Rothschild Prizes 2010
Fifty Years

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JERUSALEM

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The first meeting of the Rothschild Prize Committee took place fifty-one years ago at the home of its Chair, Professor Yigal Yadin. Since that time the State of Israel has grown, as have its institutions of higher learning. The scale of their achievements is reflected in the 122 Prize recipients since 1959, whom we celebrate today. Each of the winners embodies a tradition of learning passed down from one generation to the next, in a progression that should not be taken for granted. The recipients have shaped academic, and to no small extent, public life in Israel: University Presidents, a Nobel Prize winner, Presidents of the Israel Academy of Sciences and Humanities, a former Chief of Staff of the IDF and a former President of the State. Also among the laureates are generations of teachers and their students.

The essays in this booklet represent a diverse collection of personal reflections by Rothschild Prize recipients on the development of their fields in Israel over the past fifty years. Together, they remind us that while the award marks great past achievement, it also serves as a harbinger of future promise and an inspiration to excellence.

Jacob Rothschild

Chemical Sciences

PROFESSOR JOSHUA JORTNER
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The humanization of science will lead mankind to the Promised Land –Aharon Katzir

Prologue

The chemical sciences constitute the establishment of the experimental and conceptual framework for the structure, function and change of matter, as explored on the molecular level. This broad definition encompasses the concept of 'chemical imperialism'; whatever and whenever a scientific area involves molecular information it belongs to the realm of the chemical sciences. The traditional areas of chemistry, i.e., inorganic, organic, physical and biological, underwent interdisciplinary intrinsic unification. Furthermore, and most significantly, 'the walls are tumbling down' between the traditional disciplines of chemistry, physics, material science, nanoscience and biology with the emergence of the multidisciplinary, rich, diverse and broad field of the chemical sciences.

Chaim Weizmann, Chemist, Statesman and Zionist Leader

Among the remarkable accomplishments of Chaim Weizmann (1874–1952), the eminent organic chemist, the outstanding Zionist leader and the first President of the State of Israel, was the foundation of the chemical sciences in Israel. Weizmann studied chemistry in Berlin. Subsequently he conducted his research for the doctoral degree at the University at Freiburg, Switzerland, and in 1899 he submitted his dissertation on the reduction and condensation reactions of antrachinon. In the Senate Hall of the University of Freiburg two metal plaques are exhibited: one commemorating the thesis of Weizmann and the other in memory of a Catholic priest who studied at the university and was murdered by the Nazis in the 1930s. From 1900–1904 Weizmann held an academic appointment at the University of Geneva, where he was heavily involved in the activities of the Zionist movement, with the prevalent dichotomy between his public

Zionist service and scientific work, which would be with him throughout his entire life. His impressive scientific accomplishments (an excellent dissertation, three papers and five patents) induced William Henry Perkin, the incumbent of the first Chair of Organic Chemistry at the University of Manchester, to offer Weizmann an academic position in his department. From 1904–1914 Weizmann served as assistant, demonstrator and reader of Chemistry at the University of Manchester. He moved to novel areas of organic synthesis, studying a new class of compounds which can be turned into derivatives of anthracene. He was also active in lectures and in scientific service as the secretary of the Manchester Chemical Society, concurrently with his Zionist activities.

In 1910 Weizmann became involved in the important chemical project of producing synthetic rubber, which marked his interest in industrial, applied chemistry. The revolutionary idea was the advent of biotechnology for the synthesis of hydrocarbons from organic alcohols, which were prepared by fermentation of starch in potatoes. In 1912 Weizmann and his colleagues demonstrated that acetone could be produced by fermentation. One of the important uses of acetone was its military application, due to its ability to make gun powder 'smokeless'. With the beginning of the First World War, Weizmann placed his biotechnological process at the disposal of the British army. With his major scientific contribution to the British war effort, Weizmann became one of the world's first scientist-statesmen. World War I set the scene for Weizmann's full emergence as an important Zionist leader, the road being paved by his discoveries in chemistry. His reputation as a scientist gained him entry into the upper echelons of international diplomacy. Among his contributions as a scientist-statesman-Zionist leader was his major role in the attainment of the Balfour Declaration.

Weizmann's dual commitment to Zionism and to chemistry and his deep conviction that ideas can move people, led him to a leadership role in the establishment of The Hebrew University. In 1901 Chaim Weizmann, Berthold Feiwel and Martin Buber submitted to the Fifth Zionist Congress their first plans for the establishment of a university in Jerusalem. The Jerusalem university project was presented in 1902 in a letter written by Herzl to the secretary of the Turkish Sultan. Within two weeks Weizmann prepared a detailed plan for a Jewish university, encompassing a higher education and polytechnic institution. The recognition of the paramount importance of intellectual, spiritual, scientific and technological activities played an important role in the history of Zionism and of Israel, even before the establishment of the State. The establishment of The Hebrew University of Jerusalem in 1925, the Hebrew Technion in Haifa in 1924, and the Sieff Institute, which developed into the Weizmann Institute of Science, in 1934, were tangible expressions of this world view. Chaim Weizmann played the central role in its realization.

The Genesis of Chemical Sciences in Israel

The Hebrew University began its academic activities in 1924–5 as a research university, training graduate students. Chaim Weizmann was deeply involved in shaping the research policy and in the recruitment of scientific leaders in the chemical sciences. The first research institute was the Chemistry Institute, directed by Professor Andor Fodor (1884–1968). As Weizmann noted, the Chemistry Institute launched its activities 'with great enthusiasm'. Fodor was recruited by Weizmann in 1921 and was appointed as one of the first full Professors at The Hebrew University. The Chemistry Institute consisted of two departments: biological and colloid chemistry, and general chemistry. The research programme dealt with protein structure, enzymatic action, and theoretical colloid chemistry. Fodor considered these research areas as relevant for the understanding of life processes. The research area of colloidal chemistry was resurrected during the last two decades, with colloids providing large finite systems whose size effects form the basis for nanoscience. Concurrently, Fodor addressed applied chemistry, with a special emphasis on local problems. The integration of pure and applied research was in line with Fodor's commitment to contribute to the Zionist endeavour.

The 1920s marked a major change in the chemical sciences worldwide with the advent of quantum mechanics by Bohr, Schrödinger and Heisenberg. As early as 1927, a young scientist, Ladislaus Farkas (1904–1948), worked at the Technical University of Berlin on his doctoral thesis on the subject of quantum mechanical implications of photochemistry – quite a remarkable topic for the year 1927! The work of Ladislaus Farkas with his supervisor, Karl Friedrich Bonhoeffer, established the occurrence of resonances in intramolecular dynamics, providing experimental verification of the Heisenberg energy–time uncertainty relation in a chemical system. The seminal Farkas–Bonhoeffer work laid the foundations for the exploration of chemical change, i.e., dynamics, on the molecular level.

From 1924–1928 Ladislaus Farkas studied in Berlin. During the years 1928–1933 he acted as the assistant of Fritz Haber at the famous Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry in Berlin. In the dark days of April 1933, with the rise of the National Socialist Nazi party to power in Germany, Farkas was expelled from Berlin and found temporary refuge in Cambridge, England. In 1935 he accepted the invitation of Weizmann to take up the directorship of the new Physical Chemistry Institute at The Hebrew University. Ladislaus Farkas will be remembered for shaping the foundations, scope and standards of modern chemistry in Israel.

During the years 1935–1948 Ladislaus Farkas led an outstanding Department of Physical Chemistry at The Hebrew University. Under his leadership, the Department

conducted world-class research, addressing kinetics of hydrogen and deuterium reactions, charge transfer to solvent spectra, photochemistry of ions in solution, photochemical isotope separation, bromine chemistry and biocatalysis. A remarkable contribution of Farkas during that time was the pioneering of the field of photoselective chemistry, using UV lamps, rather than lasers! Two scientific contributions of Farkas in the areas of intramolecular dynamics (1927) and photoselective chemistry (1940) constitute cornerstones of modern physical chemistry. The impact of Farkas's scientific legacy on contemporary chemical sciences in Israel reflects a broad scope of outstanding experimental and theoretical studies of laser-driven dynamics, control and function in ultracold atoms, molecules, biomolecules, liquids, solids, interfaces, clusters and nanostructures, which are conducted at our research universities.

