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Berlin Roots – Zionist Incarnation: The Ethos of Pure Mathematics and the Beginnings of the Einstein Institute of Mathematics at the Hebrew University of Jerusalem

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Argument

Officially inaugurated in 1925, the Hebrew University of Jerusalem was designed to serve the academic needs of the Jewish people and the Zionist enterprise in British Mandatory Palestine, as well as to help fulfill the economic and social requirements of the Middle East. It is intriguing that a university with such practical goals should have as one of its central pillars an institute for pure mathematics that purposely dismissed any of the varied fields of applied mathematics. This paper tells of the preparations for the inauguration of the Hebrew University during the years 1920–1925 and analyzes the founding phase of the Einstein Institute of Mathematics that was established there during the years 1924–1928. Special emphasis is given to the first terms in which this Institute operated, starting from the winter of 1927 with the activities of the director and one of the founders, the German mathematician Edmund Landau, and onward from 1928 when his successors, particularly Adolf Abraham Halevi Fraenkel and Mihály-Michael Fekete, continued Landau's heritage of pure mathematics. The paper shows why and how the Institute succeeded in rejecting applied mathematics from its court and also explores the controversial issue of center and periphery in the development of science, a topic that is briefly analyzed in the concluding section.

Introduction

Mathematics, though not the "queen of sciences" for everyone, was certainly one of the most intensely studied subjects in nineteenth- and early twentieth-century academia. Nearly every university, in addition to offering undergraduate courses in mathematics, also had a seminar framework or institute either devoted solely to mathematics or shared by mathematics and other disciplines, such as a *Mathematisch-physikalisches Institut* (Mathematics-Physics Institute). The Hebrew University of Jerusalem (hereafter HU)[1] was one of a small number of universities that had an institute devoted exclusively to "*pure* mathematics." The Einstein Institute of Mathematics (hereafter EIM) was founded in a university that was defined as Middle-Eastern by European observers

[1] All acronyms, including those of archives, are listed at the end of the paper.

(Brady 1939), a geographical positioning that implied inherent jeopardy regarding its academic level, especially in the eyes of its supporters. Today the EIM is a world-class center of research and teaching in mathematics with about forty professors cultivating mostly pure mathematical fields (Katz 1988).[2] This double phenomenon of pious adherence to pure mathematics of EIM and its scientific excellence raises many intriguing questions concerning its historical development.

Preparations for Opening HU and for Founding EIM in Jerusalem, 1920–1928

In March 1920, the Executive Council of the World Zionist Organization met in London. A memorandum in both Hebrew and English called *Report [on] Preparations for the University in Jerusalem (to be submitted to the Annual Conference of the Zionist Organization)* (hereafter PR) was tendered at this meeting.[3] Chaim Weizmann, a well-known Russian-born organic chemist and Zionist leader from Manchester (Reinhartz 1985), initiated this memorandum in order to realize the vision of the Zionist movement and to transform the Zionist manifestos for a Jewish university into operative dimensions and concrete academic decisions, for example, which research institutes and what kind of scholars would form HU in its initial stages. The memorandum laid down several principles including a thrifty, gradual, and modular construction of HU. Consequently, the PR conceived the academic structure in the initial period as an umbrella organization for several autonomous research institutes for natural science, medical research, and Jewish studies:

> On the scientific side, research institutes in physics, chemistry and microbiology were to be opened, and on the Arts side a Hebrew language institute and a department of Jewish learning. . . . The proposed Research Institutes for physics, chemistry and microbiology will serve as the nucleus of a faculty of science and (together with existing hospitals) of a Faculty of Medicine. (PR)

It was decided that the ultimate purpose was the establishment of a national university in the territory of historical Palestine or '*Eretz Yisra'el* (the Land of Israel), which was under British Mandate after World War I. It was to become the new State of Israel in 1948. Even though that was the primary goal, it was agreed that the research institutes

[2] The research and teaching of the computer sciences began their development in HU within the framework of EIM but were transferred gradually to a new autonomous institute. Undergraduate teaching of computer science, within the framework of EIM, began in 1980. In 1992, the two departments of the "Einstein Institute of Mathematics and Computer Science" – the "Department of Mathematics" and the "Department of Computer Science" – became independent institutes, within the Faculty of Science of HU. In 1999, the Institute of Computer Science has become the nucleus of the new "School of Computer Science and Engineering," established by HU. See: http://www.cs.huji.ac.il/ins_description/background.php

[3] Bilingual, Hebrew and English memorandum, JNUL, Stencil, 2° 34 2998.

in the natural and medical – that is, universalistic – sciences would not take second place to Jewish studies devoted to Jewish history and cultural heritage.

Another principle was that systematic instruction of students would begin only after the research at the university institutes was well established. It was clearly stated that only the development of research institutes could establish HU's reputation and create the necessary scientific atmosphere in Palestine, "thus ensuring it against the danger of a low scientific standard and a correspondingly low reputation like that from which new universities in backward countries, especially in the East, generally suffer." The PR memorandum stressed that these research institutes should avoid parochialism, and that the entire university, despite its limited dimensions, should be a world-class institution of academic distinction. In the same spirit, five years later, during the official inauguration ceremony of HU on the first of April 1925, Weizmann would declare "We have made up our minds that it is for our University to win its spurs and build up its reputation by the distinctive value of its contributions to the common stock of knowledge" (Weizmann [1925] 1983, 23–25).[4]

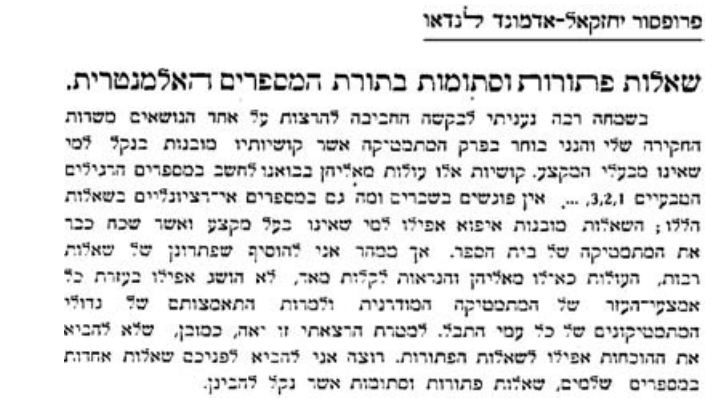
Several interesting questions arise here: How did it happen that an institute for mathematics – for pure mathematics! – was established at HU, even though it had not been included in the PR, the original program of the founders? Was the establishment of EIM the projected result of the realization of the declared ideals of scientific excellence and pursuit of pure science, or was it rather the incidental outcome of a series of circumstances conveniently exploited by the figures who were involved?

About a year before the official inauguration of HU, a Jewish-American philanthropist, Philip Wattenberg, endowed the new university with funds for a building that would bear both Einstein's and his name.[5] The founders accepted his offer and decided to establish The Einstein Mathematics-Physics Institute to be housed in the building. Its foundation stone was laid as part of the inaugural ceremonies of HU. Edmund Landau (1877–1938), one of the most prominent mathematicians of the early twentieth century, traveled to Jerusalem for the inauguration and participated in this ceremony as "the representative of the science of mathematics" (Landau 1925b). In his address there he stressed three opinions that were in accord with the university founders' ideas. The first was that joint research in mathematics and physics should be housed in one common building:

> In the large European universities, these two subjects cannot be contained under one roof, because of the vast range of each one of them. However, here in Jerusalem we are gathered to found the University, and we can lay a joint foundation-stone for a building in

[4] The historical origin of the pursuit of scientific excellence by the founders of HU, as a sort of expression for their national desires, is discussed in a separate paper (Katz 1997).

[5] Wattenberg said, "to have my name connected with The Hebrew University and with that of Einstein is surely an easy way of finding *olam ha-ba* [an afterlife]" (see The Hebrew University Archives [hereafter HUA], Wattenberg's File, No. 3, Part A).



פרופסור יחזקאל־אדמונד לנדאו

שאלות פתורות וסתומות בתורת המספרים דאלמנטרית.

בשבחה רבה נעניתי לבקשה החביבה להרצות על אחד הנושאים משרות החקורה שלי והנני בוחר בפרק המתמטיקה אשר קושיותיו מובנות בנקל לכל שאינו מבעלי המקצע. קושיות אלו עולות מאליהן בבואנו לחשב בספרים הרגילים המבעיים 3,2,1 ... אין פונשים בשברים ומה גם בספרים אריתמיוניים בשאלות הללו; השאלות מובנות איפוא אפילו לכל שאינו בעל מקצע ואשר שכח כבר את המתמטיקה של בית הספר. אך מבחר אני להוסיף שפתרונן של שאלות רבות, העולות כאילו מאליהן והנראות לקלות מאד, לא הושג אפילו בעזרת כל אמצעי־העזר של המתמטיקה המודרנית ולכורת התאמצותם של גדולי המתמטיקונים של כל עמי התבל. למטרת הרצאתי זו יאה, כמובן, שלא להביא את ההוכחות אפילו לשאלות הפתורות. רוצה אני להביא לפניכם שאלות אחדות בספרים שלמים, שאלות פתורות וסתומות אשר נקל להבינן.

Fig. 1. Reproduction of the introductory paragraph of Landau's Hebrew lecture (Landau 1925a).

> which both these sciences, that have so many common meeting points, can be cultivated. (Ibid.)

Later, when Landau realized that he himself would represent mathematics in this joint mathematics-physics structure, he changed his mind regarding the relationship between the two branches of knowledge. He insisted that the Wattenberg building, allocated to the Einstein Institute of Mathematics, be completely separate from the Einstein Institute of Physics.

The second two opinions concerned mathematics, Jews, and the new university:

> Regarding mathematics itself, the part played by Jews of European countries in the development of this science is well known; and I would like to hope that from the precincts of this building we are erecting here, Jewry will present mankind with many proper gifts in the form of discoveries and inventions of theoretical and practical importance. It is our wish that this edifice will prove to be of great benefit to the pure science that knows no limits between nations; our fervent hope is that this recognition will go forth from Zion and penetrate the hearts of those who today hold a very different opinion. (Ibid.)

