

The Research Colloquium Series Presents

Ms. Riet Borchert

**“The Life of a Research Technician - 40 Years of Biological Research
at Philips”**



**Tuesday October 7, 1997
10:30-11:30 am
Room R-8**

Refreshments will be at 10:00 am in R-8

Ms. Borchert worked for 40 years as a biological research technician at Philips in The Netherlands. She will be sharing with us her work about the influence of light on living organisms, her work using a scanning electron microscope, and her philosophy on working as a technician in research.

Lecture about my work in research.

1. Introduction

My name is Maria Theresia Borchert. But everyone calls me Riet. I am coming from the Netherlands. This is a very small country in Europe, and for most of you HOLLAND sounds more familiar. It is the same country.

I have been working for almost 40 years at the PHILIPS COMPANY.

As technician I did all kind of research at the Research Laboratory in Eindhoven.

Do you know why I am here giving a lecture ? It is because I was invited by Karen Green. I knew her mother since 1960. We both were working at that time in New Jersey.

And we still keep in contact almost every year. Around Christmas we write each other for wishing them a Happy New Year. We both were technicians and worked at the research laboratories of Merck Sharp and Dohme, a pharmaceutical industry in Rahway, New Jersey.

I stayed there as a trainee during one year. Karen's mother and me we both were doing biological investigation on looking for new antibiotics. I remember that during that year a new antibiotic was discovered from a watersample out of the Atlantic Ocean.

My grandparents originally came from Germany as my last name BORCHERT sounds like.

I am living in the Netherlands where I was born in Eindhoven, a rather large city with 200.000 inhabitants. Eindhoven is close to the Belgian border.

The country is overcrowded with almost 16 million inhabitants. There is a lot of industry and the farmland is being absorbed by factories of all kind. There is an enormous amount of people from other countries, like Suriname , the Dutch Indies, Eastern Europe, Pakistan, India, and lots of Africa. When they are not wanted in their own country they get a permit to stay here.

I have three brothers and one sister who was a teacher. My father and two of my brothers both worked

in textile business. My father used to be manager at a large department-store for man' s cloths. Herman, my oldest brother, emigrated to Canada and later on he had a job at Dupont de Nemours as a salesmanager in Europe. He once applied for a job at Milliken. I was an exception in my family because I liked as a child much more working with my hands and repairing or damaging things at home than being a saleswoman. And I don't have business blood in my veins.

Is not it amazing that now I am invited by a textile company to give a talk here about my work in biological research ?? !!

2. History of the Philips Company

Just when I started to make this speech a friend of mine gave me lots of information about your company. I was very surprised to read that the Milliken Company was founded in 1865. And before I knew this I wanted to tell you that the Philips Company already existed more than 100 years. So in comparison with Milliken that is quite young.

The history of Philips starts in 1891. In that year two brothers named Gerard and Anton Philips lived in a tiny town in the middle of Holland. Gerard, the oldest son, moved to Eindhoven and started a small factory to produce lamps. Their father had a trade business in tobacco and coffee and had made much money. At that time the electricity just was invented by Thomas Alva Edison and Gerard expected a big market for lamps in all kind of fields like in houses and industries.

Gerard developed a coalthread lamp of 72 Volt which was mounted on a lampfoot in glasballons by young girls. Because this work was done by hand the girls needed to have very good eyes and small tiny fingers. Afterwards the bulbs were evacuated and with electrical current they started glowing and gave light. The durability of these lamps was short and there was a great deal of competition with other factories especially in Germany. The price of one lamp costed half a weeks pay. In Eindhoven Gerard bought an old building in which he started on a small scale for not taking to many risks. At that time there were no patent problems. It was free trade up till 1912 when in Holland was signed a patent act.

At that time Eindhoven was a small town with 4000 inhabitants and Gerard Philips had a starting capital of 40.000 dollars. Around 1895 his younger brother Anton joined the company. He was more a sort of sales manager. Gerard needed him very much because business was going very good. A big problem was where to find enough workers and special young girls. In the neighbourhood of Eindhoven they could not find them. In the northern part of Holland there was an area where man digged peatmould out the ground. This product was used as fuel for heating and cooking. These people were very poor and had big--families with 10 or even more children. Philips asked them to move to Eindhoven offering them a job in their factories. The fathers and older sons and specially the young daughters were needed very much. I told you already why good eyes and tiny fingers were needed for assembling the coalthread lamps. Philips started building big houses for these large families and set up backeries, drugstores, grocery-stores, pharmacies to provide the newcoming people with everything they could need. Even now there is a Philips village in the center of Eindhoven.

