שממילא נלמדים במכון למדעי כדור הארץ . כיון שעדין אין שום מידע לגביה היא לא נכללה בדוח, אולם בעתיד יש לכלול אותה במסגרת לימודי הסביבה באוניברסיטה.

4. האם המרכז עוסק רק בכנסים מקומיים ואינו שותף/תומך בכנסים בינ"ל?

עד כה נערכו אך ורק כנסים מקומיים, אולם בהחלט כדאי לשקול קיום כנסים בינלאומיים בעתיד, כמובן בהינתן התקציב המתאים.

Appendix 14

בית ספר מתקדם ללימודי הסביבה

Advanced School for Environmental Studies

מטרות, מבנה וכיווני פעולה

דו"ח ביניים

מוגש לרקטור האוניברסיטה העברית – פרופסור שרה סטרומזה

על ידי:

פרופסור ערן פייטלסון, פרופסור יגאל אראל ופרופסור יצחק הדר

דצמבר 2010

בית ספר מתקדם ללימודי הסביבה
Advanced School for Environmental Studies

מטרות, מבנה וכיווני פעולה

רקע

במסגרת האוניברסיטה העברית , האוניברסיטה המחקרית המובילה בארץ, נערכים מחקרים רבים בנושאי סביבה שונים. כמו כן מתקיימות בפקולטות שונות מספר תכניות לימוד בתחומי הסביבה, אשר לכל אחת ייחוד משלה. אך אין כיום תיאום או שיתוף פעולה משמעותי בין תכניות המחקר או תכניות הלימוד. כתוצאה מכך התלמידים המתקדמים באוניברסיטה לא נחשפים ולא נהנים ממגוון האפשרויות שהאוניברסיטה יכולה להציע להם. למרות שבוגרי האוניברסיטה העברית ממלאים תפקידים מרכזיים במשרד לשמירת הסביבה, בסקטור הפרטי, ובגופים ירוקים ומקצועיים נוספים, הפוטנציאל המלא של האוניברסיטה לתרום לדיון הציבורי והמחקרי בתחומי הסביבה לא ממומש, דבר הגורם לכך שמקומה של האוניברסיטה העברית בתחומי הסביבה לא בא מספיק לידי ביטוי. יתר על כן, התלמידים המתקדמים לא זוכים בהכרח להכשרה שתאפשר להם בהמשך דרכם לתת מענה לתמורות המהירות המתרחשות בשדה הסביבתי, ובאוניברסיטה לא מתקיימת חשיבה שיטתית בדבר כיווני הפיתוח הרצויים בתחום הסביבתי במבט כלל-אוניברסיטאי. הסיבה העיקרית לאי מימוש הפוטנציאל המחקרי וההוראתי, להעדר שיתוף הפעולה, ולהעדר ראיה כלל-אוניברסיטאית, נעוצה במבנה המוסדי המושתת על חוגים בעלי בסיס דיסציפלינרי המאוגדים במסגרת מכונים ופקולטות.

בכדי להביא לשינוי בתמונת המצב הנוכחית, ולאחר בחינת מספר חלופות, ***מוצע להקים בית ספר מתקדם, על-פקולטטי***, ללימודי הסביבה באוניברסיטה העברית. לשם כך הוקם צוות הקמה בהרכב של פרופ' ערן פייטלסון ממדעי החברה ומרכז ההתמחות בניהול תכנון ומדיניות הסביבה, פרופ' יגאל אראל ממדעי הטבע, מנהל המכון למדעי כדור הארץ, פרופ' יצחק הדר מהפקולטה לחקלאות מזון וסביבה, ראש המכון (בהקמה) לאיכות סביבה ומשאבי טבע בחקלאות.

חזון בית הספר

היכולת להתמודד עם הלחצים הגוברים על הסובב תוך שיפור איכות החיים של תושבי העולם, מותנית במידה רבה ביכולת ההסתגלות החברתית (adaptive capacity), ובכלל זאת ביכולת לפתח כלים מחקריים להבנת תהליכים בקנה מידה גדול ולהערכה מושכלת של הפתרונות הטכנולוגיים האמורים לתת מענה לבעיות סביבה. ישראל היא אחת המדינות בהן הלחצים על הסובב הם מהחריפים בעולם בשל הצירוף של צמיחה מהירה, משאבים מוגבלים, צפיפות אוכלוסין גבוהה, וגידול אוכלוסין מהיר ביחס למדינות המפותחות. אי לכך יכולתה של ישראל להמשיך לפתח את כלכלתה ולצמצם את הפערים החברתיים בה, תוך שמירת ההזדמנויות של הדורות הבאים ליהנות מסביבה הראויה למחיה מותנית במידה רבה ביכולת ההתאמה החברתית שלה. יכולת זו היא בראש ובראשונה פונקציה של איכות החוקרים ואנשי המעש העוסקים בתחום הסביבתי. ***מטרת בית הספר המתקדם היא להכשיר את מיטב החוקרים ואנשי המעש בתחומי הסביבה***.