Further important contributions of Weizmann to the founding of chemistry in Israel were based on the establishment in 1934 of the Daniel Sieff Research Institute in Rehovot. During the planning stages, Weizmann searched for talented chemists and contacted Ernst David Bergmann (1903–1975), a brilliant organic chemist. Bermann studied chemistry in Berlin and was appointed as an Assistant Docent at the University of Berlin. In the spring of 1933, Weizmann met with Bergmann, who had just been expelled from Berlin, and offered him a position at the Sieff Institute. Bergmann enthusiastically accepted the position of the Founding Academic Director of the Institute. Bergmann's scientific work focused on organic synthesis and on reactions of hydrocarbons in oil, conducted in collaboration with Weizmann. From 1949–1951 Bergmann served as the Scientific Director of the Weizmann Institute. In 1951 he left the Institute, accepting a Professorship and the Directorship of the Department of Organic Chemistry at The Hebrew University where made important scientific contributions to the chemistry of alycyclic and polycyclic aromatic compounds, fluorine compounds of biological interest and natural products. Ernst Bergmann was the voice and symbol of science at the Ministry of Defence, making vital contributions to the founding and build-up of the infrastructure of the defence research and development system of the State of Israel.

In 1947 the Sieff Institute was renamed the Weizmann Institute of Science. The new research institute adopted a policy of encouraging young scientists. Among the first young scientists who were recruited by Weizmann to join the new Institute were Aharon Katzir-Katchalsky and his younger brother Ephraim Katzir-Katchalsky. Ephraim Katzir (1916–2009), the eminent biochemist and biotechnologist, who later served as the Fourth President of the State of Israel, left his mark on the development of modern biochemistry with his pioneering work on polypeptide synthesis and spatially fixed enzymes. Aharon Katzir (1913–1972) conducted his doctoral research in the

Department of Organic, Theoretical and Macromolecular Chemistry of The Hebrew University. His thesis addressed intermolecular interactions between biomolecules, a subject that would be central among his scientific interests. At the Weizmann Institute he established and led the Department of Polymer Research. Aharon Katzir was an eminent physical chemist who made great contributions to the broad area of 'soft matter' chemistry. These involved polyelectrolyte solutions as models of biopolymers, thermodynamics, electrochemistry and transport of polyelectrolytes and gels, reactions between polyelectrolytes and biological systems and their role in cellular organisation. Other major scientific contributions involved conversion of mechanical energy to chemical energy, the application of irreversible thermodynamics to biological transport, peptide polymerization under prebiotic conditions and the molecular basis of neurobiology. Aharon Katzir made central contributions to national science policy in the organisation and leadership of the defence research system and in the establishment of the Israel Academy of Sciences. He was a remarkable spokesman for science, as well as an outstanding and most inspiring lecturer. In 1972 Aharon Katzir was killed in a terrorist attack at Lod airport.

The great pioneers of the chemical sciences in Israel were remarkable personalities, combining outstanding scientific accomplishments with a deep commitment to the ideals and practice of Zionism and, later, to the State of Israel.

The Rothschild Prize in the Chemical Sciences

The establishment of the Rothschild Prizes by Yad Hanadiv in 1959 provided remarkable support, encouragement and advancement of scientific and scholarly creativity on the highest level. The distinguished Rothschild Prize in the Chemical Sciences was bestowed in 1961 on Ernst David Bergmann, a great pioneer of organic chemistry, and in 1971 to Aharon Katzir, the maverick of physical chemistry in Israel. Other outstanding laureates of the Rothschild Prize in the area of organic chemistry were: David Ginzburg (1964), the founder of the Chemistry Department at the Technion, for his work on synthesis of natural products and the invention of propellens; Abraham Patchornik (1988) of the Weizmann Institute, for his work on the use of polymeric reagents in peptide synthesis. In the areas of biological chemistry Michael Sela (1967), the President of the Weizmann Institute, was honoured for the discovery of vaccines for infectious diseases; and Meir Wilchek (1983) of the Weizmann Institute, for his work on biological affinity. In the area of organic–physical chemistry Edward Kosower (1996) of Tel Aviv University was recognized for his studies of solvation, charge transfer and biological processes. In the area of biophysical chemistry, Yitzhak Steinberg of the Weizmann Institute received the

Prize for his studies of structure and dynamics of molecules of biological interest. In physical chemistry, I received the Prize in 1975 for my exploration of the phenomena of energy acquisition, storage and disposal on the molecular level; Raphael D. Levine (1992) of The Hebrew University was honoured for the exploration of intermolecular dynamics; Zeev Luz (2000) of the Weizmann Institute for his studies of molecular structure, packing and dynamics interrogated by nuclear magnetic resonance; Joseph Klafter (2004) of Tel Aviv University and the Chairman of the Israel Science Foundation for his studies of molecular processes in complex systems; and Itamar Willner (2008) of The Hebrew University for his studies in nano-biotechnology and bioelectronics. This rich, broad and diverse scope of outstanding scientific accomplishments reflects on the interdisciplinary intrinsic unification in the chemical sciences.

It is a privilege to express deep gratitude and appreciation to The Rothschild Prize Organization for honouring outstanding scientists and the establishment of norms, values and the highest standards of scientific endeavour in the chemical sciences. The award of the 2009 Nobel Prize in Chemistry to Ada Yonath (a laureate of the 2006 Rothschild Prize in Life Sciences) for her studies on the structure of Ribosome – the protein factory – is tangible proof of the excellence of research in chemical sciences in Israel.

Professor Joshua Jortner received the Rothschild Prize in 1975.

Physical Sciences

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Physics is the most fundamental among the natural sciences. It attempts, usually with success, to formulate the basic laws which govern all natural phenomena, including those considered as the domain of chemists and biologists. The most fundamental laws obviously relate to the behaviour of the smallest objects, on one hand, and to the beginning of the universe, on the other. But the road from discovering a basic law to elucidating complex collective phenomena of large numbers of units is long and arduous. It is this journey that allows us to apply the laws of physics to technology issues, to the structure of complex materials, to living systems and to almost any other natural process or substance.

The history of physics research in Israel has travelled along all of these routes, and the Rothschild Prize has been awarded to scientists dealing with smaller and smaller units of matter, as well as to those attempting to understand the cosmos and to those who seek to uncover patterns of behaviour of complex systems, bordering on technological applications.

The Golden Jubilee of the Rothschild Prize is also a Bar Mitzvah of the physics prize. Of the thirteen physicists awarded the prize in its fifty years, ten are theoretical physicists and three are experimental practitioners. This asymmetry reflects a historical quality bias of Israeli physics, partly related to scarcity of resources, needed for sophisticated experimental apparatus, but also to a cultural inclination towards theoretical science.

Five of the theoreticians and one of the experimentalists dealt with the never ending chain of fundamental building blocks of matter, from the atom to its nucleus, onwards to the particles within the nucleus and further to the quarks within those particles. Three theoreticians dealt with the basics of the revolutionary theories of the 20th century: general relativity, gravitation and cosmology on one side and the fundamental elements of quantum mechanics, on the other. Two of the theoreticians and two of the experimentalists studied aspects of matter in its condensed forms, a topic which is

only one step removed from the entire world of electronics, microprocessors, electro-optic phenomena, microwaves and the like. Needless to say, the compartmentalization of physics research into the above categories is somewhat artificial, as all subfields of physics overlap, to some extent.

The shifting emphasis of the prizes, from one decade to the next, reflects the changing trends in physics research in the world and in Israel during these fifty years. Israel was first a one-man world centre of atomic physics (Giulio Racah); it then became a one-group world centre in nuclear physics (the Weizmann Institute), followed by a two-group centre of particle physics (Weizmann Institute and Tel Aviv University). In the last two decades, attention shifted to condensed matter physics and cosmology, and, happily, additional institutions contributed to the international success of Israeli physics.