Among the lectures given during the opening celebrations of HU, one also finds Landau's contribution, which bears the title "Solved and Unsolved Problems in the Elementary Theory of Numbers" – שאלות פתורות וסתומות בתורת המספרים האלמנטרית (Landau 1925a; see fig. 1). Apparently, this was the first time that a lecture on higher mathematics was presented in Modern Hebrew in a university context. This blending of a language that was regarded as ancient and oriental with pure mathematics, which was regarded as an expression of Western thought in its most modern abstract form, might have been interpreted by certain members of the audience as indicating the

possibility of realizing one aspect of the Zionist vision – the orientalist dream of integration between "east" and "west," between "past" and "future."[6]

Many prominent Jewish scientists, including Albert Einstein, were keen supporters of HU. Mathematicians and physicists like Jacques Hadamard, Tullio Levi-Civita, and Leonard Ornstein were members of HU Academic Council. Unlike all these, however, Landau not only participated in the inaugural ceremonies, but also took the very exceptional step of moving to Jerusalem. He arrived with his wife Marianne, two daughters, and a son shortly before the fall term of 1927–28. At long last a scientific scholar who fitted the national desideratum that Jerusalem serve as a magnet for eminent Jewish scientists arrived at HU. In order to fully grasp his outstanding status among the first professors of this institution (about five in 1928) it is necessary to briefly elaborate on his background.[7] Landau came to Jerusalem from the world's leading center for mathematics and the exact sciences at the time, the University of Göttingen, where he had been appointed Professor in 1909. Previously he had completed his dissertation in Berlin in 1899, obtained the *venia legendi* two years later, and started teaching as *Privatdozent*, with special status of professor. In many respects, Berlin and Göttingen represented two different and even opposing German mathematical traditions. Berlin came to mathematical prominence after 1860 under the overshadowing presence of Edward Ernst Kummer, Karl Weierstrass, and Leopold Kronecker. Following a typical neo-humanist orientation, this triumvirate concentrated on two mainstream fields of research in pure mathematics: analysis and number theory. They reworked much of the foundations and advanced techniques of these two vast, fundamental fields, leaving aside all appeal to geometric intuition as a possible guiding principle. They showed no interest in exploring how mathematical tools could be applied to the sciences, or in solving problems suggested in physics or other neighboring fields.[8]

The mathematical institute at Göttingen began its accelerated development as an alternative center of scientific excellence after 1892 under the energetic leadership of Felix Klein. Besides the personal and institutional opposition between the two centers, they also developed different conceptions of the aims and methods of mathematical research and its relationship to the natural sciences. Taking inspiration from the two giants of Göttingen's earlier generation, Karl Friedrich Gauss and Bernhard Riemann, Klein by no means dismissed the value of purist approaches, but sought to pursue, side by side with number theory and analysis, a much broader range of subjects, including geometry in all its manifestations and applied mathematics of all sorts. Klein

[6] For a discussion of this romantic-orientalist component in the architecture of the Einstein-Wattenberg building, see Shapiro 1997 and Dolev 1997.

[7] A full mathematical biography of Landau has yet to be written. Meanwhile the reader may consult the nine volumes of his *Collected Works*. The plan for the tenth volume, yet to be published, is to include biographical documents, photographs, facsimiles etc. See also Katz 1988 and 1997, Fuchs 1989, Schappaccher 1989.

[8] The classical and most detailed study of mathematics in Berlin appears in Biermann 1988. For a more recent, concise account, see Begehr et al. 1998; see also Knobloch 1998; Pyenson 1979; Pyenson 1983; Schubring 1989; and Tobias 1989.

developed extensive links with mathematicians all around Germany, as well as in Britain and Italy, and with scientists, engineers, and local industrialists. He created new mathematical journals and venues and further developed existing ones (above all the *Mathematische Annalen*) where his collaborators could freely pursue their own interest and techniques and where his unified picture of mathematics, both pure and applied, could be adequately deployed (especially in the ambitious *Encyklopädie der mathematischen Wissenschaften mit Einschluss ihrer Anwendungen*).[9] However, the master stroke for realizing Klein's plan for a new center in Göttingen came in 1895 with the appointment of the rising star of German mathematics, David Hilbert. Dominance was consolidated in the coming years with the arrival of Hilbert's life-time friend and collaborator, Hermann Minkowski in 1902, and later on, the arrival of such luminaries as Carl Runge, a leading expert in numerical calculus, Ludwig Prandtl, founder of aerodynamics and modern hydrodynamic research, and many other outstanding talents.[10]

When Minkowski died unexpectedly in 1909 at the height of his innovative research in collaboration with Hilbert on the mathematical foundations of relativity theory (Corry 2004, chap. 4), Landau was appointed to fill the vacancy, in what seemed to many a rather unlikely choice.[11] Analytic number theory being his main field of research, Landau was the quintessential representative of the Berlin tradition. In this exquisite combination of the two main broad fields of attention at Berlin, Landau had made important contributions, among them his contribution to the focal problem of the distribution of prime numbers. Moreover, the personal style he developed in his well-known textbooks and in his carefully prepared lectures was the ultimate depuration of the underlying spirit of the Berlin mathematical culture: he loathed practical applications of mathematics (under which he included geometry) dubbing them *Schmieröl* (grease), and in fact never referring to them directly. His texts consisted of uninterrupted and unmotivated successions of definitions, axioms, theorems, and proofs, in which the main aim was total, uncompromising rigor. This "Landau style" became highly influential in twentieth-century mathematics (Rowe 1986, 438; Schappacher 1989; Schappacher 1998).[12] Thus, Landau's integration in the Göttingen community was peculiar because he essentially differed mathematically in style and focus of interest from his colleagues and many local students. Socially, his significant family wealth added to this difference. Still he was highly respected not

[9] For a detailed account of the *Encyklopädie* project and Klein's role in it, cf. Hashagen 2003, 487–522.

[10] The mathematical culture of Göttingen under Klein and Hilbert has been the subject of numerous studies, such as Corry 2004; Reid 1986; Rowe 1986 and 1989. See also the article by David Rowe in this collection.

[11] In explaining his choice of Landau, Klein was reported to have said, "Landau is very disagreeable, very difficult to get along with. But we, being such a group as we are here, it is better that we have a man that is not easy" (Reid 1986, 118). Of course, no one disputed the high quality of his mathematical abilities. See Einstein on Landau in note 39 below.

[12] This rigorous style also became one of the principal targets in the attack on "Jewish mathematics" in the Nazi regime, which ultimately led to Landau's being forced to stop teaching at Göttingen in 1934.

only for his outstanding talents but also for his dedication to work, both teaching and research, and for his professional and personal honesty. In his many years at Göttingen, Landau remained a respected, though somewhat foreign, representative of the Berlin mathematical culture.

Landau's move to Jerusalem in 1927 raises two questions. First, what motivated him to leave, even temporarily, his cherished chair in the ideal working environment of Göttingen for the "*Wüste und Kamele*" (desert and camels) of Mandatory Palestine, with only 80,000 Jewish inhabitants in the early 1920s, and 180,000 at the end of the decade (Bachi 1957)? Second, what prompted the first national Jewish university to choose "pure mathematics" as a research field, even endowing it with a special research institute?

Landau came from a wealthy and respected Berlin family that combined German patriotism with extensive engagement in Jewish matters, mainly matters concerning the cultural life of the Jewish-German minority. On his mother's side Landau was descended from the Jacoby family, a Berlin family of bankers. His father, *Geheimrat* Leopold Landau, professor of medicine and gynecologist to the Prussian royal family, was arguably a descendant of Yehezkel Landau, the *Noda' bi-Yehudah* (the well-known of Jehudah/Judah), one of the greatest rabbinical authorities of Eastern and Central European Jewry in the eighteenth century (see *Encyclopedia Judaica* 4:1395; Fraenkel 1938a).[13]

Leopold Landau was deeply involved both in political affairs of the German capital and in matters concerning the cultural life of the Jewish-German minority. He also supported the Berlin *Akademie für die Wissenschaft des Judentums* (Berlin Academy for Jewish Studies) founded in 1919 and he was a keen supporter of Jewish cultural enterprises, including founding Hebrew schools in Palestine.[14] His concern in promoting the interests of Jewish students from Eastern Europe who came to study in Germany led to Leopold Landau's encounter with the young Chaim Weizmann when the latter stayed in Berlin around the year 1902 (Weizmann 1949, 40).

Edmund Landau's connections with the HU project began when it was *really* in its embryonic planning stages. In 1913–14 Weizmann intended to enlist support for his project from Paul Ehrlich – undoubtedly the socially most visible of German Jewish scholars and a famous medical researcher. Since Ehrlich's daughter was married to Edmund Landau, Weizmann asked Edmund's father, Leopold, to approach Ehrlich and ask him to agree to see Weizmann.[15] Ehrlich thus came to support Weizmann's

[13] Evidence of Landau's overt Jewish identity may be found in the fact that he was the sole Jewish mathematician among the many Jewish colleagues at Göttingen who was a member of the local synagogue community (see Schappacher 1989).

[14] See Weizmann's letter to Leopold Landau (Weizmann 1974, no. 215, 25 January 1914); *Encyclopedia Judaica* 4:1395.

[15] In the course of time, Weizmann asked L. Landau to keep Ehrlich's initial enthusiasm about the HU enterprise. See Weizmann's letters to Leopold Landau (e.g., Weizmann 1974, no. 230, 4 February 1914, 241–242; no. 246, 19 February 1914, 262–263, in note 1 to this document, the editors mention a letter from L. Landau to

initiative to create a kind of Pasteur or Rockefeller Institute in Jerusalem, a modest component of the grand program for a complete university, which Baron Edmond de Rothschild of Paris was ready to support (Reinhartz 1985; Weizmann 1949, 139–141; Weizmann 1983, paper 23, 113–115). However, the outbreak of World War I brought the project to a halt. And yet, what had begun as a request within the framework of family relationships evolved into more public activity when, in 1914, Leopold Landau tried to convince his son Edmund to participate, at least ad-hoc, in recruiting famous Jewish scientists as supporters of Weizmann's project (see Weizmann 1949, 141).[16]

There is no evidence that Edmund Landau thought at that time that he himself might head the mathematics institute at Jerusalem.[17] There is no doubt, however, that after his father's death in 1920, Landau became involved actively not only in HU's matters, but also in other initiatives concerning Jewish academic life in Palestine.[18] Moreover, and interestingly, in the early twenties, or even earlier, Landau began to acquaint himself with Modern Hebrew or at least its mathematical aspects, vocabulary, and writing rules. One of the few overt demands at HU was compulsory lecturing in Hebrew. Unlike some of his colleagues who at the time of their appointment did not master Hebrew, Landau was already capable of expressing himself in Hebrew when he moved to Jerusalem.[19]

Landau's letters from Jerusalem show that he was moving toward a more traditional Jewish and Zionist identity. Many letters were written in Hebrew and dated according to the traditional Hebrew calendar, marked as written in "Jerusalem the Holy City," and signed according to traditional Jewish conventions, i.e. first name followed by his priestly status: *Yehezqel ha-Levi*. This name had the significant, family resonance of his ancestor, the great Torah sage the *Noda' bi-Yehudah*. There is, however, no evidence that Landau's family shared his national or semi-religious sentiments that forced them

Weizmann) and to Strauss (Weizmann 1974, no. 235, 9 February 1914, 248–249); see also Weizmann 1949, 143, 145.

[16] According to his father, Edmund Landau approached Prof. Richard Wilstätter, who was at that time Director of the Kaiser Wilhelm Institute of Chemistry, regarding the Medical Research Institute in Jerusalem (see Weizmann's letter to Vera Weizmann in Weizmann 1974, no. 280, 24 March 1914, 299–300).

[17] From a letter from Weizmann to 'Ahad Ha'am, we learn that Edmund Landau hinted to Weizmann that he is ready to recommend for the future HU "a very good Jewish (Russian) mathematician, nationally-minded, with command of Hebrew, whose knowledge qualifies him for the post of Dozent in the Higher Institute" (Weizmann 1974, no. 22, 4 April 1913, 32–33).

[18] This includes Landau's contributions in Hebrew and in German to a volume of articles by prominent Jewish scientists and scholars that was compiled and edited, at least nominally, by Albert Einstein (Landau 1923; see also Velikovsky 1978).

[19] One of Landau's students in Jerusalem was Arieh Rappoport, whose son Professor Zvi Rappoport showed me three copybooks his father wrote in Hebrew while attending Landau's lectures. Apparently Benjamin Amira helped Landau polish up the Hebrew text he had written. According to Edmund Landau's son Matthias, Landau hired a Hebrew teacher for his family while still in Göttingen. I would like to thank Mr. Yuval Fuchs for this information, based on an interview he had with the late Mr. Matthias Landau at the Nelly-Sachs-Haus in Düsseldorf, in 1992. See also notes 43 and 66 below.

to take part in the Zionist-mathematical adventures of Edmund Georg Hermann (Poggendorff 1959, 10), now Yehezqel ha-Levi.