תחומי המחקר ה"חמים" והסוגיות העומדות במרכז הזירה הסביבתית, בארץ ובעולם, משתנות מעת לעת, ומחייבות עבודה רב-תחומית המבוססת על ראיה רחבה של יחסי אדם-

סובב ***בכדי לאפשר לבוגריו לפעול במסגרת צוותים רב-תחומיים ולהתמודד עם סוגיות רחבות היקף במבט על-תחומי ובין-לאומי בית הספר יכשיר את כל תלמידי המוסמך ותלמידי המחקר העוסקים בנושאי הסביבה באוניברסיטה העברית למחקר ועבודה רב-תחומיים***. יחד עם זאת, אופי המחקר נקבעת בראש ובראשונה על ידי ההכשרה הדיסציפלינרית של התלמידים המתקדמים. אי לכך ***בית הספר לא יחליף את החוגים והמכונים הקיימים, אלא יהווה נדבך נוסף, שבמסגרתו ילמדו קורסי ליבה*** שיכשירו את התלמידים בחוגים השונים לעבודה רחבת-היקף בתחום הסביבתי.

בנוסף, בית הספר ישמש כאכסניה ובסיס לארגון ועידוד פעילות בין-לאומית בתחומי הסביבה וישאף לפתח תחומי מחקר חדשים בנושאים סביבתיים אשר לא יתפתחו מאליהם במסגרת המחלקות הקיימות. צריך בית הספר יעודד מחקר רב-תחומי ושיתופי פעולה עם מוסדות אקדמיים מובילים בעולם ויפעל להבאת תוצאות המחקרים והדיונים שיתקיימו במסגרתו לידיעת הציבור הרחב ומקבלי החלטות בישראל. בכך בית הספר יעמיד את האוניברסיטה העברית במרכז הדיון המחקרי והציבורי הסביבתי בישראל.

<u>תכניות הלימודים</u>

כללי

במסגרת בית הספר יאוגדו תכניות לימוד לשלושה תארים מתקדמים (MA, MSc, Ph.D). ***התכניות לתואר מוסמך יעוגנו במסגרת החוגים הנוכחיים. אך כל התלמידים במסגרתן יחויבו ללמוד מספר קורסי ליבה*** אשר יקנו להם הבנה לגבי השאלות והשיטות המכוונות את המחקר הסביבתי בדיסציפלינות השונות מאילו שבמסגרתן הם לומדים לתואר. מעבר לכך קורסים אלו יאפשרו לתלמידים להתבונן בנושאים הסביבתיים במבט גלובלי ורחב, מעבר לתחומי המחקר והלימוד הקונקרטיים שלהם. ***כל התלמידים יחויבו גם להשתתף בסדנה בה הם ידרשו להכין עבודה בקבוצה רב-תחומית***. כמו כן, מוצע שבמסגרת מדעי החברה תוצע תכנית לתואר שני, בדומה לתכניות במדעי הטבע ובחקלאות. תכנית זו תעוגן במחלקה לגיאוגרפיה ותרחיב את ההתמחות המוצעת כיום במסגרת זו.

בנוסף לקורסי הליבה בית הספר יציע קורסי בחירה שיכולים לשרת את התכניות השונות. בהוראת הקורסים יעשה שימוש בוידיאו-קונפרנסים בכדי לאפשר לתלמידים בשלושת הקמפוסים לקחת את כל הקורסים המוצעים בבית הספר, ללא צורך בנסיעות מרובות בין הקמפוסים. דבר זה יאפשר גם תיאום פשוט יותר של מועדי הקורסים.

בכדי לעודד שיתופי פעולה בין-לאומיים חלק מהקורסים בבית הספר, בדגש הקורסים לתלמידי המחקר יינתנו באנגלית. בכך בית הספר יאפשר ויעודד קליטת תלמידים מחו"ל, הן כתלמידים לתואר והן במסגרת חילופי סטודנטים.

בית הספר יציע גם קורס או שניים במסגרת 'אבני פינה' במטרה להקנות לתלמידים בתואר ראשון המתלבטים לגבי לימודים בתואר השני בנושאי הסביבה תובנות לגבי הסוגיות בהן עוסקים במחקר הסביבתי והגישות השונות שבהן באים לטפל בסוגיות אלו.

תכניות המוסמך

בית הספר יכלול שלוש תכניות לימודים, האחת (מדעי הסביבה) ממדעי הטבע, השנייה (איכות הסביבה ומשאבי הטבע בחקלאות) מחקלאות, והשלישית ממדעי החברה. התכניות תמשכנה להיות במתכונתן הנוכחית למעט התוכנית במדעי החברה שתהפוך לתוכנית מוסמך עצמאית. ביה"ס יחייב את תלמידיו בכל התכניות בארבעה קורסי ליבה ברמת המוסמך. התכניות הנוכחיות וטיוטת התכנית המוצעת במדעי החברה מצ"ב כנספח.

תוכנית הלימודים תכלול קורסי ליבה משותפים וקורס מבוא למדעי הסביבה המותאם לפקולטות השונות, לימודי חובה מרשימת קורסים שיוצעו במסגרת בית הספר על מתוך קורסי הבחירה של התכניות ולימודי חובה ובחירה נוספים של שלוש התכניות, בהתאם למתכונת המפורטת להלן. היקף הלימודים הכולל בכל תכנית (סך הנ"ז) יקבע על ידי הפקולטות בתיאום עם ביה"ס. תעודות הסיום ינתנו במשותף על ידי הפקולטה במסגרתה למד התלמיד ובית הספר.

