There Are No Excuses in Paradise:
The Past, Present and Future of Institutes for Advanced Studies

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I am starting with images from a tenth-century Irish manuscript, not just to pay respect to the other founding School of DIAS, but more particularly because it is something I have always associated with Werner Nahm, whose sixtieth birthday is being celebrated belatedly by a conference this weekend, and this statutory lecture is embedded in the middle of it.

This shows two pages from what is known as the *Southampton Psalter*, and it is one of the oldest possessions of my Cambridge College, St John's, a sister college of Trinity College Dublin. The left-hand page shows a picture of David, the supposed author of the Psalms, first fighting a lion and, below, as a shepherd. The right-hand page is the beginning of the first Psalm, with an ornamental B, from Beatus, in the form of a serpent. The text is in Latin and the glosses in Irish.

The first time Werner came to visit me in Cambridge, I was showing him round the Upper Library, where some of the College's precious manuscripts were on display. I pointed this Psalter out to him and then moved on to the next cases. After a while I realized I was now talking to myself; Werner was still reading the *Psalter*––reading the Irish glosses not the Latin text. This was not the sole time I thought I was talking to Werner only to realize I was talking to myself because Werner was effectively off in some other space, some other dimension, at some other time.

I first met Werner about thirty-seven or thirty-eight years ago. He came into my room at CERN in Geneva, where I was a postdoctoral fellow and asked me some questions about dual resonance models, which were just then in the process of metamorphosing into string theory and which I was working on. Werner was about twenty-two, both shy and sort of confident, not often looking directly at me – people do not change much. But what I remember most is that he seemed to understand more as a result of my answers to his questions than I did myself. Only years later, when I got to know him, did I find out that he had written about as many papers on Cypro-Minoan and Mayan research as he had on mathematical physics. Werner is easily one of the most remarkable and original people I know. And how perfect, given his talents, that he is now a senior Professor at DIAS.

Werner is now sixty, and DIAS is almost seventy, and the Institute in Princeton is almost eighty. So I thought that I would use this occasion to reflect on the circumstances and ideas that led to the creation of our institutes and some of the intersections between their early histories. I also want to consider why our two institutes set a trend for establishing institutes for advanced study, which has recently become extremely fashionable around the world.

Looking back for the origin of institutes for advanced study is rather a chicken-and-egg enterprise, and it has to be seen in the context of the evolution of academic institutions. The antecedents to the Institute for Advanced Study are to be found in the embryonic beginnings in Germany of the development of the modern research university and the challenges this presented to the American colleges.

At the beginning of the twentieth century, the great American universities had not yet assumed a leading position in the worlds of science and scholarship. Remedies for the perceived deficiencies in American higher education were being sought. For example, in his *The Higher Learning in America,* written in 1916, the

influential American economist Thorstein Veblen, the man who coined the phrase "conspicuous consumption", wrote:

> A beginning may well be made by a joint enterprise among American scholars and universities for the installation of a feely endowed central establishment where teachers and students of all nationalities, and Americans along with the rest, may pursue their chosen work as guests of the American academic community at large … There should also be nothing to hinder the installation of more than one of these houses of refuge and entertainment.

– a rather nice name for an institute for advanced study, "a house of refuge and entertainment".

But if this was an idea whose time had come, it required someone to make it happen: to articulate and crystallize the vision, to acquire the necessary resources and to realize it in practice, to take it from dream to reality. That person was Abraham Flexner, who became the first Director of the Institute for Advanced Study, a man of genius, if that is a useful term, and therefore obsessive and infuriating, as well as visionary and committed. Let me sketch how Flexner came to have both the inspiration and the opportunity to establish the first Institute for Advanced Study.

Abraham Flexner was born in Louisville, Kentucky, in 1866, the sixth son of German immigrants. Abraham was academically precocious and, after his father died, the family hopes were pinned on him. Sacrifices were made to send Abraham to Johns Hopkins University in Baltimore, where he arrived in 1884, just eight years after it had been founded. It had been molded by its first President, Daniel Coit Gilman, who was to become a hero for Abraham Flexner and the subject of one of his books.

Johns Hopkins was the first American university to be centered on research and advanced study, following in the German tradition initiated by Wilhelm von Humboldt, when, in 1810, he convinced the King of Prussia to found Berlin University based on Friedrich Schleiermacher's liberal ideas on academic freedom, and the importance of seminars, laboratories and research. The object as Schleiermacher put it, was to make it "second nature for [the students] to view everything from the perspective of scholarship … and thus acquire the ability to carry out research, to make discoveries".