The university's Board of Governors and the Academic Council drew plans for an institute of pure mathematics at a meeting some days after the inauguration.[20] This decision was apparently influenced by Landau's willingness to move to Jerusalem, even though the minutes of the meeting suggest that there was more of a debate about basic issues than an *ad personam* discussion:

> Dr. Weizmann is suggesting founding an institute for pure mathematics. It is proposed to initially appoint one professor and two assistants. . . . This [founding an institute for pure mathematics] must and can be done immediately, since these subjects are most suitable to the Jewish nature,[21] do not require very great expenses,[22] and there is also the possibility of acquiring first-class teaching staff. [The board] delegates Dr. Weizmann and Dr. Magnes power of authority to offer Professor Landau the Chair of Pure Mathematics.[23]

Landau notified the governing bodies of HU of his willingness to come to Jerusalem in order "to open the Mathematics Institute," but the dignitaries of the university did not waive the accepted academic procedure. At the following meeting in 1926, Landau requested that he not attend one of the sessions, and it was the French mathematician Jacques Hadamard who "suggested inviting Landau to open the Institute and assist in its construction."[24] This suggestion was accepted and the chairman "asked Landau to return to the meeting and transmitted to him the decision of the Board of Governors." Landau informed his colleagues that he would "request a leave of absence from his university's administration," which he hoped they would grant.[25]

[20] Chaim Weizmann was the president of the Board of Governors and Albert Einstein the chairman of the Academic Council, which functioned as a nominated senate. Edmund Landau was a member of both bodies. See, for example HU-YB 1927–29, 51–53. On Einstein's resignation and his differences with Weizmann and Magnes, see Parzen 1974 and Rozenkrantz 1997.

[21] As to the wording regarding the connection between Jewishness and "pure mathematics," it is reminiscent of the early-twentieth-century controversy concerning the "over-inclination" of the Jews to "abstract thought" and "over-spirituality" (Pinl and Furthmüller 1973; Rowe 1986; Rabkin 1995; Hollinger 1996 and 2002; Volkov 2001; Almog 1992; Schappacher 1989 and 1998).

[22] On the moderate "expenses" of pure mathematics, compare Einstein's position, as cited by Magnes. Einstein preferred theoretical physics to experimental physics in HU, until "more organic needs are met" (Magnes 1934, 15). Magnes also quotes Landau as saying that mathematics is "die billigste und Judischste Wissenschaft [is the cheapest and most Jewish science]" (see Goren 1982, 242–250).

[23] *Minutes of the First Session of the First Conference of Board of Governors of The Hebrew University*, Tel Aviv, 12 April 1925, HUA, Board of Governors and Academic Council Files. See also *Minutes of the Second Session of the First Conference of the Board of Governors of The Hebrew University*, Tel Aviv, 12 April 1925, 8, HUA, ibid; *Minutes of the Second Meeting of the Board of Governors of The Hebrew University*, Munich, 23 and 24 April, 1925, 8, paragraph D [English version], HUA, ibid.

[24] Hadamard began his involvement with the HU project in 1914, at Weizmann's initiative (see Weizmann to Simon and Lesser, in Weizmann 1974, no. 328, 13 May 1914, 363–364).

[25] *Minutes of the Third Session of the Third Conference of the Board of Governors of The Hebrew University*, London, 1–3 August 1926, 29–31, HUA, Board of Governors files.

A mathematics library was subsequently founded at HU, consisting mainly of a collection from the private library of Felix Klein, which HU bought on Landau's suggestion after Klein's death in 1925. This was supervised by Benjamin Amira (1896–1968), a young Israeli mathematician and a close associate of Landau during his temporary residence in Göttingen.[26] Between 1922 and 1924, Amira had been Landau's student and assistant at Göttingen for five semesters, and he thus enjoyed the latter's full trust. He became the first tenured staff member of the fledgling institute, and was also delegated by Landau to supervise the construction of its building and arrange additional matters for its opening. A document written by Amira according to his revered mentor's will testifies to Landau's views on the scope of activity in the new institute:

> The work of the Institute will begin when the initial teaching and research staff arrive. Professor Landau has suggested fixing the initial number of staff members in the following fashion:
>
> a. One Professor for pure mathematics;
> b. One Dozent who will lecture according to the general plan;
> c. A librarian, to overlook the collection of models (the Dozent and the librarian are also to serve as scientific assistants to the Professor).[27]

Landau's Period in Jerusalem and the Opening of the EIM, 1927

Landau arrived in Jerusalem for the fall term of 1927–28. Although some introductory courses in mathematics were given by Amira in 1926–27, Landau's arrival enabled HU to inaugurate a new institute, at least symbolically, and to offer regular instruction in mathematics, at least temporarily. In that year HU changed its academic policy by altering the original purist decision of concentrating on research institutes only, while delaying regular undergraduate instruction for a long period. The revised policy opted for professional training and regular instruction within the faculty of Humanities (see Parzen 1974; see also Heyd 1999).[28] EIM was destined to function within this new

[26] See Amira to the Registrar of HU, 6 May 1928, HUA, Amira File, HU-YB 1939, 129. Many interesting books and offprints originally belonging to Klein's library are still in the cellar of EIM, though they might be much better organized or cataloged. I thank Leo Corry for this information.

[27] *Memorandum of the Mathematics Institute, submitted to Magnes on 25 November 1925*, HUA, EIM files. Another option was "Professor, *Dozent* and full assistant, aided by an external lecturer" (Magnes to Landau, 1 August 1929, HUA, Fekete file [Hebrew]).

[28] In the *Minutes of the Fifth Conference of the Board of Governors of The Hebrew University,* London, 3–5 June 1928, HUA, Board of Governors Files, it was resolved that students of mathematics would not be credited as for "degree courses" (section 6, "Regulations Governing the Transitional Period").

faculty until the faculty of science was set up. About thirty women and men applied for admission to EIM in October 1927.[29]

Landau taught two courses (Theory of Numbers and Elements of Analysis) and also offered exercises in the above lectures (1 hour for each course . . . with the help of Dr. B. Amira) (HU-YB 1927–29, 85–86). Amira taught Differential and Integral Calculus (6 hours weekly) (ibid.). In order to round out the curriculum of 1927–28, Landau enlisted as "external teachers" three mathematicians living or residing temporarily in Jerusalem, whom Landau knew previously from Göttingen.

First was Divsha Amira, who at that time taught at the Hebrew Gymnasium in Jerusalem, and whom Landau defined as the "only geometer in [Israel]." She had taught for several years in Geneva, after obtaining a doctorate there with the explicit support of Landau for a dissertation she had written at Göttingen. At EIM she taught various courses on geometry. Later on, in 1938, she published an introductory school textbook on geometry that followed the axiomatic approach introduced by Hilbert in 1899 in his famous *Grundlagen der Geometrie*. In 1963 she published a more advanced textbook on the same topic.[30]

Second was I[tzhak] J. Schoenberg, who taught Algebra and Determinants (4 hours weekly) and, together with B. Amira, Exercises in Algebra and Geometry (2 hours weekly) (ibid.). Schoenberg was born in 1903 and raised in Rumania in a fervent Zionist family. He was also a student of Landau's at Göttingen during his three years of study in Germany. This was followed by a junior appointment in mathematics at Jassy University. He stayed in Jerusalem for only a short period and there he met his mentor's daughter Charlotte. They married and emigrated to the United States, where he developed a very distinguished career (Schoenberg 1988, 1–10).

Third was Ze'ev Chajes, then a teacher at the Mizrahi Teachers Seminar in Jerusalem. Together with Amira, he taught Exercises in Differential and Integral Calculus (2 hours weekly). After studying mathematics at Göttingen with Landau, he was appointed to an untenured position at the University of Tchernovitz, but was forced to leave because of anti-Semitism.[31]

Until the mid-1930s, HU's structure was provisional, with three heads and without an academic head, that is, a rector. Weizmann, who still resided in London, was both head of the Board of Governors and President of the University. For some years,

[29] Document of the "Admission Committee" of HUA, EIM File 16, and HUA-LF. Landau regarded at least two of them as distinguished students (Landau to Magnes, 28 March 1928, Hebrew handwriting, HUA-LF). In one of his public speeches, referring to the opening of EIM, Magnes remarked: "how keen the Jewish mind is for mathematics. It is impossible for us to admit all of the splendid young men and women who want to come to the university for the study of mathematics" (Magnes [1927] 1936, 42–43).

[30] Divsha Amira née Etin graduated the second class of the Herzlia gymnasium of Tel Aviv in 1914 (Ben-Jehuda and Offek 1970, 642). For Landau's evaluation of her work, see Landau to Magnes, 21 March 1928, [Hebrew], HUA, EIM Files, no. 16. Details about the courses she taught appear in HU-YB 1927–29, 85–86; HU–YB 1929–30, 137–138.

[31] Chajes, a memorandum "My Biography" [Hebrew], 30 December 1928, HUA Chajes, or Chayoth file.

Albert Einstein, who lived in Berlin, was the chairman of its Academic Council. But it was Judah L. Magnes who in practice headed HU. Although not entitled to wear an academic cloak, he was the man on the spot who spent all his energies at this new institution. Indeed, where both Weizmann and Einstein failed, it was mainly Magnes who succeeded in securing the money needed for building up HU and overseeing its everyday functioning. Probably he interpreted his English title, Chancellor of the Hebrew University, as akin to the role of an American university president.[32]

Landau arrived in Jerusalem some two years after he had declared his willingness to join HU for a limited period. His contract mentioned an appointment for "a visiting professor from Göttingen." But once in Jerusalem, he was approached by the university executive with the suggestion that he "ascend to Jerusalem as permanent professor."[33] This suggestion was not answered. It seems that differences of opinion with Magnes, on both petty matters and matters of principle, led Landau to realize how limited his scope of influence would be as head of the institute.[34] Landau also felt discomfort because of the unsuitable working conditions in Jerusalem and was particularly angered by the fact that the construction of the EIM building had not been completed before his arrival. He eventually decided to leave Jerusalem and in his letter of resignation he claimed: "The scales were weighted negatively from the day I arrived [in Jerusalem] since the institute was not completed until the last day of the semester."[35]

However, it seems that what offended Landau most was the appointment of the university's academic head. Weizmann, Einstein, and other founders and supporters purported differing opinions regarding the central institutions of the university, such as the board of governors, executive committee, academic council, senate, and academic head (Parzen 1974, 9–10).[36] There is no evidence to prove that Landau had prior expectations that he would be offered the post of academic head. In fact it was Magnes who suggested Landau's candidacy and Landau merely agreed, or at the very least did not refuse it.[37] But Landau was unaware of the fact that by raising this candidacy, Magnes was trying to by-pass the Academic Council's authority over such nominations. Weizmann and Einstein interpreted Magnes' move as another

[32] For a biography of Judah L. Magnes, see Goren 1982. For his role in the first years of HU, see Goren 1997. On the role of HU's chancellor, cf. HU-YB 1939, 7–8; and the Hartog report.

[33] Landau to HU Executive Committee, 21 Shvat תרפ״ח [1928] (Hebrew handwriting), HUA-LF.

