Fred. R. Mann
Lincoln Dr. Johnson Sr.
Warwick Hotel

6:30 pm

Leo Szilard

SPEECH

October 23, 1953

When I was a student at the University, people sometimes asked me what it was that I studied.

When I said I studied Physics, most of them asked me "What is Physics" and there were even a few who asked "What are Physics?"

That was some thirty years ago.

Today, of course, everybody knows what physicists are; they are the boys who made the bomb.

Mass murderers have always commanded the attention of the public and physicists are no exception to this rule.

But just because these days scientists are often admired, it does not follow that they are also understood. And to make people understand what a scientist is seems just as difficult today as it was thirty years ago.

Henri Poincare once said that the role of science is not to provide us with meals, but to keep us from being bored -- between meals.

And, indeed, the most important thing to remember about science is the fact that it is supposed to be fun.

A man's science need not be first-rate just because he is having fun with it -- but unless he has fun with it, it can never be anything but second rate science.

In this respect science was probably better off thirty years ago in Europe than it is today in the United States.

And if this is in fact true, it is due - I believe - mostly to the attitude which Europe takes towards leisure.

Doing nothing - in a pleasant sort of way - was always considered in Europe a perfectly respectable way of spending one's time.

Here in America you are expected to keep busy all the time -- it does not matter so much what you are doing as long as you are doing it fast.

Many of you perhaps know the story of the kind old lady who never spoke anything but good of everyone.

This was known to all of her friends.

One of them tried to catch her once and asked her what she thought of the Devil.

She hesitated only for a moment and then she said in her kindly voice "I understand he is industrious."

In Germany thirty years ago, a boy who left high school had completed his liberal education.

If he wanted to obtain a doctor's degree in physics, he entered the University for four years.

There he studied what he wanted without ever passing an examination and at the end of the four years, he submitted a written thesis.

This thesis had to represent an appreciable contribution to knowledge in order to be accepted.

If it was accepted, then the student was given an examination; that is he met his professors and they discussed his work with him.

They usually asked a few additional questions about related matters.

The Professors wanted to find out what the student knew rather than to find out what he did not know and this is, of course, as it should be.

You may have heard the story of the sage in the service of the Emperor of China.

He was supposed to give advice to all those who came to him to seek advice.

A peasant who had been to see him several times and found that the sage could not answer his questions became a little impatient one day and said:

"Why does the emperor pay you 10,000 pieces of silver every year if you cannot answer any of my questions."

"My friend" said the sage, "the emperor pays me 10,000 silver pieces for what I know.

If he were to pay for what I do not know, 10,000 pieces of silver would not be nearly enough. --

In the German universities when the student was outstanding, his doctor's examination became a farce.

After the first world war, Hilbert -- in Goettingen -- was the leading German mathematician.

One of his best students was called Bernaes.

When Bernaes came up for his examination Hilbert ~~asked him~~ said:

"Mr. Bernaes, which is the most important number in mathematics?"

"Pi" replied Bernaes.

"Well" said Hilbert, "Pi is a pretty important number in mathematics, but it is not the number I had in mind."

"Then" said Bernaes "I would choose "e", the base of the natural logarithms"

"Yes" said Hilbert "e" is the number I had in mind.

I thank you very much Mr. Bernaes.

You have passed Summa Cum Laude."

There was a story of an examination given by Max Planck to a student majoring in theoretical physics.

Planck asked the student: "How do you expect to earn a living when you have your doctor's degree ~~in theoretical physics~~?"

"Professor Planck," said the student, "Can I possibly have an easier question."

"I don't know" said Planck, -- I hadn't planned to ask you more than one question."

Soon after I got my doctor's degree in physics in the University of Berlin, I thought it would be ~~interesting~~ a good idea to get also a doctor's degree in economics.

In Berlin

Whether you got your doctor's degree in physics or economics your degree was always called Doctor of Philosophy and you merely ~~majored~~ specialized in physics or economics.

When I told the University that I wanted another doctor's degree, I was handed over from one official to another until I landed in the office of the Rector.

"We would like to oblige you" said the Rector, "but I don't see how we can do it.

When we gave you the degree of Doctor of Philosophy we certified that you are a man who is able to acquire any kind of knowledge which he desires, is capable of independent judgment and ~~has the maturity of~~ is mature enough to be a scientist and scholar."

"I don't quite see" said the Rector "how we can certify the same thing twice."