The American colleges and universities had been founded largely following British models, with strong religious affiliations, following restricted syllabuses, and designed for the training of students as schoolteachers, priests, lawyers, *etc.* However, at Johns Hopkins, Gilman, who had spent time in Berlin in the 1850s, emphasized that the fundamental purpose of a university should be study rather than training. His ideal, of creating an exclusively graduate university, could not be maintained against local pressure for undergraduate education and in the absence of a sufficient stream of well-qualified graduates seeking admission. So, in 1883, undergraduates were admitted and the seventeen-year-old Abraham Flexner arrived a year later.

The two years that he spent at Johns Hopkins were a turning point for Abraham. He pursued an intensive program of study so that he could graduate in two years, before his money ran out. He wanted to stay on for further study, but the fellowship he sought eluded him. So, somewhat frustrated, he returned home to Louisville in 1886, to teach Latin and Greek, at the Louisville High School from which he had graduated just two years earlier.

He was a very successful teacher and developed an interest in educational theory. He set up his own school to prepare boys, and some girls, for entry into the Ivy League colleges. Among his pupils was one Anne Crawford, who gained entry to Vassar. When she returned to Louisville on graduating, romance blossomed and they married in 1898. Not only did Anne teach back at Flexner's School, she also became an extremely successful playwright, with leading successes on Broadway.

It was the financial success of Anne's plays, rather than the success of his school, successful though that was, that enabled Abraham Flexner to leave Louisville and to begin to make his way on the national and international scene. In 1905, he sold his school for a good price and went to spend a year studying psychology and philosophy at Harvard, gaining an MA degree.

After Harvard, Flexner went with his wife to spend two years studying at Berlin University, before beginning a caustic commentary on the deficiencies of American higher education, published as the *American College*. Flexner castigated the American college for being confused as to its purpose: it did not prepare students for university, like the German gymnasium, yet it did not provide proper university-level study like the European universities. This caught the attention of the President of the newly formed Carnegie Foundation and he commissioned Flexner to produce a report on *Medical Education in the United States and Canada*. His tough report, exposing powerful and profitable vested interest, established his reputation. It resulted in the closure of more than two-thirds of the medical schools then operating. The Flexner Report of 1910 remains a landmark in the history of medical education.

After writing further reports for the Carnegie and Rockefeller Foundations, Flexner worked for the General Education Board of the Rockefeller Foundation from 1913 to 1928, when he lost his very influential post as Head of the Division of Studies of the General Education Board in an internal power struggle. Then aged sixty-two, he was invited to Oxford University to deliver the Rhodes Lectures and, following some months traveling in Europe, particularly Germany, he developed these into a book, *Universities: American, English, German*.

His book praised the German universities with their greater opportunities for postgraduate research; he criticized the ancient English universities for being too concerned with the cultivation of gentlemen; and he was scathing in his assessment of the American colleges with their focus on undergraduate general education with graduate study then grafted on. In late 1929, as he was reviewing the proofs of the introduction to his book, two men appeared in his office, seeking advice on behalf of a businessman, Louis Bamberger, who, with his sister, Caroline Bamberger Fuld, was considering establishing a medical school in his hometown of Newark, New Jersey.

Like Flexner, the children of German Jewish immigrants, the Bambergers had made a fortune from the retail trade, owning one of the leading department stores in the United States, L. Bambergers' Store in Newark. At age seventy-three, Louis Bamberger had decided that the time had come for him to retire. He sold the store to his rivals, Macy's, for about $25 million, fortunately a few months before the crash of October 1929. Already great philanthropists, the Bambergers wanted to use their fortune to benefit the people of Newark. They also wanted to do something to counter the prejudice against Jews that they perceived as prevalent in the medical profession and in medical education, at least in the great cities. They therefore proposed to establish a medical school in Newark, with preference for Jewish students.

When asked about the Bambergers' proposal, Flexner was disparaging of the idea: a first-rate medical school needed an outstanding teaching hospital; it needed to be associated with a leading university; and Newark was too close to New York to set up competition with the medical schools there. Also, he did not think that the way to counter anti-Semitism would be to set up institutions favoring Jews. But, never one to leave a vacuum unfilled, he asked his visitors if they had ever dreamed a dream, and proceeded to tell them *his dream*: the establishment in America of a purely graduate university, devoted to learning and researching rather than to undergraduate teaching.