1. *לימודי ליבה (משותפים לכל התלמידים)*

גישות למדיניות סביבתית (2 נ"ז)
דיני איכות סביבה או אתיקה של הסביבה או כלכלת איכות סביבה ומשאבי טבע (2 נ"ז, חובת בחירה באחד משלושת הקורסים לפחות)
סדנה בין מקצועית לבעיות סביבה (2 נ"ז)

הקורס בגישות למדיניות סביבתית, המציג את התפתחות השיח הסביבתי סביב הגדרת הבעיות הסביבתיות והדרכים להתמודד עימן במאתיים השנים האחרונות, יילמד על ידי כל התלמידים במקביל (באמצעות וידיאו קונפרנס), או בקבוצות בקמפוסים השונים. הסדנה הבין-מקצועית לבעיות הסביבה, הבאה ללמד את תלמידי התכניות השונות לעבוד בצוותים רב-תחומיים תיערך במתכונת של קורס מרוכז המתמקד כל שנה בנושא שונה. לסדנה זו תלמידים יוכלו להירשם רק לקראת סיום לימודיהם, שכן ההנחה היא שכל תלמידי הסדנה לקחו כבר את שאר קורסי הליבה והם בעלי רקע מספק כדי להבין את ההרצאות המקצועיות על נושא הסדנה, ולהביא את תובנותיהם הדיסציפלינאריות לעבודת הצוות המסכמת את הסדנה. קורסי חובת בחירה ילמדו גם הם באמצעות וידיאו-קונפרנס, בכדי לאפשר לתלמידים בשלושת הקמפוסים ליהנות מהוראה של המורים הטובים באוניברסיטה ללא הזדקקות למורים מהחוץ עבור נושאי ליבה אלו.

2. *מבוא ללימודי סביבה*

המבוא למדעי הסביבה ילמד בנפרד בכל קמפוס, כאשר בכל קמפוס תיעשה התאמה לרקע של התלמידים ולמטרות התכנית. במדעי הטבע קורס בהיקף של 9 נ"ז (ההיקף הנוכחי שלו) הכולל 4 קורסים (טכנולוגיה סביבתית מים ושפכים, מיקרוביולוגיה סביבתית, תהליכים כימים וגיאוכימיים, פתוח מודלים למערכות סביבתיות). גם בחקלאות הוא יהיה בעל היקף דומה, בהתאמה לצרכי הפקולטה לחקלאות. במדעי החברה קורס זה יהיה בהיקף של 4.5 נ"ז, במוקד של מדעים אבל יותאם לתלמידים החסרים רקע בכימיה, פיסיקה וביולוגיה. מטרת קורס זה היא להקנות לתלמידים הבנה ושליטה בשפה ובמונחים המשמשים את מדעי הטבע וחקלאות, ובכך לאפשר להם לתקשר עם חוקרים במדעי הטבע וחקלאות בצוותי עבודה ומחקר משותפים.

3. *לימודי בחירה ולימודי חובה חוגיים*

בנוסף לקורסים לעיל כל תלמיד יחוייב בלימודי חובה ובחירה כנדרש לעמידה בדרישות החוג. ביה"ס יציע מספר קורסי בחירה אשר יינתנו במתכונת המאפשרת את לקיחתם בקמפוסים השונים על ידי תלמידים מהתכניות האחרות. בדרך זו יורחב ההיצע העומד בפני התלמידים וינוצלו משאבי ההוראה של האוניברסיטה בצורה יעילה יותר. הקורסים שיכללו במסגרת הבחירה שתוצע על ידי ביה"ס יקבעו בהמשך. כל תלמיד יחויב לקחת לפחות 4 נ"ז בחירה מרשימת קורסי הבחירה של ביה"ס. בנספחים ניתן לראות את קורסי הבחירה המוצעים כיום במסגרת התכניות, ואשר יוכלו לשמש כבסיס לבחירת קורסי הבחירה שיוצעו בביה"ס.

מבנה הלימודים של תלמיד למוסמך בביה"ס יהיה לכן מורכב מלימודי הליבה של ביה"ס, לימודי החובה של התכנית/חוג שבמסגרתה הוא נרשם, ולימודי בחירה של התכנית, שחלקם יילקחו מתוך לימודי הבחירה המוצעים ע"י ביה"ס.