Today, here in America, the graduate student working for his Ph. D in physics is presented with all the knowledge in physics that is considered to be useful.

If he is a good student, he will emerge from the University with a thorough knowledge of the entire field of physics -- a more thorough knowledge ~~probably~~ perhaps than his colleague who comes from some University in Europe.

And yet it may be that the American student has lost something in the course of his thorough training.

Throughout all the time he spends as a graduate student ~~in the University~~, his professors throw at him the answers to questions that have never occurred to him to ask.-

He is fed a rich diet and has never ~~the~~ any opportunity to be hungry.

Having been led to the frontiers of science and then released with a doctor's degree, the student is likely to sit back and wait until science makes further progress so that he can find something more that he can learn.

~~Probably~~ The most important quality in a scientist is originality.

How do you teach originality?

Maxwell showed great originality in his work and so did Einstein.

But can you teach originality by telling the student to read the papers of Maxwell and Einstein and then to follow in their footsteps?

To this question no one knows the answer with certainty.-

A student may know everything there is to know and yet lack the self-confidence which he needs in order to pitch in and push back further the frontiers of science.

It sounds paradox and yet it may be true that such self-confidence ~~can~~ comes to students in Europe as the result of inadequate ~~training~~ teaching -

When I was a student ~~at the University of~~ in Budapest, what I was actually taught was very little.

But during that time I became quite curious about a number of problems to which I wanted to find ~~an~~ the answers.

And I found answers to some of these problems without knowing that they had been solved before me by others.

Later on - when I found out that before me some great physicists had given the same answers -- it gave me self-confidence to know that - what others can do - I can do also.

The attitudes toward the training of scientists in Europe and in America represent two extreme approaches to the problem.

Perhaps the time has come for revising our views on this subject and adopt some middle course between these extremes.

There is another reason also for thinking of a revision at this time.

~~In the years preceding the end of the last war~~ all through this century (until before), physics was the king of the sciences --

During this period physics has ~~appropriated~~ drawn off the most gifted students who were interested in science.

And even today it is perhaps true that the most gifted students in the field of science are likely to major in physics.

But by now physics has undergone a rather fundamental change.

Before this time, a number of astonishing observations were made in physics in rapid succession.

Few of these observations needed expensive equipment or elaborate planning in advance.

The task of physics consisted in explaining puzzling observations in terms of the things which are familiar to us and which we encounter in our every day life.

In Newton's times for instance, the shape of the orbits of the planets was an astonishing observation and a cause of puzzlement.

Then one day Newton saw that he could explain it in terms of something quite familiar to all - the simple fact that an object which you hold in your hand falls down to earth when you release it.

You might say that Newton's apple is the symbol of what physics used to be.

In physics today on the other hand, it seems that we have to spend a couple of million dollars and go to a lot of trouble before we can observe anything about which we can be astonished.

We may then, after a decent period of puzzlement, go into a song and dance and say that we have found an explanation.

But, whatever we find these days it is not an explanation of the new phenomonon in terms of familiar facts taken from our every day life.

As the result of this fundamental change in physics, physics is loosing its claim to the exclusive interest of the best minds among our students of science.

Therefore, today a gifted student even though he may major in physics is - likely to be interested to find out what different branches of biology may have to offer.

The student today is also likely to discover that borderline between physics and chemistry has all but vanished, and that no progress can be made in biology without a knowledge of chemistry.

Students of science are therefore becoming aware of the fact that there is such a thing as the "unity of science."

Today I believe a student would be better off to learn what is essential in mathematics, physics, chemistry and biology during the first three years in college without specializing too much and then to specialize in his fourth year only. The work he does in the fourth year would enable him to meet the entrance requirement of the graduate schools or professional schools in his chosen field of specialization.

But to suggest that the college arrange the teaching of science accordingly would be regarded as heresy in most of the older colleges and the vested interests, are likely to be strong enough to prevent the change that is needed.

Brandeis, being brand new has a chance to lead in this respect.

Two years ago when I visited Brandeis for the first time, I was struck by the opportunity which Brandeis had for attracting gifted scientists to their staff. Among the small universities Brandeis has an exceptional position by offering a pleasant seeting outside of a large city, and at the same time offering the intellectual attraction of a center of learning such as Cambridge, Massachusetts.

The proximity of Harvard and M.I.T. and the friendly attitude which their scientists seem to take towards Brandeis should prove to be invaluable.