Flexner was not the only person dreaming such dreams. As we have seen, in 1916, Thorstein Veblen had been writing about a refuge where scholars could devote themselves to research. In 1924, his nephew, Oswald Veblen, a Professor of Mathematics at Princeton University, had written to Abraham Flexner's older brother, Simon, who had become the founding Director of the Rockefeller Institute for Medical Research, now the Rockefeller University. Like all leading mathematicians of his time, Veblen was familiar with the German research universities and the Mathematics Institute at Göttingen, then the Mecca for mathematicians from around the world.

He was seeking support for establishing a Mathematics Research Institute, whose needs would be simple: a library, a few offices, lecture rooms, some computing machines (the mechanical sort with wheels and a handle); the main expense would be salaries.

It has sometimes been said that mathematics is just about the cheapest of subjects: all you need is a blackboard and chalk, a desk, paper, pencil and a wastepaper basket. The only subject that is cheaper is philosophy—because you do not need the wastepaper basket. Simon Flexner told Veblen to contact his brother Abe.

Flexner quickly convinced the Bambergers to abandon the idea of a medical school and to make available $5 million for what was to be named the Institute for Advanced Study. Flexner persuaded the Bambergers that the Institute had to be in Princeton if it were to reside in New Jersey, because the Institute needed to be near a great library and the wider intellectual community of a great university.

By May 1930, the Bambergers had designated Flexner as the first Director and, on the twentieth of that month, the Institute was formally established. On June 4, they wrote to the first Trustees of the embryonic Institute to charge them with their task. They wrote:

> There is never likely to be an over-abundance of opportunities for men and women engaged in the pursuit of advanced learning in the various fields of human knowledge. Particularly, so far as we are aware, there is no institution in the United States where scientists and scholars devote themselves at the same time to serious research and to the training of competent post-graduate students entirely independently of and separated from both the charms and the diversions inseparable from an Institution the major interest of which is the teaching of undergraduates.

Flexner set out his plans for the Institute at the first meeting of the Trustees: "a free society of scholars and students devoted to the higher training of men and to the advance of knowledge". It was first and foremost to be a quiet retreat, a fortress of learning. At its heart was the Faculty, who needed only "simple surroundings", protection from interference, generous professional remuneration, little supervision and freedom from any obligation "to entice or compel students to work".

For the next year, Flexner traveled, consulting widely, in person and by correspondence, with the leading American and European scholars. In October 1931, he set out his plans in more detail in a confidential memorandum to the Trustees:

> The Institute should be small and plastic (that is flexible); it should be a haven where scholars and scientists could regard the world and its phenomena as their laboratory, without being carried off in the maelstrom of the immediate; it should be simple, comfortable, quiet without being monastic or remote; it should be afraid of no issue; yet it should be under no pressure from any side which might tend to force its scholars to be prejudiced either for or against any particular solution of the problems under study; and it should provide the facilities, the tranquility, and the time requisite to fundamental inquiry into the unknown. Its scholars should enjoy complete intellectual liberty and be absolutely free from administrative responsibilities or concerns.

Later, Flexner articulated his philosophy in a famous article, *The Usefulness of Useless Knowledge*, which went through a number of versions and was published in *Harper's Magazine* in 1939. In this article, he sought to examine the utilitarian value of purely intellectual pursuits and his basic thesis was that the significant advances in knowledge of highest practical value do not come from objective-driven research but from research driven by curiosity.

The prime example he gave was that of the work of James Clerk Maxwell on the theory of electromagnetism. Maxwell, seeking to understand the relationship between electricity and magnetism in a more comprehensive, unified and mathematically consistent way, set out his famous four equations in 1861. From the solutions of the equations, he concluded that visible light was an electromagnetic wave and that electromagnetic waves of long wavelength, radio waves, might be observed. These were indeed observed in 1887 by Heinrich Hertz, working in the Berlin laboratory of Hermann von Helmholtz. It took another fourteen years before Marconi gave a definitive demonstration of the utility of these developments by sending radio waves across the Atlantic. However, Flexner argued that the key step in this was Maxwell's research, driven not by considerations of practical value but rather by a desire to understand the basic laws of Nature.