תכנית הלימודים לתלמידי מחקר

תלמידים הנרשמים כתלמידי מחקר בתחומים הסביבתיים ירשמו במסגרת בית הספר לאחר במידה שהתקבלו על ידי ועדת הקבלה הבית ספרית, וזאת במקביל להירשמותם בפקולטות ובחוגים של מנחיהם. חוגים אלו לא יוגבלו לחוגים/תכניות שנכללו בלימודי המוסמך, אלא תתאפשר הרשמה גם של תלמידי מחקר העוסקים בנושאים סביבתיים והרשומים בחוגים אחרים, ובלבד שבין קורסי ההשלמה שלהם יכללו לימודי הליבה של המוסמך בבית הספר והקורס במבוא למדעי הסביבה (בהתאם לפקולטה בה רשום התלמיד). ***ההרשמה בבית הספר תזכה אותם במלגה חלקית, מחד, ותחייב אותם למספר קורסים ייחודיים המיועדים בלעדית לתלמידי מחקר, מאידך***. קורסים אלו יבואו לפתח את יכולתם של התלמידים להתמודד עם סוגיות 'גדולות' מעבר לאילו שעימן מתמודדים במהלך הכנת התיזה. מטרת הקורסים הייחודיים היא לבנות מסד שיאפשר לתלמידי המחקר להיענות בהמשך דרכם האקדמית להזדמנויות ואתגרים חדשים. כמו כן בית הספר יציע קורסים מתודיים, שבמסגרתם ילמדו תלמידים מתודות המשרתות דיסציפלינות שונות (כגון ממ"ג וחישה מרחוק), ויחשפו לדיונים תיאורטיים עדכניים.

הקורסים ברמת דוקטורט המוצעים הם: "מחקרים פורצי דרך במדעי הסביבה", ו"גישה רב-תחומית לשאלות הגדולות בסביבה". הקורס הראשון יינתן על ידי צוות מורים מבית הספר. הקורס השני ילמד על ידי דיונים בין מורים שונים והתלמידים. כמו כן ***ביה"ס יארגן ימי עיון ו/או כנס דוקטוראנטים*** בו יוכלו התלמידים לתואר שלישי להציג את עבודותיהם, לקבל היזונים חוזרים ולקיים סדנאות סביב סוגיות סביבתיות שונות.

יש מקום לשקול קיום כנס הדוקטוראנטים באנגלית כחלק מהמאמץ למשוך תלמידי מחקר מחו"ל. במידה שאכן מספר מספק של קורסים ילמדו באנגלית ניתן לקוות שתתפתח תכנית לתלמידי מחקר מחו"ל, וכן לריבוי חילופי הסטודנטים עם מוסדות בחו"ל.

<u>מחקר ופיתוח</u>

ביה"ס ישאף לעודד מחקר רב-תחומי. לשם כך ***יועברו אליו כספי קרן רינג*** שישמשו למימון המחקר הנערך על ידי תלמידי המוסמך והדוקטור בבית הספר ולעידוד הגשת הצעות רב-תחומיות למימון מחקרים גדולים יחסית.

ביה"ס ישמש כאכסניה לחוקרים בתחום הסביבתי מחו"ל. חוקרים אלו יתבקשו ללמד קורס בחירה בעת שהותם (באנגלית) שיהיה פתוח לכלל תלמידי ביה"ס.

במסגרת ביה"ס ***תוכן תכנית פיתוח אקדמית לתחומי הסביבה, אשר תשמש כקריטריון לקליטת חברי סגל*** במינויים משותפים עם ביה"ס.

ביה"ס ישאף גם להקים ***תכנית לפוסט דוקטוראנטים*** על בסיס מימון נפרד.

<u>קשר לאוניברסיטה ולקהילה</u>

בית הספר ישאף לשמש כמוקד המחקר והדיון בנושאי סביבה הן באוניברסיטה והן בציבור הרחב. לשם כך הוא יאפשר לתלמידים מתכניות אחרות לשמוע קורסים במסגרתו, שחלקם ישמשו גם כהתמחות במדיניות תכנון וניהול סביבתי, כפי שקיים כיום. מעבר לכך, הוועדה האקדמית של ביה"ס, שתכלול חברי סגל מעבר לשלושת התכניות שיכללו במסגרתו, תקדם

ותאשר ***תכנית פיתוח כלל-אוניברסיטאית לנושאי הסביבה***. במסגרת זו הוועדה האקדמית תשמש כקשר לחלקים שונים של האוניברסיטה, ובכללם כאלו שאין במסגרתם תכנית סביבתית מובנית כיום.

בנוסף לפעילותו הפנים-אוניברסיטאית ***בית הספר ייזום ויארגן כנסים, ימי עיון ושולחנות עגולים בנושאי סביבה***. בעוד שהכנסים וימי העיון יבואו להרחיב את מעגל המתעניינים, ויהיו בעקרון פתוחים לקהל, השולחנות העגולים באים לשמש כנקודת מפגש בין "שחקנים" שונים בתחומי המדיניות הסביבתית היכולים להעזר בשולחן עגול כמקום נייטראלי בכדי לקיים שיח פתוח בנושאים העומדים על הפרק. זה שירות שבית הספר יוכל לתת למקבלי החלטות. פעילות זו תוכל להיעשות בשיתוף עם ביה"ס למדיניות ציבורית וממשל ועם קרן באומן הפעילה היום במסגרת ההתמחות בניהול תכנון ומדיניות הסובב.

במסגרת תכנית הלימודים למוסמך בית הספר יוכל לקיים גם ***פרקטיקום/ים סביבתיים*** שתוצריהם יוכלו להועיל מקבלי החלטות, או לקדם חשיבה אלטרנטיבית לגבי פעולות שעל סדר היום הציבורי. בכך הם עשויים לתרום לנראות הציבורית של ביה"ס.