[34] See for instance their debate on the question of who should establish the salary of junior faculty (Magnes to Landau, 25 March 1928, HUA-LF; Landau to Magnes, 11 Nisan, תרפ״ח [1928] Hebrew, HUA-LF).

[35] Landau to HU Executive Committee, 21 Shvat תרפ״ח [1928] Hebrew handwriting, HUA-LF; Landau to HU Executive Committee, 11 Nissan תרפ״ח [1928]. The Einstein-Wattenberg building, housing EIM, was inaugurated at the end of that year. Landau did not attend this ceremony and made do with sending a greeting written in Hebrew. Cf. Landau to Magnes, [September? 1928] HUA, EIM files.

[36] See Parzen 1974, 7–13 for a summary of the different opinions of the members of The Hebrew University Academic Council in 1928 concerning the various models of allocation of academic and administrative authorities among contemporary German (academic rector), English (vice-chancellor) and American (president) heads of universities, and the bearing of these models on the case of HU (see also Hartog report).

[37] Magnes to Weizmann, 28 April 1928. HUA-LF.

manipulation in Jerusalem, and despite its harm to Landau, refused.[38] In addition, Weizmann and Einstein were convinced that the position of academic head should be bestowed on another younger and more energetic mathematician, an opinion that they politely phrased as follows: "We both felt . . . that Prof. Landau should not be burdened with this administrative function." Their preference was Selig Brodetsky, Professor of Applied Mathematics from Leeds and, like Landau, a member of both the Board of Governors and the Academic Council of HU.[39] Although the negotiations regarding the nomination of the academic head were carried out in secrecy, news of the opposition to his candidacy reached Landau. As a result he reneged on his initial agreement to serve in this position, and, perhaps due to this affair, he left Jerusalem at the end of the fall term and returned to Göttingen with his family.[40]

Landau's publications from 1928 to 1933 do not give Jerusalem or HU as his address.[41] This may be interpreted either as a sort of symbolic settling of accounts with his temporarily adopted academic home, or as a true reflection of his mathematical unfruitfulness there.[42] The latter is the more plausible hypothesis as Landau did not hesitate to include an unconventional autobiographical note mentioning his work in Jerusalem in one of his 1929 articles. In fact he even incorporated Hebrew words in the German text when he stated that he had dealt with a certain problem when teaching in Göttingen and in Jerusalem in his lectures on *yesodot ha-'analizah* (יסודות האנליזה – elements of analysis) during the winter semester of תרפ״ח (1927–1928) (see Landau [1929] 1984-9, [620] 87).[43] In any case, the outcome of the Jerusalem experience

[38] "I see in all these obstructions nothing else but components in a grand scheme of sabotage in order to paralyze the implementation of the sweeping reform promoted by us" (Einstein to Weizmann, 29 May 1928, quoted in Parzen 1974, 16–17).

[39] Weizmann (in London) to Magnes (in Jerusalem), 13 March 1928, in Weizmann 1978, Document 360, pp. 401–403; Weizmann (in London) to Einstein (in Berlin), 13 March 1928, in Weizmann 1978, Document 359, pp. 399–40. Although pure mathematics was compatible with Einstein's idea that because of financial shortage HU has to prefer theoretical subjects over experimental ones, concerning Landau himself he thought that Landau's mathematical areas of specialization were too narrow (Einstein to Leo Kohn, presumed of late March 1928, German, JNUL-AA).

[40] Fuchs (1989) elaborates on this affair, especially from Magnes' and Landau's point of view. Brodetsky, too, withdrew his candidacy for the position of academic head when it became clear to him that he was not the only candidate (see Brodetsky 1960, 119). Seven years later, in 1935, Prof. Samuel Hugo Bergman was appointed Rector, that is the academic head of the university, by the Senate of The Hebrew University, which had just been founded. Parallel to the nomination of the HU Rector, Magnes became the President of HU. After Magnes' death in 1948, Brodetsky, in 1949, became the institution's second President.

[41] Based on the address noted in Landau's papers of 1928–1933 as they appear in Landau 1984-9, and in Landau's books written during this period.

[42] If this is the case, the interesting fact is that Landau preferred to blame Magnes' improper administrative capabilities rather than admit his inability to advance in his mathematical work away from his pampering Göttingen cabinet. However, it seems that the Jerusalem period did not affect Landau's creativity in the long run. During the years 1928–1933, Landau was prolific and published about 40 works.

[43] The full original text is: "auf diesem Wege bewies ich für Zuhörer im ersten Semester den Picardschen Satz in meinen Vorlesungen über יסודות האנליזה im Wintersemester 1927–1928 (תרפ״ח) an der Jerusalemer Universität und über Funktionentheorie im Wintersemester 1928–1929 an der Göttinger Universität."

did not influence Landau's sense of obligation to the HU enterprise. He continued to regard himself as responsible for the ongoing instructional program and for the more complicated process of recruiting a substitute for himself at the institute.[44] Concerning the instructional program, Landau wrote:

> I hope that from afar I shall be able to conduct all the mathematical affairs here until the new professor arrives. (I have left here exact plans for the three lectures – of Dr. Sh. [Shoenberg], Dr. B. A. [Benjamin Amira], and Dr. D. A. [Divsha Amira] – fully detailed), and in the future I shall also assist, if I shall be requested to do so.[45]

The 1928 spring term of EIM was conducted according to Landau's plan.

The story of the establishment of the institute for pure mathematics seems to suggest that personal factors were hard at work here. However, considerations of academic principles played a significant role too. The fact that the PR's program did not mention establishing an institute for pure mathematics suggests that opportunism, contingency, or chance were no less at work here than academic considerations and fundamental principles, which were, at best, mentioned for rhetorical reasons. After all, Weizmann, Einstein, and Magnes – who did not make much of an effort to persuade Landau not to leave Jerusalem – could have welcomed the latter's resignation and taken advantage of it in order to redefine the uses of the Einstein-Wattenberg Building that had been allocated solely to pure mathematics.[46] This was not the case, however. Moreover, as will be seen now, they consistently supported Landau in his search for a new director of EIM who would have a similar commitment to pure mathematics. The academic leaders of HU certainly were also motivated by a more fundamental, not only incidental, wish to perpetuate an institute for pure mathematics, and this motivation can be traced back to the issue of "science for its own sake."

The origins of the status of "science for its own sake" or "pure science" at HU has been explored elsewhere (Katz 1997). Pure mathematics would clearly fall into this category, of course. But apart from being a "pure science" par excellence, the special status conferred upon pure mathematics can be linked to two beliefs held by certain German Jews in enlightened circles of that time. The first was the belief that learning for

[44] HU already had a well-established precedent for a university institute directed by "remote control." The well-known orientalist, J. Horovitz of Frankfurt am Main "opened" in March 1926 the university's School of Oriental Studies. After lecturing himself for several weeks, he left strict instructions in Jerusalem for the research program that would be conducted there and a comprehensive curriculum that he would supervise from Frankfurt as "visiting director." This arrangement held for several years until Horovitz died in 1931 (see Magnes 1936, 293–296, and Katz 1997).

[45] Y. Landau to the heads of HU, letter of 11 Nisan תרפ״ח [1928], Hebrew handwriting, HUA-EIM.

[46] The Wattenberg building could have been used to house applied mathematics as well, thus befitting an institute directed by mathematicians like Brodetsky and perhaps fulfilling a promise given by Weizmann to Brodetsky that he would be the first professor of mathematics in Jerusalem (Barzilay-Yegar 1981, 267). While discussing Brodetzky's nomination to EIM Magnes argued that it means the cancellation of the "chair in pure mathematics." Magnes to Weizmann (and Einstein), April 24, 1928. English typewriting. HUA-EIM Files.

its own sake is one of the central characteristics of the tradition of the Jewish people as "the people of the Book" (Eilberg-Schwartz 1991). The second was the belief that the noblest human obligation is "to discover the truth" through "pure science" conducted as "free research." Thus, Weizmann declared that when HU joined the community of institutions that nurtured research for its own sake, another link would be added to "the long, unending chain of [Jewish] intellectual development [the most prominent of which are] the sages of Babylon and Jerusalem, Maimonides and the Gaon of Vilna, the lens-polisher of Amsterdam [Spinoza] and Karl Marx, Heinrich Heine and Paul Ehrlich" (Weizmann [1918] 1983).[47]

Hence it becomes clear why founding an institute of pure mathematics was presented as being compatible with both the national and the academic aims of the new university. Yet, the fact that Landau was at the head of this institute had additional ramifications. Landau personally nurtured the belief that "pure science" was linked to the "long unending chain of intellectual development" that was a traditional aspect of Jewish heritage. Concomitantly, he gave Mount Scopus the status of a world research center for mathematics.[48] Evidence of Landau's symbolic value and special role in combining the Jewish traditional ethos of studying *Torah* for its own sake (תורה לשמה) with the modern ethos of science for its own sake is manifest in the following passage from 1927 taken from one of the Yiddish newspapers in New York:

> The wheel of history comes around. About one hundred and fifty years ago, there lived in Prague the Ga'on Rabbi Yehezqel Landau of blessed memory, called by scholars "Noda' bi-Yehudah." The son of "Noda' bi-Yehudah," Rabbi Shmu'el Landau, was well known as a great scholar. The grandson of "Noda' bi-Yhudah," Rabbi Mosheh Landau, wrote the book *Ma'arakhey Lashon*. Today all their descendants are either completely or partly assimilated. However, in this time of (our) salvation, another genius has emerged among his descendants. But this time – a modern genius. One of the four greatest mathematical geniuses of the whole world. And he is a professor from the extolled Göttingen University, Dr. Yehezqel Landau, who bears the name of his great-grandfather. In the forthcoming winter semester he will be lecturing his lessons in high mathematics before students at the Hebrew University in Jerusalem. He has been drawn back to his original source, as if his great-grandfather gripped him by the nape of his neck and brought him to lecture here in Jerusalem. As he himself said, he feels that "the Torah has gone forth from Zion." Professor Landau continues in Jerusalem the chain begun by his great-grandfather, Rabbi Landau of Prague. (Wallman 1927)[49]

[47] The quotation is from the original Hebrew speech of 1918 (Weizmann [1918] 1983).

[48] Landau planned to bring to the Fourth International Mathematical Congress, to be held in the summer of 1928, the suggestion that the next congress be held in Jerusalem. He requested that this matter be brought first before the Board of Governors of HU. Magnes did not support the idea (Landau to the HU Administration, 6 Nisan תרפ"ח [Spring 1928], HUA-EIM Files).

[49] This report was signed by "Our special correspondent in Jerusalem"; the reporter witnessed Landau's opening talk at EIM. This report was transferred to Landau, after it was received in Jerusalem. One wonders who were the other three "greatest mathematical geniuses of the whole world" that this chronicler had in mind.

As mentioned above, unlike Einstein[50] and many other Jews belonging to the European and American scientific elite, who were recruited to work for HU but never actually joined the faculty,[51] Landau did come to Jerusalem. It is not surprising therefore that when the opportunity arose again for a person with the intellectual and symbolic status of Edmund Landau, this opportunity would be seized.[52] Landau's return to Göttingen did in no way alter this situation.