The young scientist who is offered a position on the staff of a small university is in danger of being intellectually isolated.

He needs other to talk to not only about science in general but also about his own special field or work which often is quite narrow.

There are very few small universities where he will be able to do this.

At Brandeis, however he can be almost certain that some one on the staff of either M.I.T. or Harvard will share his interests and will be happy to discuss with him his problems.

If Brandeis has an able and enthusiastic staff in science it should be able to attract to the college serious minded students who have a passionate interest in science.

Of the intelligent boys who come from high school, many of those who have a gift for abstractions are attracted to science.

Science today offers them an opportunity to earn a livelihood while pursuing a hobby.

To Jewish boys in particular, pure science - as a career - has an added

attraction.

Even today a Jewish boy is somewhat handicapped if he goes in for engineering or other industrial application of science.

But in pure science, such handicap as may exist does not count in the face of real achievement.

Immediately after the first world war, Professor Einstein ~~who at that time lived in Berlin~~ made a visit to Paris. At that time he lived in Berlin and Relations were still strained between Germany and France.

A visit to Paris was frowned upon both in Germany and in France, and you had to be Einstein to get away with it.

Just about that time, an American physicist named Miller, published experiments which seemed to show that the theory of relativity was all wrong.

~~He~~ Miller was a local celebrity in those days, even though today he is all but forgotten.

In Paris Einstein was ~~cornered~~ buttonholed by reporters who wanted to know what would happen if Miller proved to be right.

"That is very simple," said Einstein.

"Today in Germany I am regarded as a German, and in France I am regarded as a Jew.

If Miller should prove to be right, I shall be regarded in France as a German and in Germany as a Jew."

A really successful education in science along novel lines will be possible at Brandeis only if Brandeis ~~will also be able to~~ can also be able to attract graduate students in ~~certain selected areas of~~ science.

~~There ought to be 30 graduate students of outstanding quality around at any one time.~~

The presence of these graduate students will greatly enrich this University ~~Brandeis~~ and without them the under graduate training in science ~~without them~~ would remain deficient.

What has Brandeis to offer to these graduate students that will enable ~~Brandeis~~ it to pick the best of the crop?

The answer to this may sound to you somewhat prosaic.

The only way to pick the best graduate students and take them away from Harvard, M.I.T., Columbia, Chicago, or the California Institute of Technology is to pay them more.

Most graduate students are married these days and find it difficult to make ends meet.

No matter what their personal preferences may be, most of them will have to go where they can earn a half way decent living.

If Brandeis can establish a fund for fellowships for graduate students in science and pay $1,000.00 more than does Harvard, Brandeis can have first choice.

Brandeis cannot hope for a long time to come to become the leading graduate school in science, but it could establish a respectable record of research achievement in certain selected fields of science.

What is perhaps more important Brandeis could become one of the leading under graduate colleges in science as well as in other fields of learning.

I am inclined to think that there is little point in having a Jewish-supported college unless it becomes one of the outstanding colleges of the United States.

Leo Szilard

D

SPEECH October 23, 1953

When I was a student at the University, people sometimes asked me what it was that I studied.

When I said I studied Physics, most of them asked me "What is Physics" and there were even a few who asked "What are Physics?"

That was some thirty years ago.

Today, of course, everybody knows what physicists are; they are the boys who made the bomb.

Mass murderers have always commanded the attention of the public and physicists are no exception to this rule.

But just because these days scientists are often admired, it does not follow that they are also understood. And to make people understand what a scientist is seems just as difficult today as it was thirty years ago.

Henri Poincare once said that the role of science is not to provide us with meals, but to keep us from being bored -- between meals.

And, indeed, the most important thing to remember about science is the fact that it is supposed to be fun.

A man's science need not be first-rate just because he is having fun with it -- but unless he has fun with it, it can never be anything but second rate science.

In this respect science was probably better off thirty years ago in Europe than it is today in the United States.

And if this is in fact true, it is due - I believe - mainly to the attitude which Europe takes towards leisure.

Doing nothing - in a pleasant sort of way - was always considered in Europe a perfectly respectable way of spending one's time.

Here in America you are expected to keep busy all the time -- it does not matter so much what you are doing as long as you are doing it fast.

Many of you perhaps know the story of the kind old lady who never spoke anything but good of everyone.

This was known to all of her friends.

One of them tried to catch her once and asked her what she thought of the Devil.