<u>משאבים, תקנים וניהול</u>

תקנים

בית הספר יבוסס על ***מספר תקנים אוניברסיטאיים (עד עשרה) שרובם יאוישו במינויים משותפים בין ביה"ס ליחידות אקדמיות שונות***. מטרת המינויים המשותפים היא להבטיח שיהיה סגל הזמין ללמד את קורסי הליבה ולהנחות תלמידים לתואר שני שאינם מוצאים בהכרח מקום במסגרות הדיסציפלינריות הרגילות. בו זמנית, המינויים יאפשרו לממש את תכנית הפיתוח הסביבתית שתגובש במסגרת בית הספר. מינויים אלו עשויים לשמש בדרך זו לפיתוח תחומים ולקישור בין תחומים אשר לא יתממשו במבנה המוסדי הקיים. איוש התקנים במינויים משותפים יבטיח, בו זמנית, שאיכות הנקלטים בסגל ביה"ס לא תיפול מאיכות הנקלטים ביחידות הדיסציפלינריות.

קידום חברי הסגל בבית הספר יתבסס על ועדות מקצועיות שיוקמו במסגרותיהם הדיסציפלינרות (קרי, על בסיס שיוכם הפקולטטי). יחד עם זאת, במידה שבית הספר לא יהיה שבע רצון מתרומתו של חבר סגל המועמד לקידום ו/או לקביעות לבית הספר, או למחקר רב-תחומי, הוא יוכל לציין זאת. במקרה זה היחידה הדיסצפלינרית תוכל לקדם את חבר הסגל במינוי מלא אצלה (במידה שועדת המינויים תמצא זאת לראוי), וחצי התקן יחזור לבית הספר.

ניהול

מאחר שביה"ס יפעל מול פקולטאות שונות מוצע ***שראש ביה"ס יהיה בדרגת פמ"ה שכבר עשה תפקיד ניהולי קודם. ליד מנהל ביה"ס תפעל וועדה אקדמית***, שתשמש גם כוועדת סינון לקליטות, ואשר תקבע את מדיניות הפיתוח של התחום הסביבתי באוניברסיטה ובכללם את כיווני הפיתוח של ביה"ס. וועדה זו, אשר תמונה על ידי הרקטור, תכלול בנוסף למנהל ביה"ס ולראשי שלושת התכניות חברים מתחומים נוספים שיש להם עניין ונגיעה לסוגיות סביבתיות. לידה תפעל וועדת הוראה אשר תורכב ממנהל ביה"ס וראשי שלושת התכניות, ואשר תעסוק בכל הסוגיות הנוגעות לתכניות הלימוד השונות.

משאבים כספיים

בכדי למשוך תלמידי מחקר לתחום הסביבתי ביה"ס יעניק כאמור ***מלגות חלקיות לתלמידי המחקר שלו (מוסמך ודוקטוראט)***. מלגות אלו יותנו בסיום בהצלחה של קורסי הליבה

לתלמידי מחקר בשנת הלימודים הראשונה לתואר. המלגות יינתנו אך ורק לתלמידים העושים מחקר במסגרת בית הספר.

בכדי לאפשר קיום יעיל ומועיל של ***הסדנה הבין מקצועית לבעיות סביבה מוצע לקיימה במסגרת מרוכזת מחוץ לקמפוס***. דרושים לכך משאבים כספיים.

בכדי לאפשר העברת קורסים בו זמנית בין הקמפוסים ***יש צורך להקצות בכל קמפוס כיתה מיוחדת בה מותקן הציוד המאפשר תקשורת דו/ תלת כיוונית*** בין המורה לכיתות. כמו כן דרוש טכנאי בעל כישורים להפעלה של מערכת מסוג זה.

בכדי לתאם את תכניות הלימוד הסביבתיות השונות, להבטיח שכל התלמידים ייקחו את קורסי הליבה, ולתאם את קורסי הליבה יהיה צורך בכ"א מנהלי בתחומי ההוראה. בנוסף יהיה צורך בכ"א מנהלי לצורך ניהול תקציבי ולצורך קידום ביה"ס בזירה הציבורית ותיאום האירועים במסגרתו. היקף התקנים שידרשו הוא ***כשני תקנים מנהליים***.

כמו כן תידרש ***תוספת ניהול למנהל ביה"ס*** וחצי תקן למזכיר/ת התכנית החדשה המוקמת במדעי החברה.

בכדי לעודד מחקר רב תחומי כספי קרן רינג יועברו לביה"ס. אך חיוני להרחיב בצורה משמעותית את מסגרת קרן זו בכדי לאפשר גם מימון מחקרים של תלמידי מחקר, וכן הזמנת מומחים וחוקרים זרים, אשר ידרשו לתת גם קורסים מרוכזים או קורסי בחירה באנגלית. בבדיקה שערכנו התברר כי חלק ניכר מהמחקרים שמומנו על ידי קרן רינג הניבו לאחר מכן תקציבי מחקר מקרנות חיצוניות תחרותיות. אחד הנושאים הראשונים להם תידרש הוועדה האקדמית שתוקם לביה"ס היא הקצאת כספי רינג.