Fraenkel, Fekete, and the Perpetuation of the EIM's Pure Mathematics Program, 1928 Onward

As indicated above, Landau took upon himself the task of recruiting the next senior staff of EIM. In a memorandum to the heads of the university he suggested seven candidates, whom he ranked in his personal order of preference.[53] Thus, the position of full professor (*ordentlicher Professor*) was to be offered to Adolf Abraham Fraenkel of Kiel (1891–1965), and the position of Dozent to Mihály-Michael Fekete of Budapest (1886–1957). Should Fraenkel not accept, then Fekete was to be appointed as full professor, and Arnold Walfisz of Warsaw as lecturer.[54]

At the same time, and despite the rule of confidentiality agreed upon by those involved, Landau privately wrote to Fraenkel employing a double secret code: Hebrew and mathematics.

> I have decided to transfer mathematics in Jerusalem the Holy City to other hands, after I had the good fortune of inaugurating it. That is, after I return I hasten to make contact with the other specialists on the Directorate [HU governing bodies], in order to suggest at the next meeting (May?) several names in the well-known serial order. Yesterday I decided to suggest seven names for our professorial position, and in this order:

[50] For a recent short summary of Einstein's attitude to Zionism, see Rozenkranz 1998, 84–91.

[51] See the list of members of the Board of Governors and the Academic Council of The Hebrew University (HU-YB 1929–30, 86–88; Katz 1997).

[52] It is also not surprising that the matter of constructing a special building for The Mathematics Institute was advanced to first priority. With the exception of the Grey Hill estate, acquired by the university when it acquired all the lands of the estate, around 1913, and adjusted to the university's needs, and the building of The Microbiology Institute in 1923–1924 – the construction of The Mathematics Institute was in fact the first of the buildings constructed there, after the official opening of the university (see Wahrman 1997; Shapiro 1997; Dolev 1997).

[53] Landau to the Presidency of the Academic Council and the *Kuratorium* (Board of Governors) of HU (handwriting in Hebrew, without date, but, as noted, after the winter semester and after leaving Jerusalem, that is after his letter of resignation of 11 Nissan תרפ״ח [1928]) HUA, EIM Files.

[54] Walfisz was never appointed in Jerusalem. His successful career developed in Tbilisi but his ties with Landau lasted until the latter's death. See Lomadse 1964 and the website: *Professor Arnold Walfisz* http://www.rmi.acnet.ge/person/walfisz/. I would like to thank Allan Pinkus for the reference to this website and for additional information on Walfisz.

primo loco – Fraenkel
secundo loco – X1 = X2 = X3
tertio loco – Y1 = Y2 = Y3

(the meaning of Xr and Yr are confidential for you too).[55]

After having studied at Munich, Marburg, Berlin, and Breslau, Fraenkel received his doctoral degree at Marburg in 1914, where he became *Privatdozent* in 1916 and *ausserordentlischer Professor* in 1922. Then, in 1928 he was appointed full professor and director of the seminar of mathematics at Kiel, a position he relinquished in 1933 (HU-YB 1939, 135; Van Rootsellar 1972). Fraenkel's international reputation began with the publication of the first edition of his *Einleitung in die Mengenlehre* (Fraenkel [1919] 1946).[56] He had gone to Marburg following advice from his uncle, the Freiburg mathematician Alfred Loewy, who like Fraenkel was an orthodox Jew. The leading mathematical figure at Marburg was the brilliant number-theorist Kurt Hensel, a follower of both Karl Weierstrass and Leopold Kronecker, and himself a typical representative of the classical Berlin tradition. In this sense, Fraenkel's mathematical roots converge with Landau's, which explains to a certain extent his strong predilection for pure mathematics. Still, it must be stressed that Fraenkel's mathematical tastes departed from the distinctive Berlin ones in important respects. First, research on set theory was never a main topic for the Berliners, and, moreover, the most notorious opponent to the theory when it was introduced by Georg Cantor in the late nineteenth century had been Kronecker. Under the influence of David Hilbert, research in set theory, and particularly research into the axiomatic foundations of set theory, at the beginning of the century had been seriously undertaken in Göttingen by Ernst Zermelo, on whose work Fraenkel was later to elaborate. Second, Fraenkel's earliest incursions into the axiomatic method were taken in relation to Hensel's system of *p*-adic numbers, under the influence of Loewy, and with an evident disinterest from the side of Hensel. Loewy introduced into Germany the methods of postulational analysis, developed in the United States at the beginning of the century, when ideas originally devised by Hilbert were taken in a direction not foreseen (and probably disliked) by him.[57] Thus, Fraenkel espoused a unique mathematical background in which typical Berlin ideals merged with some Göttingen-related ones (and their derivatives), but certainly not with that part of the Göttingen tradition that encouraged interaction

[55] Landau to Fraenkel [Hebrew], 13 Nisan תרפ״ח [1928], JNUL-FA. The idea of writing to Fraenkel in Hebrew, as a secret language, pleased Landau, who continued to amuse himself with writing postcards containing rather personal matters in Hebrew to his colleague. He stressed the fact that only the two of them would understand the messages. There is a similar, more explicit letter concerning the candidates and their mathematical achievements from Landau to the presidency of Academic Council and the *kuratorium* (Board of Governors) to London from Göttingen 29.5.1928. German typewriting. HUA-EIM files.

[56] For a bibliography of A. A. Fraenkel, see Bar-Hillel et al. 1961. For a short scientific biography and for an extensive bibliography see Van Rootsellar 1972. For Fraenkel's autobiography, especially his German period, see Fraenkel 1967.

[57] For additional details on Fraenkel's early mathematical career, see Corry 2003, chap. 4.

and mutual influence with the applications of mathematics and the natural sciences. Thus, the combination of scientific distinction, Jewish traditional background, and overtly Zionist orientations made his candidacy most "natural" and compatible with the academic ideals of HU.

While considering the invitation to join EIM, Fraenkel also took into account other, non-mathematical factors. Responding positively to the call from Jerusalem was for him a logical, yet not an easy, move. Due to his orthodox education, Fraenkel had already mastered Hebrew as a child.[58] As a devoted religious Zionist, Fraenkel had already taken an interest in HU several years before being invited to Jerusalem.[59] At the same time, this religious background was also the source of significant doubts. As a follower of the orthodox tradition,[60] he doubted whether joining a Jewish, non-religious institution such as HU was correct. The encouragement of Abraham Itzhak Hacohen Kook, Chief Rabbi of Eretz-Israel at the time, and Samuel Klein and Simcha Assaf, two rabbi-scholars who were already among HU's staff, dismissed Fraenkel's hesitations.[61]

Still, some hurdles had to be overcome on the way to a final decision. On the academic level, Fraenkel had to deal with a complicated situation. To justify his application for a lengthy leave of absence shortly after having accepted the appointment at Kiel, he conducted negotiations both with his university and with the minister responsible for higher education in the government of the *Land* in charge of the University of Kiel. He also approached the Ministry of Foreign Affairs in Berlin in this regard, arguing that HU was in its formative period, and that there was a danger of its being taken over by British influence.[62] Perceiving himself as a representative of German academic life, he wanted to serve as an emissary in Jerusalem in the service of what he called the German culture propaganda (*deutsche Kulturpropaganda*).[63] Finally, Fraenkel's request was granted.

Fekete obtained a doctoral degree in 1909 at the University of Budapest, under Leopold (Lipót) Fejér, who in turn had studied with Herman Amadeus Schwartz,

[58] However, in negotiating with HU to come to Jerusalem, he requested assistance in Hebrew mathematical terminology. B. Amira was selected to assist him (Magnes to Fraenkel, 18.7.28, Hebrew typewriting, signed as 24/54, JNUL-FA).

[59] Fraenkel's earliest article concerning HU is probably from 1919 (Fraenkel 1918–1919; see also Fraenkel 1924).

[60] That Fraenkel considered himself an orthodox Jew is apparent from Fraenkel 1924.

[61] Rabbi Kook's responsum to Fraenkel's inquiry is brought as facsimile in Zivoni 2001. See also Fraenkel 1967, 190–191. Kook as well as Assaf and Klein stressed Fraenkel's future contribution to the influence of Jewish orthodoxy in HU. Assaf to Fraenkel, 2 Tamuz תרפ״ח [1928]; Klein to Fraenkel, תרפ״ח [1928] [Hebrew] JNUL-FA.

[62] Fraenkel to the Curator of the University of Kiel, June 7, 1928, JNUL-FA; Fraenkel to *Legationsrat* Sobernheim at the Prussian Ministry of Foreign Affairs (of the government of the German *Reich*) in Berlin, June 7, 1928, JNUL-FA; Fraenkel to the Minister of Scientific Research, Arts, and Education (of the *Land*-government) at Kiel, February 8, 1929, JNUL-FA. I would like to thank Dominique Trimbur for drawing my attention to this matter. For the broader context of Fraenkel's approach to the German Ministry of Foreign Affairs, and the latter's cultural policy and interest in British Mandatory Palestine, see Trimbur 2001 and Trimbur 2003.

[63] Fraenkel to Herrn Minister für Wissenschaft, Kunst und Volksbildung, Kiel, den 8 February 1929, JNUL-FA.

Weierstrass' successor at Berlin.[64] With these indirect Berlin roots as background, Fekete went to spend some time in Göttingen before starting his teaching career back in Budapest.[65] While Fekete's mathematical aptitudes were unquestioned, his international status did not compare to that of Fraenkel.[66] Being a *Privatdozent* at the Loránd Eötvös University of Budapest, Fekete would have welcomed the appointment in Jerusalem as a golden opportunity to improve his status, though outside the Central European academic system. Indeed, it was obvious that such an appointment would be that of full professor and director of the institute. Thus, while Fraenkel was considering his reply, it is no surprise that Fekete hastened to accept the invitation from Jerusalem.

When a positive reply was received from Fraenkel as well, HU was in a quandary. The original plan, as Landau suggested and mentioned above, was for EIM to have only one full professor.[67] The decision reached by HU was to appoint Fraenkel as *ordentlicher* professor (full professor) of mathematics and director of the institute, and to compensate Fekete with the status *professor ad personam*. Although Fekete would continue to be paid the salary of a lecturer and actually teach in an un-tenured position, he would still enjoy the symbolically important rank of professor and consequently, unlike a lecturer, he would enjoy full autonomy in teaching and research. In addition, due to Fraenkel's generosity or collegiality, Fekete would act as co-director of EIM.[68] Thus, with its 21 regular students and 16 auditors seeking mathematical studies (HU-YB 1927–29, Appendix 8),[69] a framework was set up for EIM that resembled the

[64] I would like to thank Allan Pinkus for making me aware of Fekete's connection to the Berlin tradition through Fejér.

[65] See Fekete to the Registrar of HU, 26 October 1928, HUA Fekete File; HU-YB 1939, 134; Agmon 1956; "Mathematical Papers of Prof. M. Fekete" 1956. Fekete was awarded the Israel Prize in 1956.

[66] For Landau's high esteem of Fekete, see his letter to the members of both the Academic Council and the Board of Governors from 29 May 1928, JNUL-EA [in German]. There is a Hebrew version of this letter, probably written by (or dictated to) Amira, in JNUL-FA, undated. Landau remarks there that Fekete masters classical Hebrew, and that he will no doubt be capable of lecturing in Hebrew within four months, like Landau himself.

[67] Magnes to Landau, 1 August 1929 [Hebrew], HUA-LF. In the coming years Magnes wrote: "There is no need at present at this small University to create a second *permanent full* Professorship in Pure Mathematics [which implies] additional financial burden" (Magnes 1934, 32; emphasis in original). Here Magnes strongly opposes the recommendation made in the Hartog report favoring having both Fekete and Fraenkel as full professors in EIM (Hartog report, 25–26, 213).