She hesitated only for a moment and then she said in her kindly voice "I understand he is industrious."

In Germany thirty years ago, a boy who left high school at 18 had completed his liberal education.

If he wanted to obtain a doctor's degree in physics, he entered the University for four years.

There he studied what he wanted without ever passing an examination and at the end of the four years, he submitted a written thesis.

This thesis had to represent an appreciable contribution to knowledge in order to be accepted.

If it was accepted, the student was given an examination; that is he met his professors and they discussed his work with him.

They usually asked a few additional questions about related matters.

The Professors wanted to find out what the student knew rather than to find out what he did not know and this is, of course, as it should be.

You may have heard the story about the sage in the service of the Chinese emperor.

He was supposed to give advice to all those who came to him to seek advice.

A peasant who had been to see him several times and found that the sage could not answer his questions became a little impatient one day and said:

"Why does the emperor pay you 10,000 pieces of silver every year if you cannot answer any of my questions."

"My friend" said the sage, "the emperor pays me 10,000 silver pieces for what I know.

If he were to pay for what I do not know, 10,000 pieces of silver would not be nearly enough. --

In the German universities when the student was outstanding, his doctor's examination became a farce.

After the first world war, Hilbert -- in Goettingen -- was the leading German mathematician.

One of his best students was called Bernaes.

When Bernaes came up for his examination Hilbert asked him:

"Mr. Bernaes, which is the most important number in mathematics?"

"Pi" replied Bernaes.

"Well" said Hilbert, "Pi is a pretty important number in mathematics, but it is not the number I had in mind."

"Then" said Bernaes "I would choose "e", the base of the natural logarithms"

"Yes" said Hilbert "e" is the number I had in mind.

I thank you very much Mr. Bernaes.

You have passed Summa Cum Laude."

There was a story of an examination given by Max Planck to a student majoring in theoretical physics.

Planck asked the student: "How do you expect to earn a living when you have your doctor's degree in theoretical physics?"

"Professor Planck," said the student, "Can I possibly have an easier question."

"I don't know" said Planck, — I hadn't planned to ask you more than one question."

Soon after I got my doctor's degree in physics in the University of Berlin, I thought it would be interesting to get also a doctor's degree in economics.

Whether you got your doctor's degree in physics or economics your degree was always called Doctor of Philosophy and you merely majored in physics or economics.

When I told the University that I wanted another doctor's degree, I was handed over from one official to another until I landed in the office of the Rector.

"We would like to oblige you" said the Rector, "but I don't see how we can do it.

When we gave you the degree of Doctor of Philosophy we certified that you are a man who is able to acquire any kind of knowledge which he desires, is capable of independent judgment and has the maturity of a scientist and scholar."

"I don't quite see" said the Rector "how we can certify the same thing twice.

Today here in America the graduate student working for his Ph. D in physics is presented with all the knowledge in physics that is considered to be useful.

If he is a good student, he will emerge from the University with a thorough knowledge of the entire field of physics -- a more thorough knowledge probably than his colleague who comes from some University in Europe.

And yet it may be that the American student has lost something in the course of his thorough training.

Throughout all the time he spends as a graduate student in the University, his professors throw at him the answers to questions that have never occurred to him to ask.-

He is fed a rich diet and has never the opportunity to be hungry.

Having been led to the frontiers of science and then released with a doctor's degree, the student is likely to sit back and wait until science makes further progress so that he can find something more that he can learn.

Probably the most important quality in a scientist is originality.

How do you teach originality?

Maxwell showed great originality in his work and so did Einstein.

But can you teach originality by telling the student to read the papers of Maxwell and Einstein and then follow in their footsteps?

To this question no one knows the answer with certainty.-

A student may know everything there is to know and yet lack the self-confidence which he needs in order to pitch in and push back further the frontiers of science.

It sounds paradox and yet it may be true that such self-confidence may come to students in Europe as the result of inadequate training.

When I was a student at the University of Budapest, what I was actually taught was very little.

During that time I became quite curious about a number of problems to which I wanted to find an answer.

And I found answers to some of these problems without knowing that they had been solved before by others.

Later on - when I found out that before me some great physicist had given the same answers -- it gave me self-confidence to know that - what others can do - I can do also.

The attitude toward the training of scientists in Europe and in America represent two extreme approaches to the problem.

Perhaps the time has come for revising our views on this subject and adopt some middle course between these extremes.