בכדי להגביר את נירואותו הציבורית והבי"ל ביה"ס יזדקק למשאבים לשם הזמנת חוקרים-אורחים מחו"ל ולצורך קיום ימי עיון ופעילות ציבורית.

במידה ויפתחו תוכניות בלימודי סביבה בפקולטות נוספות (למשל בריאות הציבור) יוכלו להצטרף לבית הספר לפי אותם כללים.

בית הספר ייפתח לאחר שיוקצו המשאבים הנדרשים להפעלה מלאה של לימודי הליבה. היקף משאבים אלו מפורט במסמך נפרד.

<u>נספח א':</u> תכנית לימודי המוסמך במדעי הסביבה (מדעי הטבע)

מוסמך במדעי הסביבה
(מדעי הטבע) סך הכל 32 נ"ז

חובה		נ"ז
שנה א'		
89773	טכנולוגיה סביבתית מים ושפכים	2
89777	מיקרוביולוגיה סביבתית	2
89847	תהליכים כימיים וגאוכימיים	2
40478	פתוח מודלים למערכות סביבתיות	3
שנה ב'		
89707	סמינריון למוסמך	2
	בחינה מסכמת בלימודי מוסמך	0
	עבודת גמר בלימודי מוסמך	0

מסלול גאוכימי/גאופיסי
בשנים א' וב' לפחות 12 נ"ז מהרשימה הבאה

70875	תהליכי הסעה במי תהום	3
70334	גאוכימיה של איזוטופים רדיואקטיביים	3
89703	מחזורים ביוגאוכימיים	3
70511	יישומי GIS במדעי כדור הארץ	3
70515	משאבי המים בישראל	3
70705	גאוכימיה של איזוטופים יציבים	3
82657	כימיה אטמוספרית	4
82850	חישה מרחוק סביבתית	3
84839	ביוגאוכימיה ימית	2
89400	סיור לימודי לים המלח	3
89507	מחקר מודרך לתלמידי מדעי הסביבה והפקולטה	3
	שיטות נומריות במדעי כדור הארץ	3
70576	מבוא לאנרגיות קונבנציונאליות ומתחדשות	2

מסלול ביולוגי/אקולוגי
בשנים א' וב' לפחות 12 נ"ז מהרשימה הבאה

72501	אקולוגיה מיקרוביאלית	4
72530	אקולוגיה מולקולרית	2
72604	אקולוגיה מורחב	5
76716	מיקרוביולוגיה ימית	7
89400	סיור לימודי לים המלח	3
89507	מחקר מודרך לתלמידי מדעי הסביבה והפקולטה	3
89520	התמודדות מיקרואורגניזמים עם סביבתם	3
89712	מיקרוביולוגיה- זמן מרחב ושונות באקולוגיה מיקרוביאלית	5
70576	מבוא לאנרגיות קונבנציונאליות ומתחדשות	2
89703	מחזורים ביוגאוכימיים	3

בחירה עד להשלמה של 32 נ"ז בתיאום ובאישור מנחה עבודת הגמר ויועץ התוכנית

<u>נספח ב'</u>: חוג מוסמך לאיכות סביבה ומשאבי טבע בחקלאות

איכות הסביבה הוא תחום הנוגע לשמירה וטיפול בסביבה בה אנו חיים תוך בחינת יחסי הגומלין בין הפעילות האנושית לבין הסביבה. מדענים מתחומים רבים כגון כימיה, ביולוגיה, מיקרוביולוגיה, אקולוגיה, כלכלה, מדעי הצמח, מדעי הקרקע והמים חוקרים נושאים הקשורים באיכות הסביבה ומספקים מידע ופתרונות בתחום רב גוני זה.

הגדרת הפעילויות הכלולות בתחום איכות הסביבה תלויה בנקודת המבט. עם הזמן התפתחה ההכרה כי בעיות סביבתיות נוגעות לבריאותם, לביטחונם ולאיכות חייהם של בני האדם ובעלי החיים היום ובעתיד. לכן במשך השנים החלה להתגבש ההבנה שלא די בפעולות שימור אלה ויש צורך גם בפעילות שיקום וטיפול בסביבה. מורכבות נוספת של הגדרת איכות הסביבה נובעת מקיומם של קשרי גומלין, עמוקים וסבוכים בין הפעילות האנושית לבין הסביבה. לאור המחקר המדעי האינטנסיבי בקשרי גומלין אלה, חלה מגמת שינוי מדיניות עולמית בתחומים רבים כגון פיתוח מקורות אנרגיה ומים חליפיים, מיחזור פסולת, חקלאות מתקדמת הכוללת הדברה ידידותית ועוד. בגלל מורכבות הנושא אחת הגישות להתמודדות היא שימוש בכלים כלכליים.

החוג לאיכות סביבה ומשאבי טבע בחקלאות הנו חוג רב-תחומי המציע תוכנית לימודים ומחקר במגוון של נושאים הקשורים לאיכות הסביבה וחקלאות.