[68] This arrangement came about gradually. Until "the beginning of the 1929/1930 academic session [when] Professor Fraenkel [assumed] his duties," Fekete was appointed acting head of the institute (HU-YB 1927–29, 23). In 1931–32 and 1932–33, when Fraenkel returned to Kiel and was considered to be on leave from Jerusalem, Fekete, as Professor ad personam, served as director of the institute (Hartog report, 26 [citing the Board of Governors, 1931]). The Hartog report "recommended that Professor Fekete be associated with Professor Fraenkel as Joint-Director of the Mathematics Institute, the two professors to be identical in status, title, and salary," ibid. In 1935, Fekete would also gain the status of "full professor of [pure] mathematics." See the extensive correspondence concerning his academic status and salary in his HUA file and in HU-YB 1939, 134.

[69] For comparison, according to Richard Courant, reporting in 1938, at the University of Berlin in some years more than 600 students registered for a single course in number theory, and as many in calculus and analytic geometry. At Göttingen courses of functions of complex variable were attended by up to 330 students. In

more typical framework of mathematics at the universities of Erlangen and Köln at the time.[70] Under these previously unforeseen circumstances, the academic status of EIM's two senior teachers enabled it to offer a major curriculum in pure mathematics only (see below). No less important, EIM now had senior representatives of two central, pure mathematical specializations: mathematical analysis taught by Fekete and the foundations of mathematics taught by Fraenkel.

As mentioned above, a certain degree of contingency had been involved in establishing an institute for pure mathematics at HU. However, this happenstance had germinated in the soil of a proper academic ideology, which allowed even for the creation of two positions for professors at EIM. Yet, along with the perpetuation of the university heads' apparent commitment to pure mathematics, the early organization of HU into faculties and the beginning of systematic academic instruction produced new institutional dynamics with important consequences for EIM. Indeed, HU, which had started as an umbrella organization for a couple of autonomous research institutes, had to cope time and again with the requirements of teaching. In 1928, major and minor subjects began to be offered, and the public demand for professional training and professional qualifications became more significant (Heyd 1999). In these circumstances, and without any overt intention to change the original mission of EIM as an institute devoted to pure mathematics, applied mathematics was also considered by the university's authorities as an appropriate subject to be taught at EIM. This recommendation was received ambiguously, at best, by the professors. The following section is devoted to considering this affair more closely.

The Exclusion of Applied Mathematics from EIM

Starting in 1928, precisely in the short *interregnum* between Landau and Fraenkel and Fekete, the authorities at HU passed a series of resolutions pursuing the addition of applied mathematics to the curriculum. The first of these concerned the "organization of systematic degree teaching within the Faculty of Humanities." Thus, the Board of Governors and the Academic Council decided:

> [Pure] Mathematics is now credited by the Faculty of Humanities as a minor Subject . . . a plan is now under consideration of making Mathematics a major subject after adding to

highly specialized and advanced courses 50–100 students could often be found, many of them also preparing for teaching jobs (Courant 1938).

[70] The *Minerva* yearbooks of 1923 and 1928 list 23 German universities with at least one *Ordinarius* (full professor). While in most of them there were two or three *Ordinarii*, München, Berlin, and Göttingen had seven, six, and five *Ordinarii*, respectively.

> the present syllabus *a course on Applied Mathematics* (HU-YB 1929–30, 15–16; emphasis added; see also 148).[71]

This move, which directly connected upgrading the status of the mathematics curriculum with the introduction of applied mathematics, was also related to a more general plan to establish a faculty of science and to open it in 1932 (though it was actually opened in 1935). This plan would require "considerable strengthening of the science departments. . . . As a general introduction to these courses, introduction in Mathematics, Physics, General Chemistry, and Geology is to be given" (HU-YB 1929–30, 16–17). In 1931 the Board of Governors and the Academic Council were even more specific when they defined operational steps in this direction: "It was further placed on record that for the complete course of mathematics the establishment of a *lectureship in applied mathematics was indispensable* and that it shall be established as soon as funds permit . . . Mathematics [to] be recognized as major subject for purposes of graduation" (emphasis added).[72]

This trend gained additional momentum in early 1934 when the university authorities received their copies of the *Report of the Survey Committee of the Hebrew University of Jerusalem* (hereafter Hartog report). Headed by Sir Philip Hartog, a chemist and later well-known British university administrator, this committee had been established at the end to appease Einstein's extreme criticism of HU, especially the academic policy of its chancellor (Magnes 1936, 211–212; Parzen 1974; Rozenkranz 1997). The committee also included Dr. Radcliff Salaman, a medical doctor and research geneticist and virologist, and Professor Louis Ginzburg, a Talmudist, perhaps the most prominent Jewish scholar in the United States at the time. In its confidential and very influential report, the committee candidly praised EIM, pointing out that "this department, which deals only with pure mathematics, is one of the strongest in the university [and its personnel] is perfectly capable of conducting both research and teaching" (Hartog report, 25). However, as far as applied mathematics was concerned, the committee stated: "We think that on account of its [applied mathematics'] great practical importance at the present day a member of the staff should devote himself to the study and teaching of *modern statistical methods and their practical applications* to subjects as economics, biology, psychology and education (Hartog report, 25; emphasis added; see also idem, 213).[73]

[71] The Faculty of Humanities was organized in 1928–29, and a year later, in 1929–30, mathematics began to be credited by this faculty as a minor subject within its scope (*Minutes of the Second Academic Council of The Hebrew University*, August 16 and 18, at Zurich, HUA, file 137).

[72] Official Text of the Resolutions Adopted by the Board of Governors and the Academic Council of the Hebrew University at Their Conference at Zurich, July 21, 22 and 23, 1931. HUA, File 1210. English version, p. 1.

[73] This paragraph explains the sense of the term "applied mathematics" as the SCR saw it, which they distinguished from "mathematical Physics" (Hartog report, 25). See Fraenkel's explanations below.

Thus, going beyond earlier recommendations, the Hartog report stressed not only teaching, but also study of applied mathematics as well as its connections to practical application. But while the authorities of HU were debating changes in EIM's previous academic policy and considering operational steps to implement such changes, the attitude, and especially the public pronouncements, of EIM's leaders toward these plans also underwent their own evolution: from sympathetic or even determined at the beginning of this period, to almost total disregard at its end.

Mathematics was initially included within the faculty of humanities at HU mainly for organizational reasons. For mathematicians like Landau, however, this also made sense from a conceptual point of view, since they had no difficulty in perceiving themselves as promoters of the humanities. Indeed, before his arrival in Jerusalem, Magnes tried to persuade Landau to give up the plan for a special building for mathematics, and to open his institute within the premises of another building to be devoted to humanities and Jewish studies. Magnes argued that mathematics belongs to humanities and that Landau was a well-known supporter of such a position: "No one has been keener than you to point out the fact that mathematics is preeminently one of the *Geisteswissenschaften*."[74] Fraenkel could also easily identify with such a position. As a specialist in set theory he was naturally led to discuss questions pertaining to the relationship between logic and mathematics, and thus with at least some aspects of philosophy, about which he lectured quite often (see, e.g., Fraenkel 1929).[75] Fraenkel's nomination as the first chairman [dean] of the Faculty of Humanities (Magnes [1930] 1936, 113, HU-YB 1939, 7, 79) not only concurred with this basic attitude, but also with the recommendation "that Professor Adolph Fraenkel be requested to lecture on the relations of Philosophy and Mathematics [and] serve the needs of the Institute of General Humanities" (Hartog report, 213 and 23). However, different views about mathematics and its proper academic affiliation were also strongly voiced by, among others, Selig Brodetsky.

As early as the 1925 ceremony laying the foundation stone for the Wattenberg building, the applied mathematician Brodetsky had insisted that research in applied mathematics was equally important, if not superior, to the pure one:

> The applied mathematician fulfills the important task of acting as the bond of union between physics and mathematics. The applied mathematician brings to the aid of the physicist the mathematical equipment to solve the problems encountered by the physicist. He also brings to the [pure] mathematician knowledge of realities of nature and prevents him from losing himself in barren speculations. (*Inauguration* 1925, 108–109)

[74] Magnes to Landau, 8 March 1927. HUA, EIM Files and File 16[3].

[75] Fraenkel was even fond of connecting these topics with questions of Jewish religiosity (see, e.g., Fraenkel 1918, and Fraenkel 1925).

Brodetsky also chaired a HU committee that recommended reforms in the academic policy of HU and the introduction of regular instruction at Mount Scopus (Heyd 1999). His recommendations were approved by the HU Board of Governors and Academic Council, which included among its members other prominent Jewish mathematicians, such as the French Jacques Hadamard and the Italian Tullio Levi-Civita. The latter might not have shared Brodetsky's insistent views about the centrality of applied mathematics in the realm of mathematical research, but they were certainly closer to him in this regard than to the Berlin-oriented purity professed by Fraenkel and by Landau prior to him. It is safe to assume that they did endorse Brodetsky's views on the value of introducing more applied-oriented mathematics at HU, at least for educational purposes (for Hadamard, see Maz'ya and Shaposhnikova 1998, 135–136; 36).

There is evidence that, before permanently settling in Jerusalem in 1933, Fraenkel supported the idea of introducing applied mathematics to EIM. He not only placed the subject on the agendas of the HU authorities on various occasions, but also made some attempts to recruit proper candidates for a new post in EIM.[76] One might adduce pragmatic considerations for this initial attitude, such as the desire to secure an additional junior post for EIM, or Fraenkel's unwillingness to challenge mathematical authorities like Hadamard, while his personal future either in Jerusalem or in Kiel, as well as the future of EIM, were not entirely clear. On the other hand, he may have also acted on more principled considerations, such as the intention to enrich the curricula offered by EIM to its first students and a desire to upgrade mathematics from a minor subject to a major one. At this time, the institutional circumstances at HU also favored such an attitude on the side of Fraenkel. Thus, for instance, the above-mentioned decision of the Board of Governors and the Academic Council in 1931 to introduce applied mathematics to EIM implied that the institute's academic staff would comprise two professors (instead of one, according to Landau's earlier program), and two junior (pure) mathematicians. The post for an applied mathematician would be an additional post, contingent on the availability of proper funding. At the same time, HU authorities consented to Fraenkel's personal financial demands for joining HU permanently. These circumstances, however, changed in the aftermath of the Hartog report that coincided with Fraenkel's return to Jerusalem. As mentioned above, the report did not limit itself to stressing the need for the teaching of applied mathematics at EIM, but was

[76] JNUL-FA contains letters sent during this period to half a dozen mathematicians in Europe, such as Landau, and the United States, such as Paul Epstein at Cal Tech, asking their opinion especially on Julius Rosenhead and Sidney Goldstein (Fraenkel to Epstein, 26.5.1930, JNUL-FA). The latter eventually came to the Technion in Haifa in 1950, but in 1955 he accepted a chair in applied mathematics at Harvard. Other young applied mathematicians that Fraenkel suggested were Alexander Weinstein, Hilda Pollaczek-Geiringer and Paul Nemenyi (form letter to a "Kollege" of 30/6/1930, German typewriting, HUA-EIM Files). Later Fraenkel argued that his efforts to recruit promising young applied mathematicians for HU, during the years discussed here were made in order to further his plan brought to Magnes to establish a special department for applied mathematics in HU (see Fraenkel to Sir Leon Simon, chairman of HU executive council, 8.11.48, Hebrew handwriting, HUA EIM Files).

very specific about what kind of applied of mathematics this should be. Clearly, this specification was way beyond what Fraenkel and Fekete understood, and were willing to admit, as the legitimate and desirable kind of mathematics to be undertaken at EIM.