To my best knowledge, the Rothschild Prize has been the only major science prize awarded in Israel exclusively to Israelis on the basis of international reviews, rather than on the basis of intra-national views and evaluations. This fact, together with the low frequency of the prize in any given field, makes it a very unique honour.

On a very personal level, I allow myself to note that I studied as an undergraduate in courses of two of the prize winners at The Hebrew University; my three supervisors for the MSc and for the PhD theses have all won the prize; another winner shared with me the Israel Prize; another was a PhD student of one of my advisors; two others were, respectively, my fellow undergraduate at The Hebrew University and my fellow graduate student at the Weizmann Institute and, finally, one winner was recruited to the Weizmann Institute by me, when I served as its President. I also hasten to add that I have never been a member of the jury of the Rothschild Prize, I have never been consulted by the jury and I do not know who recommended me and who was in the jury when I won the prize. This tells us first, that Israel is still a very small country and its world renowned community of leading physicists is extremely compact. It also tells us that role models, and individual scientists who establish dynasties of talented young followers, are still the best methods of transmitting the spirit and practices of creative research, from one generation to the next.

My own prize was awarded for work done during the 'hottest' decade in the history of particle physics, the 1970s. Without any false modesty, I can state categorically that whatever one achieved during that decade in particle physics research included a significant component of serendipity. You had to be lucky to be born and to be trained as a physicist just at the right time for actively participating in such a fantastic intellectual adventure. But we also know that in science almost everybody gets lucky on some occasion, but not everybody knows how to convert the lucky break into significant

achievements. If I had to rewrite what the jury said, I would claim: 'The prize has been awarded for making very interesting discoveries, while accidentally being at the right time in the right place.' Fortunately, it is not customary for prize winners to amend the verdict of the jury which gives them the prize.

I remember receiving the prize, as the youngest prize winner, so far, in physics, in a ceremony at the Knesset, presided over by Yigal Allon, then foreign Minister and Deputy Prime Minister in the first Rabin Government. As he was shaking the hand of the 34 year old winner, Allon literally whispered in my ear, on stage, near a microphone but inaudible to the audience: 'Haim, don't let this go into your head'. I will forever be thankful for that remark. I also remember that the prize money was exactly the sum needed to replace my five-year-old Israeli made Triumph by a new Fiat 131, creating an amusing indirect connection between the theory of quarks and the car industry.

Today, the role of physics as a tool at the service of chemistry, biology and other scientific fields has increased significantly. It is a safe bet that some future Rothschild Prize winners in the physical sciences will be physicists working in fields such as cell biology, systems biology, genetics, new materials and other related areas. But perhaps a renaissance of the march to the early universe and to the smallest particles will reappear on the horizon. One thing is clear: If we could now predict with certainty the results of the prize winners of the next fifty years, it would logically follow that these people would not be worthy of their prizes. The beauty of science is mainly in discovering the unexpected. The next crop of winners will undoubtedly do just that.

Professor Haim Harari received the Rothschild Prize in 1975.

Life Sciences

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As I began to write this piece, I encountered a serious problem: What is the definition of the term 'life sciences'? This difficulty does not arise in dealing with branches of science such as chemistry, biology, physics or mathematics, though the precise definitions of these terms have also undergone changes over time.

In view of the youth of this particular scientific discipline and the significant modifications that it has already undergone, the most appropriate definition I have been able to find is: *the study of living things*. This is a general definition that offers no indication whether the research is being conducted on animals or plants as whole organisms, or on cells or the molecules that comprise them. The development of life sciences in Israel over the past 50 years encompasses research in all of the above areas, with the main emphasis upon comprehensive and in-depth research on the laws of nature – from understanding the key processes in the lives of animals or plants as entire organisms, to a description of these processes on the molecular level and down to the level of atomic detail.

The Rothschild Prize in Life Sciences was first awarded in 1960, not long after the structure of DNA was decoded by Watson and Crick, based on the research of Rosalind Franklin. This led to a precise understanding of the organisation of the genetic code and of the possible linkage between the structure of DNA and the mechanism of passing inherited genetic information from one generation to the next. (DNA is a double helix, each strand of which complements the other by 'pairs' made up of the four bases of DNA – the double helix opens and each of the strands serves as the template for a new chain.)

In the 1960s Israeli science was in its infancy. The scientific community was tiny, as were budgets. Nevertheless, scientists in Israel were apprised of global developments; they paid close attention to the topics of research and adopted them, engaging in cutting-edge research from original perspectives. The decision to embark upon front-line research, without consideration for the level of technical and conceptual difficulty involved, was characteristic of the entire field of research in life sciences.

The first Rothschild Prize was awarded to Ephraim Katzir. Prof. Katzir guided and led innovative approaches to illuminating the characteristics of polymers of amino acids which simulate biological molecules. This research paralleled intensive activity in centres around the world (in particular in England), which led to the determination of the spatial structure of the proteins haemoglobin, myoglobin and lysozyme. The second Rothschild Prize, awarded in 1969 to Arieh Berger, reflected great progress on another track: biochemical research with an initial nod towards investigating structural features that determine the behaviour of enzymes. The understanding that the activity of enzymes was made possible by their three-dimensional structure and that the fold of each enzyme was unique and determined by the sequence of the amino acids that form them, had just begun to penetrate the entire world, including Israel. Revelations concerning the connection between the structure of DNA and the sequence of amino acids in protein were being researched in Israel and in the rest of the world simultaneously, and this pursuit opened the gates to molecular biology in the decade that followed.

The award of the Rothschild Prize to George Haas in 1963, to Yitzhak Bernblum in 1966, to Michael Zohary in 1973 and to Leo Sachs in 1977, demonstrates that the interest in animals and plants, and in describing the processes of life on a cellular level, continued side by side with molecular research. Animal and plant organism research, together with in-depth investigation of cellular activities with a biochemical and biomedical emphasis, as well as preliminary forays into structural biology, developed in the following decades. The award of the Prize to Hans Lindner in 1981, Michael Feldman in 1985, Alexander Levitsky in 1990, Shmuel Shaltiel in 1994, Ruth Arnon in 1998, Zvi Selinger in 2002 and to Yoram Gruner in 2010 represent the culmination of three decades of exciting activity which focused on the biochemical bases for past discoveries while pursuing groundbreaking research in monitoring the cell as a whole, the connection among cells and the interaction between the elements that comprise them. This was also a period in which impressive results were attained in biomedical research in the areas of immunology, infectious diseases, viruses, degenerative diseases, cancerous tumours, and in various genetic syndromes. Some of this research, which began with a basic desire to answer key questions, produced highly specialized pharmaceuticals. The best known of these is Copaxone, based on the research of Ruth Arnon and Michael Sela and manufactured in Israel by Teva. Additionally, structural research employing nuclear magnetic resonance and electron microscope techniques which generate important information (albeit limited in the level of precision and the size of the molecules it can study) flourished, largely due to the explosion of information and the knowledge it can create.

It is noteworthy that the fruits of the intensive biochemical and biomedical research carried out in Israel during those three decades enjoyed broad recognition throughout

the world. This was evidenced by the activity of Israeli researchers in international organisations conducting health-related scientific research (such as the World Health Organisation), by Israeli memberships in national academies of sciences in Israel, the US, Europe and even the Vatican (Michael Sela). In addition, Israel was among the initiators of the establishment of the European Molecular Biology Organisation (EMBO), in which over a dozen Israel scientists in the life sciences are active. An additional manifestation can be seen in the 'courting' of Israel by national research institutes (such as the European Synchrotron Radiation Facility (ESRF) in Grenoble), which offer an opportunity to carry out relevant research at the highest possible level.