Some of Flexner's advisors thought he was too obsessed with European models for the Institute. His brothers Simon and Bernard, a leading New York attorney, urged him to visit the West Coast, Caltech in particular, and there he headed in February 1932. Also visiting Caltech at the same time was Albert Einstein, already an iconic figure. Encouraged by others to talk to Einstein, Flexner found him full of enthusiasm for his plans. They agreed to discuss them further in Oxford that summer. Einstein cabled Flexner from his home in Potsdam saying he was "flame and fire for it". Eight months after his visit to Caltech, Abraham Flexner was able to announce publicly the creation of the School of Mathematics, with the appointment of Albert Einstein and also Oswald Veblen to the first Faculty positions.

The announcement in the *New York Times* on 11 October, 1932, said, "The institute will be unique among American institutions of higher education designed to make it 'a scholar's paradise,' although it is hoped that eventually it will set an example that will be followed by the establishment of similar institutions". The Institute for Advanced Study was already seen as a potential model for other institutes.

By the time the first session of the Institute began in September 1933, a Faculty of five leading mathematicians and theoretical physicists had been assembled for the School: Alexander, Einstein, Veblen, von Neumann, Weyl. In December 1933, Flexner wrote to Felix Frankfurter, a Trustee and Professor at the Harvard Law School, later a Supreme Court Justice, to tell him how life at the new Institute was shaping up.

> What has happened is not exactly what I planned but is much better than I planned. I have frequently used the phrase, "paradise for scholars", without any very distinct notion of just how a paradise would be created. We have admitted to the Institute about twenty persons who have shown capacity for independent work. They have been turned loose in Fine Hall without any regulations whatsoever. The professors know of course what they want to do and are doing it. The students shop around in order to find the man who can be most helpful to them.
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> Every afternoon tea is served informally and there is, to my astonishment, an attendance of about sixty. They talk mathematics but not only mathematics and drift in and out without explanation or ascertainable reason.

Fundamentally not much has changed. Tea remains a fixture on the daily Institute timetable.

But Felix Frankfurter, who rather curmudgeonly played Devil's Advocate most of the time, didn't like Flexner's exuberance. Across the letter from Flexner he scrawled "NEWS FROM PARADISE. Not my style."

And to Flexner he commented,

> Nor do I think it very helpful to take too seriously the exuberant rhetoric of thinking of the Institute as a "paradise of scholars". For one thing, the natural history of paradise is none too encouraging as a precedent. Apparently it was an excellent place for one person, but it was fatal even for two—or at least for two when the snake entered, and the snake seems to be an early and congenial companion of man. Really, figures of speech are among the most fertile sources of intellectual confusion. Let's try to aim at something human, for we are dealing with humans and not with angels.

And so the Institute in Princeton was established. It has grown to four Schools: Mathematics, Historical Studies, Natural Sciences, and Social Science. It has remained faithful to the mission set by its founders of fostering disinterested research into fundamental questions in the sciences and humanities, and providing essential opportunities for the intellectual development of generations of scientists and scholars. But those have not been the only impacts.

In January 1939, a letter was sent on behalf of the Irish Minister for Education to the Institute for Advanced Study in Princeton asking for copies of the Institute's most recent bulletin containing details of the Institute. Soon after assuming office as Prime Minister, Eamon De Valera had begun investigating the possibility of establishing in Ireland an institute for advanced studies, inspired in part by the Princeton Institute. De Valera sent Edmund Whitaker to ascertain whether Schroedinger and/or Max von Laue, another Nobel Laureate in Physics, would accept a position at such a new Institute and in March he reported back that von Laue was not

available but Schroedinger would be willing to accept appointment.

In the summer of 1938, De Valera had assisted Erwin Schroedinger in his flight from Austria, after dismissal by the Nazi regime, and told him of his plans to establish an Institute in Dublin. Schroedinger arrived in Dublin in October 1939, on a temporary appointment, while the bill to establish an Institute for Advanced Study was still being considered by the Dáil. When he sought De Valera's help in securing a visa for Frau Hildegunde March, a married woman who lived in a *ménage à trois* with Erwin and his wife Annemarie, he assured him that he would "take personal responsibility for her *entertainment* as well as for her never causing any trouble to you, Sir, or your country".