There is another reason also for thinking of a revision at this time.

In the years preceding the end of the last war, physics was the king of the sciences --

During this period physics has syphoned off by far the most gifted students who were interested in science.

And even today it is perhaps true that the most gifted students in the field of science are likely to major in physics.

But by now physics has undergone a rather fundamental change.

Before this time, a number of astonishing observations were made in physics in rapid succession.

None of these observations needed any expensive equipment or elaborate planning in advance.

The task of physics consisted in explaining these observations in terms of the things which are familiar to us and which we encounter in our every day life.

In Newton's times for instance, the shape of the orbits of the planets was an astonishing observation and a cause of puzzlement.

Then one day Newton saw that he could explain it in terms of something quite familiar to all - the simple fact that an object which you hold in your hand falls down to earth when you release it.

You might say that Newton's apple is the symbol of what physics used to be.

In physics today on the other hand, it seems that we have to spend a couple of million dollars and go to a lot of trouble before we can observe something about which we can be astonished.

We may then, after a decent period of puzzlement, -- go into a song and dance and say that we have found an explanation.

But, whatever we find these days it is not an explanation of the new phenomonon in terms of familiar facts taken from our every day life.

- As the result of this fundamental change in physics, physics is loosing its claim to the exclusive interest of the best minds among our students of science.

Therefore, today a gifted student even though he may major in physics is - likely to be interested to find out what challenge different branches of biology may have to offer.

The student today is also likely to discover that borderline between physics and chemistry has all but vanished, and that no progress can be made in biology without a knowledge of chemistry.

Students of science are therefore becoming aware of the fact that there is such a thing as the unity of science.

Today I believe a student would be better off to learn what is essential in mathematics, physics, chemistry and biology during the first three years in college without specializing too much and then to specialize in his fourth year.

The work he does in the fourth year would enable him to meet the entrance requirement of the graduate schools or professional schools in his chosen field of specialization.

But to suggest that the college arrange the teaching of science accordingly would be regarded as herecy in most of the older colleges and the vested interests, are likely to be strong enough to prevent the change that is needed.

Brandeis being brand new has a chance to lead in this respect.

Two years ago when I visited Brandeis for the first time, I was struck by the opportunity which Brandeis had for attracting gifted scientists to their staff.

Among the small universities Brandeis has an exceptional position by offering a pleasant seeting outside of a large city, and at the same time offering the intellectual attraction of a center of learning such as Cambridge, Massachusetts.

The proximity of Harvard and M.I.T. and the friendly attitude which their scientists seem to take towards Brandeis should prove to be invaluable.

The young scientist who is offered a position on the staff of a small university is in danger of being intellectually isolated.

He needs other to talk to not only about science in general but also about his own special field or work which often is quite narrow.

There are very few small universities where he will be able to do this.

At Brandeis, however he can be almost certain that some one on the staff of either M.I.T. or Harvard will share his interests and will be happy to discuss with him his problems.

If Brandeis has an able and enthusiastic staff in science it should be able to attract to the college serious minded students who have a passionate interest in science.

Of the intelligent boys who come from high school, many of those who have a gift for abstractions are attracted to science.

Science today offers them an opportunity to earn a livelihood while pursuing a hobby.

To Jewish boys in particular, pure science - as a career - has an added

attraction.

Even today a Jewish boy is somewhat handicapped if he goes in for engineering or other industrial application of science.

But in pure science, such a handicap as may exist does not count in the face of real achievement.

Immediately after the first world war, Professor Einstein who at that time lived in Berlin made a visit to Paris.

Relations were still strained between Germany and France.

A visit to Paris was frowned upon both in Germany and in France, and you had to be Einstein to get away with it.

Just about that time, an American physicist named Miller, published experiments which seemed to show that the theory of relativity was all wrong.

He was a local celebrity in those days, even though today he is all but forgotten.

In Paris Einstein was cornered by reporters who wanted to know what would happen if Miller proved to be right.

"That is very simple," said Einstein.

"Today in Germany I am regarded as a German, and in France I am regarded as a Jew.

If Miller should prove to be right, I shall be regarded in France as a German and in Germany as a Jew."

- A really successful education in science along novel lines will be possible at Brandeis only if Brandeis will also be able to attract graduate students in certain selected areas of science.

There ought to be 30 graduate students of outstanding quality around at any one time.