Determination of structures of molecules or biological accumulations in order to shed light on the molecular mechanisms of extremely simple or highly complex processes, such as translation of the genetic code to proteins by ribosomes, is carried out by a method known as biological crystallography, i.e., research into the structure of molecules through the use of their crystals. Biological crystallography, which is an enormously important trajectory in life sciences, is a demanding multidisciplinary field that yields unique and illuminating information that cannot be obtained by any other means. Research in this field began in Israel in the 1970s, burgeoned to an unprecedented extent in the first decade of the 21st century (Ada Yonath, 2006) and branched out to form new areas, such as genomics and proteomics. Another relatively new field that has witnessed lively activity in Israel and is based on structural findings and genetic and biochemical information is the field of systems biology. It is dominated primarily by young researchers – our future generation – aspiring to describe the interaction and processes by which elements of a living cell communicate.

Particularly praiseworthy is research conducted in Israel for over three decades on the universal mechanisms of the life of proteins from their birth to their demise. This research attained international recognition – a Nobel Prize to Avram Hershko and Aaron Ciechanover in 2004 (degradation) and to myself in 2009 (creation). It should be pointed out that these Nobel Prizes were not awarded in life sciences, but in chemistry, owing to the fact that at the time of the death of Alfred Nobel, the discipline known as 'life sciences' did not yet exist.

In conclusion, a characteristic feature of Israeli research in life sciences is the ability to define the key problems that will stimulate researchers to seek profound answers on both an intellectual and practical level. In light of the hard work and the innovative thinking evident in much of the research carried out today in Israel, I anticipate breakthroughs, exhilarating insights and significant achievements in all of the areas discussed here.

Professor Ada Yonath received the Rothschild Prize in 2006.

Humanities

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There is a distinctive, indeed unmistakable fragrance to intellection in the humanistic disciplines in Israel that is, like other subtle things, astonishingly resilient. Despite far-reaching changes of a structural and systemic nature over the last fifty years, the primary qualities and textures of Israeli humanistic scholarship have held their own. Some of them are perhaps amenable to definition: a Mediterranean mingling and heterogeneity with concomitant linguistic pluralism; the haunting, living presence of the distant past informing, shaping, sometimes distorting, present visions and perspectives; the primacy of the text and its meticulous philological explication and exegesis; a certain monotheistic intensity, often polemical and positivist, infusing a vivid, sensual mythology, rich in affect; a vast horizon, 'nothing alien'; and the occasional, indeed not so rare, flashes of imaginative daring. I've seen nothing like this particular mélange elsewhere in the world.

Historically, breakthroughs in the Humanities are usually the work of lonely, driven mavericks. A multi-lingual and multi-cultural matrix also helps. Such, indeed, were the great Israeli humanists of forty and fifty years ago, many of them recipients of the Rothschild Prize: people (well, let us be honest, all of them were men) such as Jakob Polotsky (1961), Gershom Scholem (1961), Shmuel Samborsky (1966), Zeev Ben-Hayyim (1971), Shlomo Pines (1975), David Ayalon (1975), and Meir Kister (1988). Ben-Hayyim and Kister both came from the same small shtetl in Galicia, Mosciska – evidently a lively place. Many of these men passed through the middle-European university system (Berlin, Vienna, Heidelberg, Breslau, Göttingen, Königsberg) on their way to Palestine. Some were child prodigies like Polotzky, who taught himself Egyptian and Coptic while still in school. Some emerged through the institutions of higher Jewish learning, with the demanding discipline that was natural to the latter (Yehoshua Blau, Ben-Hayyim). In general, these were polymaths at home, minimally, in Latin, Yiddish, Hebrew, and usually more than one of the main languages of humane letters in Central Europe (German, Russian, Hungarian, Polish, Czech or French). We

could also speak of a creative convergence in Mandatory Palestine and the early years of the State of Israel of three strong cultural streams that, together, fashioned the world of humanistic scholarship: the long tradition of Jewish erudition in its several branches; the classicist and typically middle-European disciplines of scholastic philology; and what might be called the Hebrew Renaissance, that is, the vibrant, newly emergent world of literary and academic discourse in modern Hebrew. These scholars, deeply engaged with all these domains, established standards of uncompromising severity. They never spoke about 'excellence' in scholarship but naturally, often eccentrically, embodied it. Today we have committees in search of it.

I had the privilege of studying, as a raw beginner, under some of these masters, and I can affirm from my own experience: in those days each one of them alone could shift from atop the well, the rock that seven of us can hardly budge today. And yet – somehow the gifted mavericks keep turning up in our classes, no less driven and versatile than our exemplary models. It's not so easy to explain how this happens.

The system itself has expanded almost beyond recognition over half a century. In humanities alone, we have five major universities, an Open University and a host of colleges. Whole new fields have crystallized and matured: for example, Far Eastern, Central Asian and South Asian studies; Slavistics, broadly defined; comparative literature and semiotics; post-Chomskian linguistics; and the scintillating, synergetic blend now referred to as 'Cognition'. Sub-specializations, such as the diverse, ramified, often path-breaking study of Judaeo-Arabic and its manifold sources, are flourishing. (Other Jewish languages and literatures are still being discovered: witness the recent case of Judaeo-Malayalam). This striking expansion in the map of defined intellectual domains, despite the ebb and flow of resources and the constant, hence familiar threat to the survival of whole disciplines, is one sign of meaningful and enduring change. I hesitate to reveal a secret: like great poetry and music, humanistic studies often thrive on the edge of the abyss – a natural, culturally syntonic metaphor in Israel.

To no small extent we have witnessed the Israeli variant of a gradual paradigm shift away from the older models of lower and higher criticism that guided the lonely nineteenth-century philologist, toward large-scale cooperative and inter-disciplinary ventures informed by a modernist theoretical canon (Vico, de Saussure, Lévi-Strauss, Jakobson, Mukarovsky, Gadamer, Becker). History, too, has undergone a sea-change, moving toward radically new concepts of process and factuality and continuously expanding the social range of its study. German has given way to English as the predominant international idiom of the humanities – by no means a trivial change when it comes to the modes and habits of thought. The shift has philosophical implications as well: a comfortable, naïve positivism (with more than a soupçon of latent idealism)

has metamorphosed into a decidedly uncomfortable skepticism and cultural relativism. At the same time, the old core of Israeli humanistic science has cracked open. It used to comprise a strong interweaving of Jewish studies (widely conceived, from Bible through modern literature, thought, and history) with a dense concentration in Arabic and Islam and the heavily intertextual disciplines of European history and philosophy. Today, Jewish studies seem to have slipped out of the core; the richness and range of Judaic scholarship in Israel is beyond question, but humanists in other disciplines may no longer feel they need to engage profoundly with Jewish sources or even, for that matter, to write and publish in Hebrew. Such was not the case fifty years ago. The distance between humanities and the natural sciences and mathematics also seems to be widening.

But this is not – certainly not yet – a story of decline or diminishing returns. Probably humane letters have always developed in the shadow of the philistines, who may be a necessary presence if we are to find our way. If we feel a degree of disorientation, it may reflect the profound tension between the demands of mass higher education, a fine thing in itself, and the exigencies of classical philological and hermeneutic praxis, elitist through and through. Only systemic solutions can address this challenge. Can the evolving Israeli academic system continue to generate the great humanistic synthesizers and the exquisitely fine-tuned philologists, historians, philosophers and specialists that we have known in the past? Apparently, it can, judging by the current landscape – also by the sheer volume of seminars, inter-disciplinary workshops, publication series, collaborative ventures, and unconventional frameworks for research (especially for younger scholars). Yet we surely face an ever more bureaucratized and objectified academic environment in which external constraints and criteria may erode the instinctive standards of the visionary humanist. It is not faith but taste, as Osip Mandelstam said, that moves mountains.

By some miracle – the Rothschild Prizes have a part in this miracle – Israeli humanistic scholarship is, I think, still governed by good taste.

Professor David Shulman received the Rothschild Prize in 2004.