In May 1940, Denis Devlin, Secretary of the Irish Legation in Washington wrote to Frank Aydelotte, Flexner's successor as the Director of the Institute, asking for details of the Institute's "origin, function and work". Aydelotte replied promptly and with enthusiasm, providing the requested details and inviting Devlin to visit the Institute. On 6 June 1940, Devlin wrote again to Aydelotte, thanking him for his information and letting him know that the bill to establish the Dublin Institute for Advanced Studies had been enacted, with Schools of Theoretical Physics and of Celtic Studies, reflecting, of course, De Valera's intellectual interests. Later, in 1947, the third School, the School of Cosmic Physics, was added.

In Devlin's correspondence, Schroedinger was not mentioned, of course. However, he was not a stranger to the Princeton Institute. He had visited Princeton University early in 1934, soon after the opening of the Institute, and he had been offered a Chair in Mathematical Physics in the University. Part of the potential attraction of the post was the presence in Princeton of the Faculty of the Institute, including not only Einstein but also Hermann Weyl. Schroedinger and Weyl had been colleagues at the Eidgenössische Technische Hochschule in Zürich, and there had been a personal connection as well: Hermann Weyl and Anny Schroedinger had had an affair. However, let us not get diverted onto the affairs of the Schroedingers; that subject would require a talk of its own.

The year after Schroedinger's Princeton visit, Albert Einstein wrote, from Old Lyme in Connecticut, where he was summering, as the Americans say, to Abraham Flexner, who was doing the same in Ontario, saying that he was engaged in scholarly correspondence with Schroedinger and that he would be a wonderful acquisition for the Institute.

Flexner replied to say that any approach to Schroedinger would have to be handled with the greatest delicacy because of the embarrassment that he caused in Princeton the previous year. Flexner was not referring to another affair, or even to the well-established *ménage à trois*.

The problem was that, when Schroedinger declined the offer of the Professorship of Mathematical Physics from Princeton University, he had given as a reason that he was expecting an offer from the Institute for Advanced Study on more attractive terms. But, rather than securing Schroedinger for the Institute, Flexner had been hoping that the presence of Einstein and Weyl at the Institute, which was still housed in the Mathematics Department of the University, would encourage Schroedinger to accept the University's offer, thus improving relations between the Institute and the University. Three of the first five Faculty members of the Institute had been taken from the University and not everyone was happy about this.

This was not the last time that the Institute considered adding Schroedinger to its Faculty. In 1937, a report on possible future appointments in theoretical physics listed Dirac, Heisenberg and Schroedinger as the leading theoretical physicists in terms of achievement, with Dirac viewed as the one of these with the greatest future promise. The possibility of approaching Heisenberg was dismissed, perhaps because of the international political situation, and Pauli and Fermi were set alongside Schroedinger as regards future promise. After discussion, and taking into account "personal elements and peculiarities", it was decided to offer a Professorship to Pauli if Dirac declined. Neither came.

In his tantalizingly brief *Autobiographical Sketches*, Schroedinger tells how he came to Dublin because of what he regards as a lucky error: in 1936, offered Chairs in both Edinburgh and Graz in Austria, he chose Graz. The move to Graz proved to be disastrous because of the Nazi annexation of Austria, and Schroedinger was forced to flee in 1938 assisted as we have seen by De Valera. His seventeen years spent in Dublin he

described as a wonderful time and gave ironic thanks to the Fuehrer for providing him with the time he spent in this "remote and beautiful island" as he put it: "I can't imagine spending seventeen years in Graz 'treading water', with or without the Nazis, with or without the war".

The Dublin Institute was operational by early 1941. Schroedinger gave two courses of lectures on quantum theory to large audiences. Walter Heitler arrived in June 1941 to take up an Assistant Professorship. Soon, as De Valera had intended, the Institute became a center for theoretical physics, drawing in professors and students from University College and Trinity College. To establish international contacts, then attenuated because of the war, a colloquium was held in July 1942. Paul Dirac, who had shared the 1933 Nobel Prize for Physics with Schroedinger, gave lectures on quantum electrodynamics and Arthur Eddington lectured on the unification of relativity and quantum theory.

Dirac described his visit with characteristic innocence and directness in his almost daily letters to his wife, Manci: the shaky landing and the liberal use of film by camera men at Dublin airport, the plentiful provisions of ham, eggs, butter, cake – "as much as one wants" – unused air raid shelters, the strange mixture of peace and war. On the 16th of July, members of the conference were invited to dinner by the President of University College, and the next day Paul sent the menu home to Manci with the comment that it was a pity she was not there because it would have suited her (presumably she took to such feasts more than he did).