החוג מאחד תחת קורת גג אחת מורים העוסקים בתחומי מחקר שונים, החל במיקרוביולוגיה סביבתית, אקולוגיה, זיהומים בקרקע ובמים והטיפול בהם, כלכלה ו פיסיולוגיה וכלה בהתנהגות של נגעים חקלאיים והדברתם באמצעים ידידותיים לסביבה. *הקו המאחד את המורים בחוג הוא זיקתם להבנת תהליכים המשפיעים ומשפרים את איכות הסביבה ולשמירה על סביבה חקלאית ברת-קיימא ושימורה לדורות הבאים.*

מתמחי החוג מקבלים הכשרה רב-גונית והם משתלבים לאחר סיום לימודיהם בשטחים שונים ורבים של המשק הישראלי: במחקר בסיסי ויישומי באקדמיה ובתעשייה, בהוראה, בשרות ההדרכה והמקצוע, בחברת "מקורות", בתה"ל, ברשות המים, במשרדים להגנת הסביבה וחקלאות, בסיוע למדינות מתפתחות, בתפקידי יעוץ וניהול שונים ובריכוז משקים במגזר הקיבוצי.

<u>תוכנית הלימודים:</u>

תוכנית הלימודים הינה אישית, וכוללת לימודי חובה ובחירה, ונקבעת ע"י המנחה באישור ועדת הלימודים של החוג בהיקף של 32 נ"ז במסלול המחקרי (40 נ"ז במסלול הלא מחקרי). נושא עבודת הגמר יהיה קשור באופן מובהק לתחומי איכות ושמירת הסביבה ויאושר על-ידי ועדת הלימודים של החוג.

<u>מערך קורסי החובה</u>

עליך להשתתף ב 7 נקודות זכות ב:

1. 2 סמינרים. אחד יינתן במסגרת החוג (73504) השני במסגרת חוג נוסף (2 נ"ז)
2. סדנא אחת (73554 או 73555) (2 נ"ז)
3. קורס 71148 מבוא לכלכלת משאבי טבע וסביבה (3 נ"ז)

<u>קורסי חובת בחירה</u>

על התלמידים לבחור 10 נקודות זכות לפחות מתוך הרשימה של קורסי איכות הסביבה שלהלן.
יש להשלים ל- 32 נ"ז לפי תחום עבודת הגמר שלהם במסלול המחקרי ולהשלים ל- 40 נ"ז לפי תחום הסמינריון המחקרי במסלול הלא מחקרי.

מס' קורס	שם הקורס	נ"ז	שם מרצה
71110	אינטראקציות של תרכובות אורגניות וחרסיות	3	פרופ' ש. ניר
71116	אקולוגיה של היער	3	דר" ז. גרינצוויג
71123	הרכב כימי של משאבי מים	3	דר'" א. וקשל
71126	אקולוגיה כימית בהגנת הצומח	2	ד"ר ו. סורוקר
71130	טיפול במים ובקרת איכותם	4	פרופ' ע. קאן
71165	היבטים שיווקיים בהמחרה	3	פרופ' ע. לוונגרט
71173	אקולוגיה התנהגותית של האבקה	3	פרופ' ש. שפיר
71179	החומר האורגני בקרקע	3	פרופ' י. חן
71183	כלכלת משאבי טבע למתקדמים	3	פרופ' י. צור
71185	התנהגות מזהמים אורגניים בסביבה	3	פרופ' ב. חפץ
71186	צמחים כאמצעי לייצור חומרי טבע ולטיהור הסביבה	2	פרופ' א. תל-אור
71912	מודלים לסימולציה של מערכות חקלאיות	3	ד"ר י. אפרת ד"ר ח. אייזנברג
71915	היבטים אידמיולוגיים וסביבתיים של מחלות צמחים	2	פרופ' י. אלעד פרופ' ד. שטיינברג
71918	תנועת מומסים בקרקע	4	פרופ' ר. וולך
71919	מעבדה באקולוגיה מיקרוביאלית	3	פרופ' א. יורקוביץ
71930	קולחים – השבה, השקיה והשלכות סביבתיות	3	ד"ר ח. טרצי'צקי
71939	הדברה ביולוגית של מזיקים	2	פרופ' מ. קול
71945	היבטים סביבתיים בהדברת עשבים	2	פרופ' ב. רובין
71946	שיטות להערכת איכות במערכות מידגה	3	פרופ' י. ואן -ריין
71947	עקרונות אקולוגיים בתכנון מרחבי לשמירת טבע	2	ד"ר י. מנדליק
71972	כימיה של הקרקע	4	ד"ר מ. שנקר
71973	כימיה פיזיקלית ותופעות שטח פנים בקרקעות	4	ד"ר י. מישאל
71976	שינוי גלובלרי – השלכות ביולוגיות ואקולוגיות	3	דר' ז. גרינצוויג
71977	מיקרוביולוגיה סביבתית	2	פרופ' י. הדר
73509	תורת המשחקים	3	ד"ר ג. אורשן
73536	אקולוגיה מולקולרית של חיידקים	2	פרופ' א. יורקוביץ

<u>נספח ג':</u> טיוטה ראשונית לתכנית מוסמך בניהול ומדיניות משאבי טבע וסביבה (שם זמני, מדעי החברה)