Social Sciences

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Social sciences have seen intense development since the establishment of the State of Israel and since the awarding of the first Rothschild Prizes, which have become an integral part of the academic and public discourse. In some ways it is a rather surprising development because unlike the humanities and Jewish studies, not to mention many areas in the natural sciences, the beginnings of the discipline in the pre-State period were extremely modest. One might note the very small but influential *chug mishni* in sociology of culture which was the special domain of Martin Buber. In 1942 or 1943, Arthur Ruppin gave lectures on the Sociology of the Jews based on Jewish demography in the Department of Jewish History at The Hebrew University; these were discontinued following his death. Broader public discussion regarding approaches to social sciences was carried out in the publications of ideological, in particular socialist, groups.

It was not until in the mid-1940s that preparations were undertaken to create larger frameworks for the social sciences. Under the leadership of Buber, sociology was gradually transformed into a major discipline: lectures and seminars in sociology and economics of the Middle East were given by Dr. Alfred Bonne and demography was pursued by Roberto Bachi. But it was only in the early 1950s that all of these efforts were amalgamated into fully-fledged departments of social sciences: including political science, international relations and to some extent psychology. Although the study of psychology had begun under the leadership of Professor Bonaventura (who was killed in 1948), debate continued over where it belonged. The first Department of Sociology was established at The Hebrew University and, very quickly, parallel departments which typically combined sociology and anthropology, economics and political science appeared at all the major universities in Israel, and later in colleges as well. Today these are all departments in good standing and have been joined by research institutes. Concomitantly, economics, sociology and political science discourses became part of the public discourse in Israeli sociology.

Needless to say, the departments and the subjects developed in different directions, but the presence of certain common components can be discerned in almost all of them: 1) the development of theoretical and analytical models; this is most clearly evident in departments such as statistics, very prominent in economics and somewhat less so in the other fields. 2) inclination towards comparative studies, strongest in sociology, to some extent in political science and less so in economics where the study of the economics of Middle Eastern societies was not continued but was carried out to a limited degree in some departments of Middle East studies 3) emphasis on the history of social and political thought; irrespective of the fact that this focus was manifest primarily in political science, the most influential study of this kind – on totalitarian democracy – was developed by J.L. Talmon in the Department of History. 4) The fourth and probably most extensive common thread running through these departments is the study of various aspects of the Israeli scene. These were of several different types, ranging from comprehensive and systematic studies of the fundamental characteristics and development of Israeli society, economics or polity to far-reaching analyses of the minutiae of Israeli life. They were usually placed in systematic and analytical frameworks; the more detailed analysis of different aspects thereof were ultimately integrated into those frameworks as well.

These common strands can be identified in all disciplines, evolving differently in each, depending on the period in question. They also differed from location to location. Most of the analytical and comparative studies are done at the universities. Many of the studies of the local scene are concentrated in special institutes, such as the Falk Institute and the Research Department of the Bank of Israel, depending on the subject. Significantly, most of the analytical models and comparative studies became closely intertwined with international professional communities, while the studies of the local scene tended to become more and more diversified.

Many of the analytical and comparative studies produced according to professional standards were fully accepted in their respective international scholarly communities. In the case of monetary theories, international economic relations, game theory and modes of rationality in economics, studies of civilizations, modernization and modernity, sociology of science and sociology of traditional and modern Jewish communities, many of the authors of these works were recognized by the Rothschild Prizes and carved out distinct niches in their respective disciplines. Another noteworthy milestone was the study of Jewish demography which flourished, especially under the leadership of the late Professor Roberto Bachi; since then it has been taken up and advanced by a number of scholars.

Quite important variations emerged among different subjects and among the realms within them. For example, the study of the Israeli scene initially paralleled

comparative studies in respective periods in the development of sociology, but that link subsequently became more tenuous.

In later years, many of these subjects experienced a sharp disassociation between analytical and to some extent comparative studies on the one hand, and on the other, more empirical studies of the Israeli scene, which have predominated in sociology in the last two decades. This rift was heavily influenced by prevailing ideological currents and tendencies. This in itself is not unique to Israel and can be found all over the world, but it is perhaps intensified by the country's relative isolation and the problems specific to Israeli society.

As the divergence grew, the study of the local scene tended to become more and more interwoven with ideological attitudes and controversies in sociology and political science and with the debate over Zionism and post-Zionism and to parallel developments in the study of Israeli history, often involving blatant ideological labeling.

Thus, the overall picture of the development of social sciences in Israel is a very dynamic and diversified one – portraying continuously evolving fields and generational changes in which the various approaches combined in a multitude of ways; within this context, the Rothschild Prize has played a very important – indeed crucial – role in encouraging the development of the highest scholarly standards.

Professor Shmuel Noah Eisenstadt received the Rothschild Prize in 1969.

Mathematics

PROFESSOR MICHAEL O. RABIN

School of Engineering and Computer Sciences
The Hebrew University of Jerusalem
School of Engineering and Applied Sciences
Harvard University

Israel is a mathematical and computer science empire. Despite its small size, the State of Israel is recognized world-wide as an important centre for modern mathematical innovation of the highest calibre. In computer science, Israel is second only to the United States as a source of ground-breaking scientific work. This excellence is testified to by invitations of Israeli scientists to deliver keynote lectures at the most important scientific conferences, by their election to leading academies of sciences such as the US National Academy of Sciences, the American Academy of Arts and Sciences, the French Academy of Sciences and the Royal Society, and by being awarded major international prizes. For example, three Israeli scientists were recipients of the A.M. Turing Award, a prize widely considered to be the equivalent, in the field of computer science, of the Nobel Prizes.

The roots of Israeli prominence in mathematics go back to the years before the establishment of the State of Israel. The Hebrew University Einstein Institute of Mathematics was by founded by mathematicians such as B. Amira, A.A. Fraenkel, M. Fekete, J. Levitzki and T. Motzkin. They brought the European tradition of mathematics from the great centres in Germany and Hungary to the tiny university in Jerusalem. They educated a series of brilliant students, many of whom went on abroad to obtain doctorates and later returned to Israel to start a lineage of students and students of students who formed the core of leadership of mathematical research in Israel. These people were joined by a large number of brilliant researchers who emigrated to Israel over the years, bringing with them further diversity and excellence in mathematical research.

The list of Rothschild Prize recipients reflects the strengths and superior achievements of Israel in mathematics and computer science. It is comprised of absolute world class leaders in the study of partial differential equations, applied mathematics, abstract algebra and ring theory, dynamical systems and ergodic theory, theoretical computer science and its applications to cryptography, group theory and

group representations and their applications to fields such as combinatorics and physics, mathematical logic, model theory and its profound applications to algebra. Many of the results bear the names of their prize winning innovators and are of fundamental and lasting importance in their respective fields. Some of this work has spawned practical industrial applications of considerable economic value.

Mathematics and computer science in Israel have blossomed in other fields which will surely be recognized by Rothschild Prizes in future years. These include functional analysis and theory of Banach spaces, combinatorics, a strong school spearheaded by Nobel laureate J. Aumann in game theory and its connections with economics, bioinformatics, and mathematical modelling of neural networks and of the brain.

Yad Hanadiv acted wisely and with foresight in recognizing fifty years ago the importance and high level of Israeli mathematics and in including this subject amongst the Rothschild Prize categories. This inclusion and the roster of outstanding awardees were based on the excellence of Israeli mathematicians and in turn contributed to further foster and enhance this excellence. All in all, the Rothschild Prizes in mathematics represent a brilliant past and present, and a glorious future!

Professor Michael O.Rabin received the Rothschild Prize in 1973.

Agriculture

PROFESSOR YEHUDITH BIRK AND PROFESSOR ILAN CHET

Faculty of Agriculture, Food and Environment
The Hebrew University of Jerusalem

An advanced level of agriculture in the Land of Israel is familiar to us from the days of the Bible where mention is made of Israel's seven species. Agriculture in the modern sense was revived at the end of the 19th century with the return of the Jews to their land. Since the establishment of the State of Israel, cultivated land has increased from 165,000 to 435,000 hectares. With of the rise of hi-tech exports, the economic importance of agriculture has declined in recent years and it constitutes just 2.5 per cent of the GDP, although this belies the scope of activity reliant on agriculture, such as the food industry, fertilizers, transportation and marketing.