Paul continued, "I spoke with De Valera yesterday. He was a mathematician before he took up politics, and he keeps up his interest in mathematics and is coming to the conference. It seems a little strange to have a prime minister at these very specialized lectures. I wonder how he can spare the time."

In the group photograph for the colloquium, you can see Dirac sitting on De Valera's right with Arthur Conway, President of University College and a mathematical physicist, on De Valera's left. Sheila Power, who was subsequently a member of the Princeton Institute, is at the left of the photograph as we look at it and then Monsignor Patrick Browne. To the right of Arthur Conway are Eddington, Schroedinger and finally A.J. McConnell, then Professor of Natural Philosophy at Trinity College and later Provost.

As the war ended, international contacts broadened and the basis for the distinguished achievements of the Dublin Institute over the subsequent decades had been established. It is not the purpose of this talk to review those. Here are the Directors of the Institute up to 2001. Both Lochlainn O'Raifeartaigh and Jack Lewis spent a year at the Institute in Princeton, from 1967 to 1968 and from 1969 to 1970, respectively, maintaining the connections.

An early Member of the DIAS, for the year 1946-47, was the theoretical physicist Cecile Morette, later Cecile de Witt Morette. After a year in Copenhagen, she visited the Institute in Princeton as a Member, arriving in the fall of 1948 along with Freeman Dyson – exemplifying the connections between institutes for advanced study established by the scholars who move between them.

Freeman Dyson, in one of his letters home to his parents, which provide a marvelous chronicle of decades of life at the Princeton Institute and much else, tells of a French visitor to whom Cecile Morette introduced him at lunch one day, a visitor who looked more distinguished than the usual run of Members of the Institute:

> Cécile amused us all yesterday by bringing down a French millionaire to see the Institute (an industrial magnate of some kind). She said she hinted to him fairly strongly that France could do with an institute of a similar sort. She said that if she were made Director of the French Institute she would invite all of us to come and lecture there. It will be interesting to see if anything comes of it.

Something certainly did come of it. That visitor was Léon Motchane, an industrialist who maintained strong academic interests, even gaining a doctorate in mathematics at age 54, who had been considering the possibility of establishing an institute in France. Encouraged by Cecile Morette on the basis of her experiences in Dublin and Princeton and with continuing help and support from Robert Oppenheimer, the third Director of the Princeton Institute, Motchane went on to establish the Institut des Hautes Études Scientifiques (IHÉS) about ten years later.

In December 1959, Oppenheimer wrote to the French Ministry for Education in support of the proposal that government support should be given to IHÉS:

> With the increasing magnitude, complexity, and busyness of scientific progress in all fields, and with the growth of educational systems which corresponds to a new development in the world's history, university chairs no longer necessarily offer that opportunity for seclusion, and for the most difficult and intensive intellectual effort, which was once their special hallmark. For this reason, places of retreat, which are in effect places for advance, have been brought into being. These serve multiple functions, but basic to them all is an opportunity for much more intensive concentration on study and research than is elsewhere possible. …
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> It needs hardly to be stressed that these experiences are helpful to the universities and institutions of learning to which our visitors return; and that they are passed on in appropriate form to the students whom they are teaching and training. For these reasons, … institutes for advanced study … will multiply throughout the western world.

Another example of one institute begetting another is provided by the Institute for Advanced Study in Jerusalem, founded by Aryeh Dvoretzky in 1975, after he had visited the Princeton Institute some years earlier. He wrote:

> An Institute for Advanced Study in Israel will fulfill a long-acknowledged need for an appropriate setting to encourage scientific and academic leadership, along with promoting the highest standard of research. The proliferation of universities in Israel, along with the overall trend toward mass higher education, has heightened the need for an Institute here in Israel. The inspiration and achievement of these institutes are essential for strengthening and advancing Israel's scientific and academic landscape.

Oppenheimer's words were prescient. The great growth in the number of institutes for advanced study, particularly in the last couple of decades, all around the world, is a powerful testimony to their perceived value. To list just a few, the IAS founded in 1930 was followed by DIAS founded in 1940, the Center for the Advanced Study of the Behavioral Sciences in 1954, IHÉS in 1958, and so on. Now there are literally hundreds of institutions around the world calling themselves "institutes for advanced study (or studies)", fulfilling Oppenheimer's prophecy.