The presence of these graduate students will greatly enrich Brandeis and the under graduate training in science without them would remain deficient.

What has Brandeis to offer to these graduate students that will enable Brandeis to pick the best of the crop?

The answer to this may sound to you somewhat prosaic.

The only way to pick the best graduate students and take them away from Harvard, M.I.T., Columbia, Chicago, or the California Institute of Technology is to pay them more.

Most graduate students are married these days and find it difficult to make ends meet.

No matter what their personal preferences may be, most of them will have to go where they can earn a half way decent living.

If Brandeis can establish a fund for fellowships for graduate students in science and pay $1,000.00 more to them than does Harvard, Brandeis can have first choice.

Brandeis cannot hope for a long time to come to become the leading graduate school in science but it could establish a respectable record of research achievement in certain selected fields of science.

What is perhaps more important Brandeis could be one of the leading under graduate colleges in science as well as in other fields of learning.

And I personally feel that there seems to be little point in having a Jewish-supported college at all unless - within the limits it sets itself - it becomes one of the outstanding colleges of the United States.

6 30 pm Frederick R. Mann
Worwick Hotel Lincoln Tower Johnson St

Leo Szilard

SPEECH

October 23, 1953

When I was a student at the University, people sometimes asked me what it was that I studied.

When I said I studied Physics, most of them asked me "What is Physics" and there were even a few who asked "What are Physics?"

That was some thirty years ago.

Today, of course, everybody knows what physicists are; they are the boys who made the bomb.

Mass murderers have always commanded the attention of the public and physicists are no exception to this rule.

But just because these days scientists are often admired, it does not follow that they are also understood. And to make people understand what a scientist is seems just as difficult today as it was thirty years ago.

Henri Poincare once said that the role of science is not to provide us with meals, but to keep us from being bored -- between meals.

and indeed

The most important thing to remember about science is the fact that it is supposed to be fun.

A man's science need not be first-rate just because he is having fun with it -- but unless he has fun with it, it can never be anything but second rate science.

In this respect probably

It might be that science was better off in Europe thirty years ago than it is today in the United States.

- I believe - mainly

And

If this is in fact true, it is due mainly to the attitude which Europe takes towards leisure.

Doing nothing in a pleasant sort of way was always considered in Europe a perfectly respectable way of spending one's time.

Here in America you are expected to keep busy all the time -- it does not matter so much what you are doing as long as you are doing it. fast.

Many of you perhaps know the story of the kind old lady who never spoke anything but good of everyone.

This was known to all of her friends, and one day some of them tried to catch her and asked her what she thought of the Devil.

She hesitated for a moment and then she said in her kindly voice "I understand he is industrious."

In Germany thirty years ago, a boy who left high school at 18 had completed his liberal education.

If he wanted to abtain a doctor's degree in physics, he entered the University for four years.

There he studied what he wanted without ever having to pass an examination.

At the end of the four years, he submitted a written thesis.

This thesis had to represent an appreciable contribution to knowledge in order to be accepted.

If it was accepted, the student met his professors and they discussed his work with him.

They usually asked a few additional questions about related matters.

The Professors wanted to find out what the student knew rather than to find out what he did not know.

This is, of course, as it should be.

You may have heard about the sage who was in the service of the Chinese emperor.

He was supposed to give advice to all those who came to him to seek advice.

A peasant who had been to see him several times and found that the sage could not answer his questions one day became a little impatient and said

"Why does the emperor pay you 10,000 pieces of silver every year if you cannot answer any of my questions"

"My friend" said the sage, "the emperor pays me 10,000 silver pieces for what I know.

If he were to pay me for what I do not know, 10,000 pieces of silver would not be nearly enough. --

In the German universities when the student was outstanding, his doctor's examination became a farce.

Hilbert -- in Goettingen -- after the first world war was the leading German mathematician.

One of his best students was called Bernaes. When Bernaes came up for his examination Hilbert ~~said to~~ asked him

"Mr. Bernaes, ~~I want you to name a number which plays a very important role~~ which is the most important number in mathematics?"

"Pi" replied Bernaes.

"~~Yes~~ Well," said Hilbert, "Pi is a ~~very~~ pretty important number in mathematics, but it is not the number I had in mind."

"Then"said Bernaes"I would choose "e", the base of the natural logarithms"

"Yes", said Hilbert "e" is the number I had in mind. I thank you very much Mr. Bernaes. You have passed Summa Cum Laude."