After 1933, both Fraenkel and Fekete probably had achieved enough personal and organizational self-confidence to stir up recommendations of this kind and to manipulate the HU demand for applied mathematics according to their own academic values and interests. Fraenkel had gradually become one of the leading academic figures at HU, both officially and informally, to such a degree that Magnes saw him as a potential threat to his own hegemony at HU.[77] No doubt Fraenkel's personal relationships with international figures, like Einstein, contributed to his special personal status at the institution.[78] Following his appointment, as mentioned above, as chairman of the Faculty for Humanities around 1930, he became the acting dean of the newly founded Faculty of Science, 1936–1938, and rector in 1938–1940. This being the case, Fraenkel may have felt more comfortable expressing his opinions freely and not compromising in realizing Landau's original academic views. His public statements concerning a senior appointment for applied mathematics definitely began to change when he took his post as acting dean of science. In this new post, Fraenkel increasingly came to express more radical, purist attitudes regarding mathematics. For instance, he encouraged students to register in mathematics as a major subject, together with two minor subjects in the humanities, while arguing that for him the virtue of pure mathematics lay exactly in its lack of usefulness:

> Such a suggestion is based on both theoretical [pure] and practical arguments. The first is that there is no possibility to think of mathematics as a [field belonging to] natural sciences, and if a student will choose minor subjects only of humanities, he demonstrates his will to occupy himself with mathematics as a pure science and not with its applications in natural sciences.[79]

In discussing a proposal for further developing the faculty, Fraenkel still claimed that the university had a vital need to teach applied mathematics, both for mathematics itself and for other sciences like biology, which needed statistics. However, in contradistinction

[77] "Professor Fraenkel has canvassed members of the Board of Governors privately on various matters. . . . If the atmosphere at the University is to be cleansed, it must be apparent that it is a large concession to agree to Prof. Fraenkel's presence at all" (Magnes 1934, 32).

[78] Einstein's relationship with Fraenkel became stronger after Fraenkel's decision to come to Jerusalem. Fraenkel became Einstein's informant about Mount Scopus affairs (Fraenkel to Einstein, 13.7.30, JNUL-AA, German hand writing, Fraenkel 1967, 170–175). In the Fraenkel Files there is a great amount of correspondence with many of the most prominent contemporary scientists and scholars. For example, in JNUL-FA there are letters from the Jewish historian Adolph Büchler from London (October? 1931), the physicists Neils Bohr from Copenhagen (11 June 1931), and Herman Bondy from Wien (13 April 1937), the philosopher Edmund Husserl from Freiburg (27.1. 1931) and the historian of science Alexander Koyré from Cairo (26.1.41).

[79] The Acting Dean Fraenkel to the Rector of The Hebrew University, 27 February 1936, HUA, File 231 [Hebrew].

to his previous insistence on the allocation of a new lectureship for this field, he now implied that some member of EIM could take over this duty.[80] Fraenkel, whose responsibility now included manning the Einstein Institute of Physics, tried to explain to his non-EIM colleagues what the English term "applied mathematics" really meant as opposed to the German *angewandte Mathematik*:

> In the field of applied mathematics one has to differentiate between what is called in Central Europe as *angewandte Mathematik* and what is called in England *applied mathematics*. The second belongs, according to our view, in the framework of our university, to physics. In contrast with it, *angewandte Mathematik* belongs entirely to the framework of the [Einstein] Institute of Mathematics. And part of it, that is some methods of geometry, even belongs to pure mathematics.[81]

This claim was more than empty rhetoric invoked in order to advance his views. The different approaches of Berlin and Göttingen mathematicians to what pure mathematics would involve, and the varying attitudes even towards what many considered the archetypal pure mathematical branch of geometry were already mentioned above. The case with applied mathematics was even more convoluted, especially given important developments over the prior twenty years. On the one hand there were indeed some well-established and very productive traditions, such as the British (especially Cambridge) and to a certain extent the French and Italian ones, for which applied mathematics was a main, if not *the* main focus of attention, and which differed in important senses from the German, especially Berlin, conceptions.[82] On the other hand, the history of physics since the turn of the century had also brought about new definitions of the boundaries and interrelations among disciplines, some of them just recently consolidated, including theoretical physics and mathematical physics.[83] The development of the theory of relativity introduced after 1907 some even more complex questions concerning the relationship between geometry and physics, and concerning the borderlines across all the above-mentioned disciplines and sub-disciplines (see Corry 2004 and Rowe 2001). Finally, the application of mathematical methods – statistical and

[80] Fraenkel to the Rector, 14 May 1936, HUA-FF. The pressure to introduce statistics into the university curricula came especially from the biologist F. S. Bodenheimer, who was keen at that time to give mathematical representations to his biological observations (e.g., in Bodenheimer 1936). Bodenheimer tried to interest Max Schiffer and Arieh Dvoretsky, among the first Ph.D.s of EIM, in mathematical studies of animal populations. The collaborative work of these mathematicians in cooperation with the zoologist Bodenheimer would be published many years later (see Bodenheimer 1959, 477 and 480).

[81] Fraenkel to [the rector] Bergmann, 14 May 1936, HUA-FF [Hebrew]. Compare: Protocol of session of the rector Prof. L. A. Mayer with Prof. Frankel, Prof. Fekete and the Mr. Shneerson, financial secretary of HU, concerning a chair for applied mathematics. The same explanation for the differences in the meaning of applied mathematics in England and America and in Germany, Switzerland and Sweden, and the appointment of Dvoretzky (see below) were discussed in this occasion. Hebrew typewriting, 3/7/1944. HUA, File 231.

[82] For a recent, comprehensive account of the Cambridge tradition of mathematical physics, see Warwick 2003.

[83] As described for the dominant German context in Jungnickel and McCormmach 1986, especially vol. 2.

others – to disciplines like biology (including agricultural research) or economics had even less clear status within the general panorama of the applications of mathematics to the sciences (see Israel and Gasca 2002, and Weintraub 2002). Definitely, such applications were not within the scope of what the term *angewandte Mathematik* implied for someone like Fraenkel, namely differential equations and rational mechanics.

In dealing with the university authorities, these subtleties must have added to the difficulties created by the different institutional interests that each of the parties brought into the fray. For one, it should come as no surprise that in preparing the Hartog report, the British academic background of Hartog and Salaman laid much greater stress on applied over pure mathematics.[84] Fraenkel insisted on separating what belonged to the proper organizational framework of EIM and what belonged to the non-mathematical HU institutes. Concerning EIM, he aspired to keep its spirit of pure mathematics. There would be no problem in incorporating subjects of *angewandte Mathematik* into the EIM's curriculum, provided they could also belong to pure mathematics. And if there was any intention to create a new position for a mathematician destined to teach *angewandte Mathematik*, this could be secured for a researcher who was a pure mathematician to begin with.

By means of this strategy, Fraenkel succeeded in preventing any assault, such as that of the survey committee, on Landau's original definition of EIM as staffed by cultivators of pure mathematics. The Board of Governors, for instance, decided some months later that the duty of teaching statistical methods (applied mathematics) was to be conferred on a senior assistant of EIM.[85] At this time there were already two assistants serving at EIM. They were Jacob Levitzki whose specialization was linear algebra and who had joined the EIM in 1931, and Theodor Motzkin, whose main specialization was geometry, and had joined on 1934. According to archival sources, neither of them was obliged to take on this assignment.[86]

[84] It is indeed instructive to compare the notions employed by the Hartog report and by Magnes. Concerning physics the Hartog report recommends that the "Chair of Applied Mathematics (*Mathematische Physik*) be established, and filled by a German academic refugee. . . . Dr [Felix] Bloch [Nobel Prize 1952] has been suggested to this post" (Hartog report, 214). This quotation from the Hartog report also suggests an identification of applied mathematics with the application of statistical methods in biology, economics, psychology, etc. Nothing could be farther away from what Fraenkel meant by *angewandte Mathematik*. Magnes, in turn, opposed to this equation (i.e. applied mathematics = mathematical physics) a different equation when he referred to "[the] Chair of Applied Mathematics (or Theoretical Physics)" (Magnes 1934, 14). Brodetsky's terminology in his inaugural address of 1925 differed from these two.

[85] *Resolutions Adopted at the Tenth Meeting of the Board of Governors of The Hebrew University* 1936, 110, HUA. This protocol hints that the dean of the Faculty of Science considered this subject urgent, while the senate of HU did not share this point of view. To all of them it was clear that the implementation of this item, like other items of the new program for the development of The Faculty of Science, was dependent on new financial resources.

[86] Dr J. Levitzki, a former student of Emmy Noether in Göttingen, served as research assistant with Fraenkel for a period. He began his career in the EIM as junior assistant in 1931, according to Landau's plan discussed above. He became "senior assistant in mathematics" in 1934 (Biographical data, HU-YB 1939, 138. HUA Levitzki File). Theodor Motzkin studied in Berlin, Göttingen, and Basel; at the Hebrew University he was awarded "research scholarship" in 1934, and was appointed "senior assistant in geometry" in 1937 (Biographical data,

When the Faculty of Science of HU was organized in 1935, EIM had been attached to the new faculty, and "methods of statistics" did not appear as research or instruction area of EIM (HU-YB 1939, 63–66, HU-YB 1942, 43–44). In any case, from the mid-thirties onward, the teachers of the EIM answered the HU demand for applied mathematics by taking upon themselves preparatory courses of "Mathematics to non-Mathematicians," aimed for students of other disciplines.[87]

The rise of the Nazi regime in Germany provides the next milestone in this story. After the destruction of the most of the European centers of mathematical research by the Nazis, EIM remained almost the only mathematical institute that kept following piously the Berlin neo-humanistic mathematical tradition. Jewish scientists and scholars began to seek new academic posts abroad, but there is no evidence that any real effort was made by either the authorities of HU or by Fraenkel to clarify whether any of these mathematicians were prepared to consider coming to Jerusalem.[88] Fraenkel and the university authorities, on the other hand, did make a real effort to bring to Jerusalem prominent or young promising physicists, such as Georg Placzek, Felix Bloch, Fritz London, or Eugene Wigner, to serve in Einstein Institute of Physics (Chayut 1994; Unna 2000).

And yet, two mathematicians who defined themselves as applied mathematicians and who managed to escape the Nazis did arrive in Mandatory Palestine by their own means and established their new homes in Jerusalem. One of them, Samson Breuer, who had been professor of insurance mathematics at Karlsruhe and Frankfurt, ended up as chief mathematician in an Israeli insurance company.[89] The other was Wolfgang Sternberg, who had been professor of both pure and applied mathematics at Heidelberg and Breslau (see Siegmund-Schultze 1998, 109–110). If Fraenkel on behalf of the HU authorities wanted to implement the plans for a professorship in applied mathematics, either Breuer or Sternberg, or any of the many émigré Jewish applied mathematicians

HU-YB 1939, 139. HUA Motzkin File). See also Cantor, Gordon, and Rothschild 1983, 13-18; and the chapter devoted to mathematics in the consecutive editions of HU-YB 1939, 63–66; and HU–YB 1942, 43–44.