Last year the *London Times Higher Educational Supplement* asked whether "the 'institutes of advanced study' being set up across the UK were simply research hotels where academics can enjoy precious thinking time or evidence of a fundamental shift in cutting-edge research".

So what are the reasons for this phenomenon? Some of the reasons have been given in some of the observations I have quoted during this talk; I think the essential ones were articulated by Flexner when he set out his farsighted vision in 1930. He saw the need for scholars and scientists of high achievement and promise to be given opportunities to undertake research, motivated by their own intellectual curiosity, unconstrained by predetermined goals or considerations of immediate utility. And he took the view that such opportunities could not be provided readily within the university – at least the American university of his day, with its multiplicity of purposes.

Flexner's arguments tended to point towards a separation of undergraduate teaching from research, at least in the context of his time and place, that few of us would agree with as a general proposition. But the growth of mass tertiary education, the great expansion of the university system, good and necessary in itself, has led to the maelstrom of the immediate, as Flexner described it, being an all too familiar sensation in academia. And this expansion inevitably entails much greater expenditure, often of public funds, and with this naturally comes demands from government and others for greater accountability, which in any case is the spirit of the age.

It is the form that this accountability and associated audit consciousness takes that is the problem. The view is quite often taken that if you are giving away public money you had better know what it is going to be used for and precisely how it is going to be used; and then you should check up afterwards that it has been used exactly in the way that was specified, that the defined objectives have been realized. The problem is that such

requirements are inimical to research into truly fundamental questions: if you have to say what you are going to do, how you are going to do it, and when it is going to be finished, before you start, you are unlikely to be doing truly original research.

I have been told more than once that this problem was solved long ago in the former Soviet Union. In this month's issue of the *Notices of the American Mathematical Society*, Yuri Manin, interviewed by Mikhail Gelfand, explained, "In the Mathematics Institute in Moscow there was a clear-cut system: I would write that I was planning to prove the theorems that were in fact proven in the past year. Then I had a whole year to continue my work." Of course, this is not the only way in which the culture of the former Soviet Union is preserved in the West for future generations.

Along with simplistic ideas of accountability and audit, has come a form of utilitarianism, in particular a focus on attempted wealth creation, and an assumption that even fundamental research can be taken forward by a managerial approach, by requiring that research necessarily fit into national or international programs or frameworks.

As theoreticians in the mathematical sciences, we might be tempted to take the view that we are cheap, and, if the worst comes to the worst, do not really need grants, but even that is not acceptable as success is measured by funds and particularly overheads raised.

Arguably it was the realization of the effectiveness of science in conjunction with technology in the early nineteenth century that encouraged the development of the modern university, with its specialized disciplines, largely freeing it from its clerical past and taking it beyond the *idea of a university*, articulated here in Dublin by John Henry Newman in the 1850s, as a place whose objective was, as he put it, the diffusion and extension of knowledge rather than its advancement. But to some extent this was a Faustian deal, so that the practical benefits that have flowed from scientific research now tend to be used as the principal criterion for determining the success of universities and the areas within them that should be developed in the future.

Beyond this, the sheer busyness of the modern university has increased dramatically since Robert Oppenheimer referred to it fifty years ago. Universities have become addicted to growth – for example, judged by the number of students matriculating, Cambridge University has doubled in population every forty years since about 1800. That is an average growth rate of just under 2 percent per year; not too drastic, you might think, but it means that the university is now in some sense thirty-two times bigger than it was two hundred years ago. So now the philosophy in universities has become: you grow or you die. But the biological truth is that you grow and you die and, as a general rule, the faster you grow, the sooner you die.

Apart from the loss of institutional continuity, which may have its good and bad points, and of collegiality, the continual emphasis on institutional development (which I confess I have spent a fair amount of my time on) means that the organization units, the university departments, that resulted from the university reforms of the nineteenth and first part of the twentieth century, have become embedded within universities, as the frameworks for the power structures, financial and otherwise; they have become bailiwicks for professorial barons expanding or defending their territory and so often are concerned with cooperation rather than collaboration, not least between cognate disciplines. In universities lacking a collegiate structure, academics from disciplines may not come across one another, except when fighting for resources on university committees.