There was a story of ~~another~~ an examination given by Max Planck to a student majoring in theoretical physics.

Planck asked the student: "How do you expect to earn a living when you get have your doctor's degree in theoretical physics?"

"Professor Planck," said the student, "Can I possibly have an easier question."

"~~Well~~," said Planck, "I don't know -- I hadn't planned to ask you more than one question."

Soon after I got my doctor's degree in physics in the University of Berlin I thought it would be interesting to get also a doctor's degree in economics.

Whether you got your degree in physics or economics your doctor's degree officially was always given in philosophy and you majored either in physics or in economics or in any other of a number of other subjects.

When I went to the university and said I wanted another doctor's degree, I was handed over from one official to another until I landed in the office of the Rector.

"We would like to oblige you" said the Rector, "but I don't see how we can do it, having given you the degree of doctor in philosophy we have certified that you are a man who is able to acquire any kind of knowledge which he desires, capable of independent judgment in any field on which he may wish to concentrate and has maturity required to be regarded as a scientist and scholar."

"I don't quite see" said the Rector "how we can certify the same thing to you twice.

If you want to publish any paper in the field of economics there is no reason why you should hesitate to use the doctor's degree in conjunction with your name under which you publish the paper.

Today here in America the graduate student working for his Ph. D in physics is presented with all the knowledge of physics that is considered to be useful.

If he is a good student, he will emerge from the University having a thorough knowledge of the entire field of physics -- a more thorough knowledge probably than his colleague who gets his degree in some University in Europe.

And yet it may be that the American student has lost something in the course of his thorough training.

Throughout all the time he spends as a graduate student in the University, his professors throw at him the answers to questions before any of these questions ever occurred to him.

He is fed a rich diet without ever having had the opportunity of being hungry.

Having been led to the frontiers of science and then released with a doctor's degree, he is likely to sit back and wait until science makes further progress so that he can find something more that he can learn.

The most important quality in a scientist is originality. How to you teach originality? Maxwell showed great originality in his work and so did Einstein.

Can you teach originality by telling the student to read the papers of Maxwell and Einstein and then follow in their footsteps?

To this question no one knows the answer with certainty. —

A student may know everything there is to know and yet lack the self-confidence which he needs in order to pitch in and push back further the frontiers of science.

It sounds paradox and yet it may be true that such self-confidence may come to students in Europe as the result of inadequate elementary training.

When I was a student at the University of Budapest, what I was actually taught was very little.

During that time I became more and more curious about a number of problems to which I wanted to find an answer and I found the answers to some of these problems without knowing that they had been solved before by others.

Later on I found out that before me some great physicist had given the same answer which I found, -- it gave me self-confidence to know that what others can do I can do also.

The attitude towards the training of scientists in Europe and in America represent two extreme approaches to the problem.

Perhaps the time has come for revising our views on this subject and adopt some middle course between these opposite extremes.

There is another reason also for adopting a revision at this time.

In the years preceding the end of the last war, physics was the king of the sciences -- and within physics theoretic physics was the gathering place of the elite.

During this period physics has syphoned off by far the most gifted students who were interested in science.

And even today it is perhaps true that the most gifted students in the field of science are likely to major in physics.

By now physics has undergone a rather fundamental change. Before this time, a number of astonishing observations were made in physics in rapid succession.

None of these observations needed any expensive equipment or elaborate planning in advance.

The task of physics consisted in explaining these astonishing observations in terms of the things which are familiar to us and which we encounter in our every day life.

In Newton's times for instance, the shape of the orbits of the planets was such an astonishing observation and a cause of puzzlement.

Then one Newton saw that he could explain it in terms of common experience. In this case, the common experience was the simple fact that an object which you hold in your hand falls down when you release it.

You might say that Newton's apple is a symbol of what physics used to be.

In physics today on the other hand, it seems that we have to spend a couple of million dollars and go to a lot of trouble before we can see something about which we can be astonished.

We may then, after a decent period of puzzlement,-- go into a song and dance and say that we have found an explanation.

But, whatever we find these days is not an explanation of the new phenomonon in terms of common facts taken fromour every day life.

As the result of this fundamental change in physics, physics is loosing its claim to the exclusive interest of the best minds among our students of science. A gifted student even though he may major in physics is likely to be interested to find out what prospects different branches of biology may have for coming of age and becoming full fleged members of the family of sciences.