Alongside growth in the agricultural industry, agricultural research centres have been established; chief among them are the Agricultural Research Administration – the Volcani Institute in Beit Dagan and the Faculty of Agriculture, Food and Environment at The Hebrew University in Rehovot. Research conducted at these institutes has led to the development of innovative agricultural methods and new species, and in cooperation with educated farmers, agriculture has advanced to an extraordinary level.

Yad Hanadiv has been supporting agricultural research for 50 years. It has awarded and continues to assist outstanding researchers to develop all areas of research including agricultural economics (Mundlak), plant diseases (Wahl), animal nutrition (Birk, Bondi), biological pesticides (Chet), recycling of agricultural waste and compostation (Chen, Hadar), entomology (Harpaz, Appelbaum), virology (Lobenstein), solarization (Katan), tomato cultivation (Kedar and Rabinowitz).

In practical terms, today's agricultural sector is almost totally dependent on science-based technology. A combination of ingenuity, applied science, determination and governmental assistance has helped advance Israeli agriculture despite difficult climatic conditions. At present, Israel's agriculture provides most of the country's food requirements.

One of the great revolutions in agriculture, which also transformed agriculture worldwide, was the development of drip irrigation. Methods for irrigating crops were

devised with every possible precaution taken to conserve water. Technologies were developed for optimal irrigation and fertilization with no waste and maximum crop yield. Irrigation techniques have been developed using purified waste water, brackish water at various levels of salinity and desalinized water. It should be noted that Israel is a global pioneer in the use of waste water. Today, 67 per cent of all waste water is recycled for irrigation. In European countries just 6 to 12 per cent of water is purified and recycled for agricultural use.

Modern agriculture helps protect the environment by recycling agricultural waste and transforming it into compost. It has developed a method to grow edible mushrooms of the Pleurotus type on cotton straw scraps and a plant bed; remains of the mushrooms are used as feed for ruminant animals.

In the realm of vegetable produce, emphasis is placed on shape, taste, scent and long shelf life. Noteworthy among the outstanding new species are the tomato species that have a long shelf life. It has been shown that when they are grown in brackish water, the level of sugar in cherry tomatoes increases. Peppers have been developed in different colours including green, yellow, deep red-purple and white. An anti-oxidant enriched pepper has recently been developed and will shortly enter the market.

New species of basil, oregano, rosemary, hyssop, celery and lemongrass have been developed and have broken into the European and American markets. There are unique species of paprika with a distinctive taste that can be 'mechanically' picked using Israeli-developed fruit picking machines. The paprika, which is in great demand worldwide – including in Hungary – is the result of an entirely mechanical process in which there is no human contact. It represents one of Israel's most outstanding export branches.

Among melons, the Galia species with its unique texture, aroma and sweetness in noteworthy and is sold throughout the western world. Among citrus fruits, there are new grapefruit species (especially red grapefruits); there is special emphasis on peelable fruits, which have led to a renewal of plantings throughout the country and specifically in the South. New species of table grapes without pits and with special texture, colour and taste have been developed. The avocado is being widely grown in Israel and with the help of publicity regarding its nutritional advantages, a huge market is opening up in Europe. Recently, new pomegranate species with powerful anti-oxidant features have been developed and are in great demand in the US and Europe.

New species of flowers with special texture, colour, size, stem length and long shelf life have been developed. Moreover, current research has succeeded in developing new breeding methods to restore the scent to roses, which was partially lost when breeding for other characteristics such as flower size and shape.

Livestock has also experienced great development. Cows with potential for high yields of milk have been bred, and development of special feeding equipment and automatic milking equipment with virtually no human contact – a significant savings in manpower as well as being extremely hygienic – have begun making the yields of Israeli cows among the highest in the world. There has been an increase in the quality of poultry products together with an improvement of the conditions in which the poultry are kept and the environment in the poultry farms.

The area of plant protection has seen many developments particularly with respect to the reduction in use of pesticides. Israel is among the more progressive countries in the area of biological pesticides against fungi and insects. A method employing the sun's rays to heat ground covered with plastic sheets (solarization) has been developed. The heat destroys the pathogenic fungi without the use of any pesticides whatsoever. Such development leads to a reduction in the surrounding residents' exposure to hazardous materials.

Modern agricultural development would not be viable without the concomitant development of agricultural machinery and, indeed, the Volcani Institute has developed machinery enabling mechanical harvesting of vegetables, collection of potatoes and onions, and recently, an implement to open pomegranates and separate the fruit from the peel.

In order to ship fresh agricultural products to all the world's markets by sea rather than by air, which is costly and pollutes the environment, controlled storage methods preventing spoilage have been developed using a cleaning and brushing installation for the fruit and vegetables at the storehouse. Likewise, special packaging for fruit, vegetables and spices makes it possible for the products to remain fresh for weeks.

A business sector's efficiency is assessed by its productivity and its technological advancement. A Dutch institute conducted an international study and found that Israel is among the leading countries in agricultural production relative to land, water and manpower utilized. High productivity and production efficiency have been achieved with the help of research and development.

The real prices of agricultural produce are characterized by a multi-year decline and this represents a significant contribution to reducing inflation. In this way, agriculture increases consumers' purchasing power and they become the main beneficiaries of its greater efficiency. The rise in the level and quality of life have placed strict demands and set clear standards for production processes and marketing, particularly in the food industry and with respect to the environment.

This past decade's technological developments and breakthroughs in the fields of biology and biotechnology have leveraged an unexpected level of progress in the agriculture industry. The economic potential derived from these new opportunities is also of an unprecedented scale. Estimates of billion-dollar potential in the global market

indicate that we are witnessing the beginning of a new era, taking initial steps toward a 'different agriculture'. The dimensions of this change, its scope and the trajectory of development are still not fully apparent, but it is obvious that the new agriculture will be knowledge and capital intensive and will focus not only on standard agricultural products but also on functional foodstuffs and imparting resistance to disease through agricultural innovation.

Israel is likely to earn preferred status in entering the sphere of 'different agriculture'. This will be the result of the broad level of biological–agricultural knowledge based on basic and applied scientific research and development which it has already accumulated, and on the close ties between research and agricultural production that have existed for many years.

Professor Yehudith Birk received the Rothschild Prize in 1977.

Professor Ilan Chet received the Rothschild Prize in 1990.

Engineering

PROFESSOR JACOB ZIV
Faculty of Electrical Engineering
Technion – Israel Institute of Technology

The birth of engineering as an academic discipline in Israel came with the establishment of the Technion in 1924. This process gained momentum with the immigration to Israel of Professor Max Kurrein (Rothschild Prize in Engineering for 1959), a mechanical engineer, renowned for his research into the relationship between macro- and micro-structures in metals, which led to establishing the discipline of plasticity of metals; Professor Markus Reiner (Rothschild Prize in Engineering for 1962), the father of rheology, the branch of physics concerned with the deformation and flow of matter, particularly viscous fluids and soft solids (oil, food, polymers, clay, cement, asphalt), which cannot be characterized as solid matter; and Professor Franz Ollendorff (Rothschild Prize in Engineering for 1973), founder of the Department of Electrical Engineering at the Technion, whose research dealt with electromagnetic waves and radar; in the context of his research, he developed the theory of transparency to resolve the problems of electromagnetism. His research also dealt with vacuum tubes.

These three eminent scientists brought with them the academic tradition which pervaded Germany in the 1930s, establishing the Technion as a preeminent institute of engineering in the image of the Technische Hochschule of Central Europe. The Technion trained Israel's first generations of outstanding engineers – a major contribution to the Israeli economy – but at the same time instilled in its graduates the curiosity and proficiency needed to engage in advanced academic engineering research.