In this context, the Institute for Advanced Study, envisaged by Flexner, provides a sanctuary from the maelstrom, where, in general, one is not disturbed by the noise of an empire being built and where success is not judged precipitately or oppressively, where research is driven by intellectual curiosity towards the discovery of what could not even have been conceived in advance, rather than towards precisely defined objectives set out in advance. Of course, one begins a research project with an interesting idea but it is a real disappointment if one does not end up doing something more exciting than that original objective.

In project management you are told to insist on SMART objectives, where SMART is an acronym for Specific, Measurable, Attainable, Relevant and Timetabled; in fundamental research, I think it is exactly the reverse and, for this reason, project management is quite unsuited for organizing fundamental research.

Ultimately, what is important, and therefore the real criterion by which the work of a research institute should be judged, is the long-term impact of research ideas and the impact that the institute and its academic staff have on the development of the scientists and scholars who spend time there.

In the conference to celebrate Werner Nahm's sixtieth birthday that is taking place this weekend, we are seeing excellent examples of this through the impact that his highly original ideas have had on theoretical physics and mathematics and also the inspiration he has provided to his many students and to others. Personally, I think the experience is very moving. At a dinner last night, we heard Sir Michael Atiyah describe how Werner has achieved what is perhaps the ultimate accolade in mathematics and physics – he has some simple, beautiful equations named after him, Nahm's equations. It is difficult not to envy Werner his equations particularly if, like me, you were very well placed to find them before he did but did not have the requisite insight.

Now research is increasingly assessed by counting citations. If you consult the standard database used by physicists to find how many citations concern Werner's papers on these equations, you might be surprised. Actually the SPIRES database lists none because Werner published these papers in ways that the database does not count. Of course, Werner would not be allowed to get away with that now!

Because people in institutes for advanced study are not, or should not be, involved with the general scramble for funds, which may at times involve some disingenuousness, as in the process Manin describes, they are better placed to remain rigorous and uncompromising about academic standards and the true purpose of academic research and scholarship. They can constitute a statement of appropriately high aspiration, as was made by De Valera in founding DIAS or by Aryeh Dvoretzky in establishing the Institute in Jerusalem.

Most institutes, like the Institute in Princeton and DIAS, combine strong international connections, bringing leading academics from around the world both as long-term members and as visitors, with strong local connections. For these reasons, many leading universities have established their own institutes for advanced study, as statements of aspirations to the highest standards in research and of international status and as a means of giving temporary respite from the pressure of university life for senior academics.

Curiously, the process of assessment of universities in the UK and the excellence initiative in Germany have led to many universities establishing institutes, both as self-assessments of excellence and to provide havens from the assessment process for favored academics.

However, an institute for advanced study established within a university will inevitably have a struggle in staying committed to its mission in the longer term because at some point the concern to the parent institution will become overriding; and it can not play the same role in bringing together academics from many universities if it is embedded in a particular one.

The current growth in the number of such institutions would not be happening around the globe if they were not perceived as successful over the longer term, both in terms of the research they have produced and the influence they have on the intellectual lives and development of those who spend time there. Comments from those who have been Members of the Princeton Institute very frequently speak of a life-changing experience.

So in summary the reasons for the proliferation of institutes for advanced study include:

- the opportunities they provide for academics to pursue curiosity-driven research away from the usual pressures of the modern university;
- they provide contexts within which academic standards can be maintained against external and internal pressures;
- they are international in character;
- they are successful in terms of the research produced and their impact on the development of those who spend periods there.

They can provide nearly ideal conditions for theoretical research, so that there are no excuses for failing to do something important. Frequently, since the earliest days, the term "academic paradise" has been used to describe such institutes, but THERE ARE NO EXCUSES IN PARADISE.

What of the future, referred to in my title? Fortunately, I am out of time. I will only note that the need for institutions cutting across the departmental structures of universities has grown as disciplines established in the nineteenth century have increasingly intersected in more recent decades. Interdisciplinary research centers of various forms have been established, some very focused, others broader, like our institutes. A third stage of university development has been referred to, following first the medieval form of the university, as evolved into the form conceptualized by Newman, diffusing knowledge rather than advancing it; second the formation of the modern research university, from the nineteenth century onwards, based on departmental structures; and now the formation of institutes inside and outside universities cutting across departmental structures and disciplines. This can mean that an academic may have three roles within a university, and even three offices: in undergraduate teaching, in a department with a research function, and in an interdisciplinary institute.

Whether this provides a healthy tension or what Flexner thought was a confusion of purpose, I am not sure, but what is clear is that his dream, and that of De Valera, has been realized.