The borderline between physics and chemistry has all but vanished, and no progress can be made in biology without a knowledge of chemistry.

Students of science are therefore becoming aware of the fact that there is such a thing as the unity of science.

But in the conventional colleges it is impossible for a student today to acquire the knowledge in mathematics, physics, chemistry and biology which he must have to be well-grounded in science.

In most of the old extablished colleges there are a great number of elective courses offered in any one of the special scientific areas -- this is not what s is needed today.

Today I believe a student would be better off to learn what is essential in mathematics, physics, chemistry and biology during the first three years in college without specializing too much and specialize in his fourth year

The work he does in the first year would enable him to meet the entrance requirement of the graduate schools or professional schools in his chosen field of specialization.

But to suggest that the college arrange the teaching of science accordingly would be regarded as herecy in most of the colleges and the vested interests are likely to be strong enough to prevent the change that is needed.

Brandeis has a chance to lead in this respect.

Insert 1

Will Brandeis be able to attract serious-minded and gifted students who have a passionate interest in science?

Brandeis has easy access to the Jewish population of the eastern seaboard, and this is a reservoir rich in gifted boys who are attracted to science. They seem to be attracted to science for more than one reason.

First and most important, they are attracted because of their native gift of abstraction.

Then also they are attracted to pure science as a career.

Even today a Jewish boy is somewhat handicapped if he goes in for engineering or other industrial application of science.

But in pure science, such a handicap as may exist does not count in the face of real achievement.

Immediately after the first world war, Professor Einstein who at that time lived in Berlin made a visit to Paris.

Relations were still strained between Germany and France.

A visit to Paris was frowned upon both in Germany and in France, and you had to be Einstein to get away with it.

Just about that time, an American physicist named Miller, published experiments which seemed to show that the theory of relativity was all wrong.

He was a local celebrity in those days, even though today he is all but forgotten.

In Paris Einstein was cornered by reporters who wanted to know what would happen if Miller proved to be right.

"That is very simple," said Einstein.

"Today in Germany I am regarded as a German, and in France I am regarded as a Jew.

If Miller should prove to be right, I shall be regarded in France as a German and in Germany as a Jew.

Is Brandeis in a good position to attract an outstanding teaching staff in science?

Two years ago when I visited Brandeis for the first time, I was struck by the opportunity which Brandeis had for attracting gifted scientists to their staff.

Among the small universities Brandeis has an exceptional position by offering a pleasant seeting outside of a large city, and at the same time offering the intellectual attraction of a center of learning such as Cambridge, Massachusetts.

The proximity of Harvard and M.I.T. and the friendly attitude which their scientists seem to take towards Brandeis should prove to be invaluable.

The young scientist who is offered a position on the staff of a small university is in danger of being intellectually isolated.

He needs other to talk to not only about science in general but also about his own special field or work which often is quite narrow.

There are very few small universities where he will be able to do this.

At Brandeis, however he can be almost certain that some one on the staff of wither M.I.T. or Harvard will share his interests and will be happy to discuss with him his problems.

A really successful education in science along novel lines will be possible at Brandeis only if Brandeis will also be able to attract graduate students in certain selected areas of science.

There ought to be 30 graduate students of outstanding quality around at any one time.

The presence of these graduate students will greatly enrich Brandeis and the under graduate training in science without them would remain deficient.

What has Brandeis to offer to these graduate students that will enable Brandeis to pick the best of the crop?

The answer to this may sound to you somewhat prosaic.

The only way to pick the best graduate students and take them away from Harvard, M.I.T., Columbia, Chicago, or the California Institute of Technology is to pay them more.

Most graduate students are married these days and find it difficult to make ends meet.

No matter what theirpersonal preferences may be, most of them will have to go where they can earn a half way decent living.

If Brandeis can establish a fund for fellowships for graduate students and pay ~~$500.00~~ to $1,000.00 more to them than does Harvard, ~~or the other first class universities~~, Brandeis ~~will~~ can have first choice.

~~It seems to me that Brandeis needs to have first choice.~~

It cannot hope for a long time to come to become the leading graduate school in ~~all fields of~~ science but it ~~could~~ can establish a respectable record of research achievements in certain selected fields ~~or perhaps~~ more important it could be one of the leading colleges in science as well as in other fields of learning.

I personally feel that there seems to be little point in having a Jewish-supported college at all unless within the limits it sets itself it becomes one of the outstanding colleges of the United States.