Academic research at the Technion reached a new level when it adopted the model of American research universities. An excellent example in the early period was the hiring of Professor Sol R. Bodner by the Faculty of Mechanical Engineering. Professor Bodner was engaged in research on mechanical behaviour of materials, and established the Nautical Engineering Programme at the Technion, which has trained hundreds of, primarily Naval, engineers. Professor Bodner (Rothschild Prize, 1981) was involved in the consolidation of innovative planning methodologies for the pressure hull of the Dolphin-class submarine.

Soon the early graduates of the Technion joined its faculty, contributing to the invigoration of the institution and its research, as well as to other research institutions that are part of Israel's security establishment (such as Rafael), and later, to the development of knowledge-based communications and computer-engineering industries. These included figures such as Prof. Yitzhak Kidron, the father of research and development in Israel's microelectronics industry (Rothschild Prize, 1985); Professor Moshe Zakai (Rothschild Prize, 1994), among the leaders in the field of stochastic integrals and random fields and their use to solve engineering problems, and a major contributor to defence research; Professor Abraham Lempel, a pioneer in the area of data compression and a major contributor to computer science (recipient of this year's Rothschild Prize). I myself was recognized as a leader in the fields of information theory, communications and data compression technology and was awarded the Rothschild Prize in 2002.

At the same time, research in materials science continued to develop, contributing a great deal to advanced industry in this field. An outstanding figure in this regard is Professor Dan Shechtman, one of the foremost world experts in material engineering, who is responsible for an unexpected discovery that seemingly defied the laws of crystallography (Rothschild Prize, 1990).

Another major area of research that developed at the Technion under the leadership of Professor Jacob Bear (Rothschild Prize, 1998), a world renowned researcher in the science of hydrology, is the engineering of water resources, which has contributed considerably to the planning and development of Israel's water system. Professor Gideon Dagan of Tel Aviv University, who conducted pioneering research in hydrology and who founded a new area in geohydrology (Rothschild Prize, 2006) also joined this field.

Whereas most engineering research in Israel was originally led by the Technion, impressive achievements were also made at the Weizmann Institute of Science, including the planning, development and construction of the first digital computer in Israel, and among the first in the world, by a team of researchers: Myron Melman, Shmuel Ruchman and Zvi Riesel (Rothschild Prize winners in Engineering for 1969).

It goes without saying that other departments of the science of engineering were established in Israel's research universities, all staffed by scientists of the first order, whose original contributions to this field have gained world acclaim and won numerous prizes.

The list of Rothschild Prize winners is a true reflection of the achievements of science in Israel in all the areas of research in which the prize is conferred. For all this, warmest congratulations and felicitations to the Rothschild Prize as it marks the first golden jubilee of its important and much appreciated work. Bravo!

Professor Jacob Ziv received the Rothschild Prize in 2002.

Jewish Studies

PROFESSOR MOSHE BAR-ASHER

Department of Hebrew Language
The Hebrew University of Jerusalem

Contemporary scholarly research in Jewish studies in Israel has been marked by a surge of activity and broadening of scope in traditional, as well as new fields. Topics of study such as the ancient and later *piyutim* have seen substantial expansion. The greatest researchers in this field are Israelis. Hundreds of *piyutim* have been published and the writings of many authors of *piyutim* have undergone in-depth analysis. Extensive scientific study of the Dead Sea Scrolls is also being pursued. The full publication of the Qumran Scrolls has brought investigations of the ideology as well as of linguistic and literary aspects of these texts. A number of Israeli researchers, together with their colleagues abroad, lead the world in this field. The study of Hassidism has also had its share of new and innovative research, as has Hebrew literature of various periods – beginning with the literature of the sages, through mediaeval rabbinic literature and up to modern Hebrew literature, which reflects the changes that the Jewish people have undergone in the past two hundred years (modernity and secularization). In addition, the study of Jewish thought and Kabbalah are thriving anew, with second and third generations of scholars in Israel making major strides; they are today the leaders in this field of research. The history of the Jewish people throughout the ages is another area of academic pursuit that has seen achievements in the publication of original documents and the appearance of descriptive histories of Jewish communities, both large and small. The scope of research has extended to the study of the history and culture of Oriental communities – an area which made impressive progress in the publication and study of original texts and in analyzing what they revealed about the communities in question. Especially noteworthy is the comprehensive study of Jewish languages and literatures pursued by Israeli scholars, some of whom are acknowledged worldwide as leaders in the field. We must also point to the development of gender studies; and this is but a brief sample.

All this activity is reflected in the increasing number of academic publications in Israel: hundreds of books and many thousands of articles, including some very

innovative studies have been published, and new periodicals have been established in almost all the universities. It is also manifest in the multitude of scientific conferences and symposia held every year in Israel's universities, and in particular the major congresses that the World Union of Jewish Studies holds every four years: fifteen such congresses have convened since the Union was founded prior to the establishment of the State; fourteen of them in the years 1957–2009.

Over the past fifty years, databases have been created to serve all areas and scholars of Jewish studies. The most comprehensive and important are the Hebrew Language Academy's databases of the historical dictionary of the Hebrew language, encompassing virtually all the literature written in Hebrew from the years 200 BCE to 1050 CE; soon databases covering major periods in modern Hebrew literature (1750–2000) will be added. Also noteworthy is Bar-Ilan University's Responsa Project; sixteen editions of the database have already appeared and it is constantly being updated.

However, we cannot ignore some of the unresolved problems that have plagued Jewish studies. There is a preoccupation with subjects which, although fascinating, are sometimes peripheral and have little to contribute to the larger issues. For example, in the context of the study of the Tannaic and Mishnaic literature, one can find in-depth and comprehensive studies of the writings of a particular Tannaic or Amoraic sage, or an innovative, scholarly analysis of particular issues discussed in the Babylonian Talmud, whereas we still have no scholarly edition of the Mishna or even of a single, complete Mishnaic Order or section of the Babylonian Talmud. Moreover, quite a few scholars conduct research into the Book of the Zohar, but we have yet to find the scholar willing to labour over the publication of a scientific edition of the Zohar. Furthermore, in the past 75 years, not a single grammar book of any period of the Hebrew language has been written in Israel and scholars are forced to refer to books published by experts abroad.

One of the measures of academic activity that reflects on the future of scholarship is the level of nurturing the next generation of researchers – graduate students who write theses, and in particular, doctoral candidates that produce dissertations. Many hundreds of pieces of such work have been completed over the past fifty years and continue to be written in Israel's five universities. It can be said with satisfaction that the considerable number of innovative studies signals a younger generation of great promise. Sadly enough, too many of these researchers have no future in the universities due to severe cutbacks in the number of academic positions. At the same time, we cannot ignore a fairly large number of doctoral dissertations, whose contribution to science is marginal – some of which give research a bad name. To the best of my knowledge, this phenomenon is not limited to Jewish studies; this is the case in the humanities and

social sciences, as well as in the exact sciences. But the fact that other faculties share this problem is no consolation for the scholars of Jewish studies.

There are two secondary phenomena in this area, which are indicative of the difficulties encountered in preparing the next generation of scholars. On the one hand, we have gifted young people completing their degrees, who have no future in university research. On the other hand, universities confer doctorates on a certain number of candidates who are undeserving of them, thereby increasing the frustration and bitterness, not to mention the damage caused by research that is, at best, substandard.

In this context, we must note the sharp decline in the number of students who choose to major in Jewish studies in the universities. No in-depth research has yet been conducted to explain this decrease, but the establishment of so many colleges (some are good, but some mediocre) where one can obtain a BA or MA degree with greater ease, attracts many good students who ought to be receiving a better academic education of the kind available in the departments of Jewish studies at the universities. Furthermore, many students are drawn to the study of subjects that can assure them of a career offering a higher standard of living, such as economics, business administration and computer science, and this too is driving good students away from the academic pursuit of Jewish studies and the humanities.