[87] Indeed it was Fraenkel himself who gave this "Lecture" with the assistance of Abraham Shimshon Amitsur who gave the "exercises" (see Fraenkel to HU administration, 3.8.49, Hebrew typewriting, HUA, File 231).

[88] In the *List of Displaced German Scholars* (1936, 1937) one finds the names of about seventy mathematicians, and in the short biographies of almost half of them, applied mathematics of some kind is mentioned as their specialty. Although the subject of their national identity is not mentioned, many of them were of Jewish origin. A more recent and updated, though perhaps not yet definitive, list appears in Siegmund-Schultze 1998, 292–298, and it comprises 133 mathematician émigrés, of which around 90 per cent are Jews. Around 34 of them can be considered in retrospect as more applied than pure, but as Siegmund-Schultze points out, this classification is sometimes problematic and even meaningless, since in many cases it was only after emigration that some of them moved away from their previous pure, into more applied research. See also Siegmund-Schultze 2003.

[89] Cf. *List of Displaced German Scholars* 1936, 51. That Fraenkel had some measure of appreciation for the professional level of Breuer is apparent from an obituary he wrote for his late uncle, Alfred Loewy: "I am indebted to Professor Samson Breuer for his help in the editing remarks dealing with Loewy's contributions to actuarial mathematics" (Fraenkel 1938b). Actuarial mathematics was only one among many mathematical fields cultivated by Loewy. As Breuer was educated also in Jewish orthodox frameworks, he certainly mastered Hebrew. So there is no question concerning his capability to teach in 1930s HU.

around the world would have been adequate candidates. If this did not happen, one can only speculate that Fraenkel pursued a different set of academic priorities at the time at HU.

However, two other German pure mathematicians of exceptional mathematical prominence – Issai Schur, the foremost algebraist of his generation in Berlin, and among the world leaders of his discipline, and Otto Toeplitz, a Göttingen graduate who had worked with Hilbert and later developed a very significant career in mathematical analysis in Bonn – arrived in Jerusalem. However they did not join EIM in real academic positions (ibid.). The most that HU could offer them were honorary or administrative appointments.[90] In contrast to what has been offered to Schur and Toeplitz there is evidence of an invitation for a chair in HU for Tullio Levi-Civita of Rome, considered by HU Board of Governors in 1938 (Minutes of the 11th meeting of the Board of Governors, paragraph 20). There is no evidence that arrangements of such kind were offered to Samson Breuer or Wolfgang Sternberg.

A final, noteworthy example of the wavering attitude towards applied mathematics in the early years of EIM becomes apparent in the case Arieh Dvoretsky, who earned his Ph.D. in HU in 1941 (HU-YB 1957, 218). In 1944, a local insurance agency donated a special grant to finance a teaching position for a member of EIM specializing in applied mathematics. The EIM directors considered it a good opportunity to secure the academic career of this very promising young mathematician, and the position went to Dvoretsky.[91] His teaching subjects included mathematical statistics and mathematics of insurance (HU-YB 1948, 50–51). With the transition from the more rigid German university organizational tradition to the more flexible American one, Dvoretsky, in 1951, became the third full professor of EIM. He and his colleagues became devout custodians of the exclusive pure-mathematics definition of EIM (Katz 1988, 66–82). Mathematics of insurance became an interesting curiosity in the teaching history of EIM.

Concluding Remarks

During the fourth decade of the twentieth century, with the voluntary emigration and enforced expulsion of scientists and scholars from Nazi Germany, new centers of

[90] Incidentally, Schur and Landau were the two outstanding students of the same teacher in Berlin, Georg Ferdinand Frobenius. Schur arrived in Jerusalem in 1939. As a sort of gesture of charity, EIM awarded him the status of Honorary Fellow and he was given a working office. As he joined HU after the publication of the university's 1939 Yearbook and died before the publication of the following 1942 Yearbook (HU-YB 1939, HU-YB 1942), Schur was not incorporated into HU's official memory. He died in Tel-Aviv (HUA, Schur File). Toeplitz was appointed Academic Adviser for the Executive Council of HU (HUA, Toeplitz File, a letter of nomination dated 13.6.39, signed by S. Schocken [Hebrew]).

[91] Protocol of 3 July 1944, in continuation to a decision of 20 May 1944, taken by the University Administration, EIM files, File 231. See note 81, above.

mathematical research were created. The great nineteenth-century German scientific heritage, which had hitherto slowly pervaded Europe and abroad, now dispersed to new intellectual havens. Former students of the German academic system carried their heritage to new harbors to anchor their scientific expertise, and implement their intellectual traditions from Istanbul to New York and Buenos Aires. Displaced mathematicians were part of this migration. Although it took place at roughly the same time, the founding of the EIM at HU belongs to a different kind of phenomena. The EIM was less the outcome of the push of anti-Semitism and Nazism, and more a result of the pull exerted by the Jewish national movement.

It was the Zionist vision that drove a few dozen scholars and scientists, most of them European, to prefer the new university in Jerusalem opened in 1925, over their mainly European *alma mater*. There is no other overwhelming explanation for Landau's coming for a short period to Jerusalem in 1928, followed by the arrival of Fraenkel in 1929. And it was a sort of mathematical idiosyncrasy of Landau, coupled with a certain variety of European national movement, Zionism, that embraced wholeheartedly pure science and its promotion as one of its exalted cultural ideals (a kind, so they tended to believe, of national transformation of the biblical "From Out of Zion Goes Forth Torah") that begot the pure-mathematics trajectory of EIM. Concomitantly, Landau, Fraenkel, and Fekete were proud intellectual inheritors of this variety of the Berlin tradition that not only conceived pure mathematics as a sublime neo-humanistic ideal, but also in parallel also disdained applied mathematics. Therefore EIM maintained the cultivation of pure mathematics only. Since the framework of European migration of the 1930s does not suggest itself as a proper comparative historical one for EIM case, a more general family of phenomena with more historical depth and geographical width invites attention. It is the comparative perspective of the process of implementation of Western science outside Europe.

Although nineteenth-century Ottoman Palestine was a locus for intensive European research, HU came into being as a new European organizational transplant without continuing, at least in institutional expression, the Bible studies or the *Palästinologie* enterprise of the nineteenth and early twentieth centuries.[92] By the time HU was inaugurated, Palestine was already under British Mandate, yet the British rulers did not interfere with HU matters, neither in its self-governance nor in academic appointments and research policy. They even failed to convince HU authorities to introduce limited instruction in English alongside the regular instruction in Hebrew.[93] Thus the Jerusalem-Israeli case challenges not only the dependency perspectives of the "spread of Western science" and its many intellectual scions but also questions the

[92] For especially the German research activity in nineteenth-century Palestine, see Goren 2003; Katz 2001.
[93] Ben-Israel (forthcoming). In 1932 the Palestine [British] Government began to contribute to the HU budget. In the coming years its contribution stood at about half per cent [!] of HU overall annual income. HU-YB 1939, 112–113.

possibility of the dichotomy of center/periphery and similar perspectives to suggest a useful framework for explaining the EIM and HU case.[94]

The EIM of the thirties and forties not only maintained the creative mathematical activity of its first-generation teachers and researchers, but also succeeded in perpetuating its mathematical heritage by cultivating a generation of novices who became creative mathematicians integrated in the international mathematical community.[95] From the perspective of the 1950s and beyond it is clear that the EIM, after the retirement of its first generation of teachers and researchers succeeded not only in filling its ranks mainly from former students, but also in perpetuating some degree of outstanding mathematical excellence (Katz 1988).[96]

It is therefore difficult to see how the case of EIM may be squared into the center/periphery dichotomy and consequently be regarded as peripheral or marginal. The perspectives of theories of consensus and cultural authority with their dichotomies of center/periphery, and metropolis/province (Hannertz 2001), or the newer theories of conflict with their concepts of center/margin, or metropolis/satellite and the wider political context of the hegemony of empires over their ruled colonies (Reingold and Rothenberg 1987; Petitjean et al., 1992; MacLeod 1987; MacLeod 2000) might not apply in the case of the EIM. Therefore, using the concept "subcenter" introduced by Horowitz and Lissak in their discussion of the Israeli cultural and political arena,[97] EIM and HU are considered a "subcenter of scientific research" or even better, a "secondary center of scientific research" (hereafter SCSR). SCSRs esteem metropolitan centers and share their scientific ethos, beliefs, and criteria, but strive to redefine the current scientific agenda. SCSRs do so either by suggesting new problems and innovative perspectives for their solution, or by framing new original perspectives and modes of coping to replace old unsolved ones. Moreover, based on the EIM example, the concept of SCSR suggested here for introduction into the historic discussion of the phenomena of scientific research in new spatial, cultural, or political contexts. The advantage of employing the notion of SCSR is that it broadens the repertoire of conceptual tools for

[94] Basalla's article (1967) is considered the first to open the discussion on the history of Western science outside Europe within a comparative outlook.

[95] Schott (1987) compared the mathematical productivity and the degree of international integration of Danish and Israeli mathematical communities. Schott claims that the very high mathematical productivity in Israel is connected with the Israeli high international integration.

[96] A report by an assessment panel of the U.S. National Science Foundation claimed, in 1998, that in some mathematical areas, like set theory and model theory, and half-dozen other areas, Israel (that is EIM and other research centers) shares leadership with United States, England, France, Russia, and a few other countries like Japan (Bordogna 1998, Appendix 2).

[97] In a discussion of nation-building processes in Israeli society during the British Mandate period, the Israeli sociologists, Horowitz and Lissak, introduce, after Shils, the intermediate notion of "subcenters." The subcenters, cultural, economic, political, and others, share with the peripheries the reverence for the center, both in its institutional and symbolic expressions. However, they compete with the latter for its monopolistic authority (Horowitz and Lissak 1978, 10–12, 72–73). In the original Hebrew version of this book the authors employ a Hebrew term for "subcenters" which is better translated into English as "secondary centers."

dealing, both diachronically and synchronically, with the "spread of Western science" from Europe to non-European contexts, and also with science in "small states," most of them European.[98]

Edmund Yehezqel Landau, having suffered in his last years in Germany by the hands of those who seized control of his mathematical homeland and were far from recognizing that "pure science knows no boundaries between peoples," might have found some comfort in the possibility that from the mathematical home that he constructed in Jerusalem there would emerge if not "great benefit for pure science," as he hoped, at least a humble SCSR – secondary center of scientific research.

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Abbreviations and acronyms

EIM	The Einstein Institute of Mathematics
HU	The Hebrew University of Jerusalem
HUA	The Hebrew University of Jerusalem Archive
HUA-FF	Hebrew University Archive, Fraenkel File
HUA-LF	Hebrew University Archive, Landau File
HU-YB	*The Hebrew University Jerusalem Yearbooks*
JNUL	Jewish National and University Library
JNUL-EA	Jewish National and University Library, Einstein Archive

[98] In Europe itself, scientific centers of the metropolitan kind, active outside the European core of large states and cultures, are not an uncommon phenomenon. The story of physics in Sweden as "center on the periphery" is well documented (Lindquist 1993). For a broader sociological and economic perspective on European small states, see Allapuro et al 1985 and Gal 2003.

JNUL-FA	Jewish National and University Library, Fraenkel Archive
PR	"Report [on] Preparations for the University in Jerusalem (to be submitted to the Annual Conference of the Zionist Organization)" (Preparation Report)
SCSR	Secondary Center of Scientific Research

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