<u>מטרה</u>

ישראל היא מהמדינות הצפופות בעולם, וקצב ההתפתחות בה הוא מהמהירים בעולם. ישראל היא גם אחת המדינות המגוונות בעולם, והיא מוגדרת על כן כ-hot spot מבחינת מגוון המינים בה. בו זמנית, סך המשאבים העומדים לרשותה מצומצמים. ישראל מהווה לכן "מעבדה" לניהול משאבים ולהתמודדות עם סוגיות סביבתיות בתנאי מחסור ולחץ. היכולת להתמודד עם הלחצים על הסובב ועם השלכות הפעילות האנושית תלויה בראש ובראשונה באיכות החוקרים והעוסקים בנושאי הסביבה. מטרת התכנית היא להכשיר את אנשי המקצוע והחוקרים אשר יעסקו בניהול המערכות הטבעיות ובגיבוש מדיניות סביבתית בכדי להתמודד עם הבעיות הסביבתיות הנובעות מהגידול המהיר בהיקף הפעילות האנושית. תכנית זו תעוגן בבית הספר המתקדם ללימודי הסביבה, ומיועדת לתלמידים מצטיינים מתחומים שונים.

<u>חובה</u>

קורס רקע:	
תהליכים סביבתיים[1]	4 נ"ז
קורסי בסיס נושאיים:	
מבוא למדעי הסביבה לתלמידי מדעי החברה	4.5 נ"ז
גישות למדיניות סביבתית	2 נ"ז
דיני סביבה	2 נ"ז
מינהל סביבתי השוואתי[2]	2-3 נ"ז
כלכלת משאבי טבע וסביבה ללא כלכלנים	2 נ"ז
סדנה בין מקצועית לבעיות הסביבה	2.5 נ"ז
קורסים מתודיים:	
מבוא לממ"ג	2 נ"ז
סטטיסטיקה לתלמידי מוסמך	3 נ"ז
גישות מחקר	2 נ"ז

<u>חובת בחירה</u> (אפשרות: במסלול ב' ידרשו שני הקורסים)

אחד מהקורסים הבאים, המקנים כלי עבודה:

אולפן בתכנון סביבתי (חובה לתלמידי המסלול התכנוני)	3 נ"ז
סדנה בניהול קונפליקטים סביבתיים	2 נ"ז

<u>סמינר</u> 2-4 נ"ז + 4 נ"ז

במסלול א יידרש סמינר אחד, בעוד שבמסלול ב' ידרשו שני סמינרים

סמינרים אפשריים יכללו:

ממשל סביבתי חוצה גבולות ב'/יישוב סכסוכים חוצי גבולות ב[3]

תחבורה ואיכות סביבה

פיתוח בר קיימא וצדק סביבתי: תפיסות, הגדרות, יישום

ניהול משאבי מים

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[1] קורס המקנה מונחי יסוד לתלמידים שלא באים מרקע של גיאוגרפיה או מדעי כדור הארץ בנושאי אקלים, גיאומורפולוגיה והידרולוגיה. תלמידים בעלי רקע בתחומים אלו יהיו פטורים מקורס זה וייקחו במקומו קורסי בחירה.

[2] במסגרת קורס זה ילמדו גם עקרונות המנה"צ באמצעות תרגיל וקריאה

[3] תנאי קדם לסמינר זה: ממשל סביבתי חוצה גבולות א/יישוב סכסוכים חוצי גבולות א

<u>לימודי בחירה</u> (להשלמת התואר: 40 נ"ז במסלול מחקרי, או 51 נ"ז מסלול לא-מחקרי)
במסגרת לימודי הבחירה התלמידים יוכלו להתמקד באחד משלושה מסלולים:
1) תכנון (בשיתוף המכון ללימודים ואזוריים)[4]
2) ניהול ומדיניות סביבתי
3) ניהול ומדיניות משאבי טבע

מתוך לימודי הבחירה 4 נ"ז לכל הפחות יילקחו מבין קורסי הבחירה של ביה"ס המתקדם ללימודי מוסמך, ומחוץ לחוג (קרי, ממדה"ט או מחקלאות)

נושאי קורסים שיוצעו במסגרת התכנית יכללו, במידת האפשר (בסוגריים מצויינים המסלולים במסגרתם הם נכללים):
ממשל סביבתי חוצה גבולות א/יישוב סכסוכים חוצי גבולות א (2,3)
ניהול משאבי המים בישראל (3)
ניהול פסולת מוצקה (1,2)
ניהול שטחים פתוחים (1,3)
תכנון מרחבי ואיכות הסביבה (1,3)
תכנון סביבתי: סוגיות וגישות (1,3)
חישה מרחוק (1,3)
קורסי ממ"ג מתקדמים (1,2,3)
אתיקה סביבתית (1,2,3)
פיתוח מודלים למערכות סביבתיות (2,3)
שילוב היבטים סביבתיים בעסקים ופיננסים (2)
הפוליטיקה של שינויי אקלים (2,3)
שמירת טבע: גישות וסוגיות (1,3)
ניהול חופים (1,3)
פרקטיקום סביבתי (1)
בריאות ציבורית ואיכות הסביבה (2)

[4] תלמידים יוכלו להרחיב את המסלול הזה לכדי התמחות, בתוספת 12 נ"ז, אם ילמדו את מלוא התכנית של המכון ללימודים עירוניים ואזוריים.