Where Jewish studies are concerned, there is yet another problem: the discernible decline in the scope of knowledge of Jewish subjects among the graduates of high schools in Israel, evident in all subjects – Bible, Talmud, literature, Hebrew and more. This is bringing to the universities students who are inadequately prepared to tackle Jewish studies. These gaps in the basic knowledge of classic sources of Jewish literature over the ages are not – and can never be – filled, even in the universities. Only particularly gifted young people are able to supplement their knowledge to an extent that will prepare them for advanced research in Jewish studies on a worthy level.

Still, all the problems I have noted and others cannot offset the fact that today a younger generation of researchers does exist, including several dozen exceptionally gifted and promising scholars. There are those who have already attained the rank of lecturer and senior lecturer, advanced doctoral candidates and those who have already completed their doctoral dissertations. The mark left by these young researchers can already be felt in all areas of scholarship. They assure us of yet another generation of outstanding research.

Professor Moshe Bar-Asher received the Rothschild Prize in 2008.

Rothschild Prize Recipients since 1959

1959

Prof. Max Kurrein ..... Engineering
Prof. Shmuel Agmon ..... Mathematics
Prof. Dan Patinkin ..... Social Sciences

1960

Dr. Avraham Komarov ..... Agriculture
Prof. Ephraim Katzir ..... Life Sciences

1961

Prof. A.D. Bergman ..... Chemical Sciences
Prof. Yaakov Polotzky ..... Humanities
Prof. Gershom Scholem ..... Jewish Studies
Prof. Yoel Rokach ..... Physical Sciences

1962

Prof. Markus Reiner ..... Engineering
Prof. Abraham Halevy Fraenkel ..... Mathematics
Prof. Louis Eliahu Guttman ..... Social Sciences

1963

Prof. Yitzhak Wahl ..... Agriculture
Prof. Yigal Yadin ..... Humanities
Prof. Georg Haas ..... Life Sciences

1964

Prof. David Ginzburg ..... Chemical Sciences
Prof. Yitzhak Be'er ..... Jewish Studies
Prof. Zeev Lev ..... Physical Sciences

1965

Prof. Abraham Kogan ..... Engineering
Prof. Chaim Leib Pekeris ..... Mathematics
Prof. Gad Tedeschi ..... Social Sciences

1966

Prof. Aharon Bondi ..... Agriculture
Prof. Shmuel Samborsky ..... Humanities
Prof. Yitzhak Bernblum ..... Life Sciences

1967

Prof. Michael Sela ..... Chemical Sciences
Prof. Ben-Zion Dinur ..... Jewish Studies
Prof. Yuval Ne'eman ..... Physical Sciences

1969

Mr. Myron Melman ..... Engineering
Prof. Zvi Herbert Riesel ..... Engineering
Prof. Shmuel Ruchman ..... Engineering
Prof. Aryeh Berger ..... Life Sciences
Prof. Shimshon Abraham Amitzur ..... Mathematics
Prof. Shmuel Noah Eisenstadt ..... Social Sciences

1971

Prof. Yair Mundlak ..... Agriculture
Prof. Aharon Katchalsky-Katzir ..... Chemical Sciences
Prof. Yehoshua Prawer ..... Humanities
Prof. Zeev Ben-Hayyim ..... Jewish Studies
Prof. Yigal Talmi ..... Physical Sciences

Rothschild Prize Recipients since 1959

1973

Prof. Franz Ollendorf ..... Engineering
Prof. Michael Zohary ..... Life Sciences
Prof. Michael Rabin ..... Mathematics
Prof. Michael Bruno ..... Social Sciences

1975

Prof. Joshua Jortner ..... Chemical Sciences
Prof. David Ayalon ..... Humanities
Prof. Shlomo Pines ..... Jewish Studies
Prof. Haim Harari ..... Physical Sciences

1977

Prof. Yehudith Birk ..... Agriculture
Prof. Leo Sachs ..... Life Sciences
Prof. Hillel Furstenberg ..... Mathematics
Prof. Roberto Bachi ..... Social Sciences

1979

Prof. Yitzhak Steinberg ..... Chemical Sciences
Prof. Haim Blank ..... Humanities
Prof. Harry Y. Lipkin ..... Physical Sciences

1981

Prof. Gad Loebenstein ..... Agriculture
Prof. Sol R. Bodner ..... Engineering
Prof. Yeshayahu Tishbi ..... Jewish Studies
Prof. Hans Lindner ..... Life Sciences
Prof. Saharon Shelah ..... Mathematics
Prof. Joseph Ben-David ..... Social Sciences

1983

Prof. Meir Wilchek ..... Chemical Sciences
Prof. Nachman Avigad ..... Humanities
Prof. Ephraim Elimelech Urbach .... Jewish Studies
Prof. Yakir Aharonov ..... Physical Sciences

1985

Prof. Yitzhak Harpaz ..... Agriculture
Prof. Yitzhak Kidron ..... Engineering
Prof. Michael Feldman ..... Life Sciences
Prof. Israel Gochberg ..... Mathematics
Prof. Yaacov Katz ..... Social Sciences

1988

Prof. Abraham Patchornik ..... Chemical Sciences
Prof. Meir Kister ..... Humanities
Prof. Shraga Abramson ..... Jewish Studies
Prof. Yaacov Beckenstein ..... Physical Sciences

1990

Prof. Ilan Chet ..... Agriculture
Prof. Dan Schechtman ..... Engineering
Prof. Alexander Levitzki ..... Life Sciences
Prof. Achi Brandt ..... Mathematics
Prof. Nissan Leviathan ..... Social Sciences

1992

Prof. Raphael Levin ..... Chemical Sciences
Prof. Yehoshua Blau ..... Humanities
Prof. Ezra Fleisher ..... Jewish Studies
Prof. Zeev Vager ..... Physical Sciences

Rothschild Prize Recipients since 1959

1994

Prof. Jaacov Katan ..... Agriculture
Prof. Moshe Zakai ..... Engineering
Prof. Shmuel Shaltiel ..... Life Sciences
Prof. Adi Shamir ..... Mathematics
Prof. Menahem Yaari ..... Social Sciences

1996

Prof. Edward Kosower ..... Chemical Sciences
Prof. Moshe Gil ..... Jewish Studies
Prof. Yosef Imry ..... Physical Sciences

1998

Prof. Jacob Baer ..... Engineering
Prof. Yitzhak Hadar ..... Agriculture
Prof. Yona Chen ..... Agriculture
Prof. Sergiu Hart ..... Social Sciences
Prof. Ruth Arnon ..... Life Sciences
Prof. Ehud Hrushovski ..... Mathematics

2000

Prof. Zeev Luz ..... Chemical Sciences
Prof. Hayim Tadmor ..... Humanities
Prof. David Flusser ..... Jewish Studies
Prof. Amnon Aharony ..... Physical Sciences

2002

Prof. Nachum Kedar ..... Agriculture
Prof. Haim D. Rabinowitch ..... Agriculture
Prof. Jacob Ziv ..... Engineering
Prof. Zvi Selinger ..... Life Sciences
Prof. Alexander Lubotzky ..... Mathematics
Prof. Elhanan Helpman ..... Social Sciences

2004

Prof. Joseph Klafter ..... Chemical Sciences
Prof. David Shulman ..... Humanities
Prof. Haim Beinart ..... Jewish Studies
Prof. Asher Peres ..... Physical Sciences

2006

Prof. Gedeon Dagan ..... Engineering
Prof. Ada Yonath ..... Life Sciences
Prof. Benjamin Weiss ..... Mathematics
Prof. Asher Koriat ..... Social Sciences

2008

Prof. Itamar Willner ..... Chemical Sciences
Prof. Etan Kohlberg ..... Humanities
Prof. Moshe Bar-Asher ..... Jewish Studies
Prof Mordechai (Moty) Heiblum ..... Physical Sciences

2010

Prof. Shalom Applebaum ..... Agriculture
Prof. Abraham Lempel ..... Engineering
Prof. Yoram Groner ..... Life Sciences
Prof. David Kazhdan ..... Mathematics
Prof. Ariel Rubinstein ..... Social Sciences