The wife of Anton Philips took care for the education of the housewives and younger children. She set up schools and educated the women by organizing sewing and cooking-lessons. A medical center took care of the health both of the workers as their families. Also social help was provided. Even sport organizations were founded for everyone. The working schedule at that time was 10 hours a day and 6 days a week. At the age of 60 everyone got retired and a Pension-fund was set up to give all the old-workers a carefree old-age.

Philips organized schools for training their own workman to competent employees as for instance glassblowers, fitters, assistent engineers and so on. Even there came a fund for excellent students to

study at an University which their parents never could have afford.

In 1898 the production of lamps was 3 million lamps that year. But where can you find a market to sell these lamps? Gerard the oldest brother was the technical man but Anton much more was a sales man. He travelled all over Europe especially to Russia which took him over 3 weeks by train. It was an enormous success. Then that time 400 people joined the company. Later on Europe and South America were discovered as a market for their products.

The follow-up of the coalthread lamp was a tungsten filament lamp. This new lamp could stand a very high temperature because of the melting point of tungsten is 400 centigrade. So these new type of lamps lasted longer and produced much more light. Machines were designed to produce this new type of lamps . The industrial revolution was born. And the poor girls no more were needed.

In 1914 the Philips Research Laboratories were founded to invent new products, support their production on a large scale and do fundamental research on materials. etc. In that laboratory I started to work in 1952.

In 1920 the production of radio-tubes took place and the first RADIO with a speaker was produced called LITTLE CHAPPEL. On this radio you can see the first Philips logo. It shows a symbol of radio-waves and up till now and this logo has not changed. You can find it all over the world, as I did traveling a lot. And everytime I saw it it made my feel happy.

Right from the beginning the most important policy the management of Philips had was not to be dependend on suppliers who deliver products which we re not of the best quality. So they founded their own product divisions.

The best quality had to be made and nothing less. Even now their slogan is:
THE BEST IS NOT GOOD ENOUGH and LET US MAKE THINGS BETTER.

Then you are ready going to any University or college. There are no colleges in Holland.

Nowadays only English and Dutch are obligatory languages in Highschool.

After finishing highschool I wanted to work in some kind of laboratory with my hands because I always liked to spoil and play with water. As I did not like to work in a hospital I applied for a job as technician at Philips Research Laboratories. At that time they were looking for girls you know! ! ! !

Up till then they did not accept girls doing research. The policy of the management was that a women should stay at home working in the kitchen but not at a laboratory bench.

At that time however the experimental research was growing very rapidly so they needed many more technicians then the number of boys available. The board of managers and the personal department decided to hire female technicians as some kind of experiment!!!!

We were not allowed to wear lipstick and long trousers were forbidden as well. Only in wintertime when we had to go bicycling back and forth to work in very cold and freezing weather wearing trousers was allowed but we had to wear a skirt over it while working.

Can you imagine at that time?

Another discrimination was that we got paid only 70 percent of the salary the boys earned for the same kind of work. We were furious when we heard about this but we could not do anything about it because everybodys salary was a secret. You were not allowed to tell somebody else how much money you got at the end of the month. And a trade-union was not yet born.

It took another 3 years before there the equalization of salary between man and female technicians took place. At that time no female Phd. were born. In the beginning, it was around 1952, we had to work 5 and a half days a week. Altogether 43 hours.

My salary was 100 guilders a month , at that time 25 dollars, of which the company subtracted 1 dollar income-tax and 50 pennies social security. Fortunately I was living at home with my family so I did not starve from hunger.

I worked in research for 30 years in the biological group and afterwards another 10 years with an Scanning Electron Microscope.

In 1927 the first broadcasting by radio overseas were transmitted to Asia and Australia. Around 1930 the first sodium discharge tube was developed which had the advantage of lower costs on electricity and more contrast in the dark partly because of the yellow-orange color. These tubes were mainly used

outdoors as lightning streets, harbours etc. Nowadays most highways in Western Europe are provided with Philips lamps of that kind.

During worldwar II a portable disc-phonograph called hat-box came on the market. The records made at that time turned 75 rounds a minute. And just after the war the first television was born called: dog kennel. This T. V. had a screen of 10 inches and 4 channels. The image and the sound was of a much better quality than the televisions produced anywhere else in the world. I am a little chauvinistic but it is true ...

Around 1950 the economy was going very well and there was an enormous shortage of employees. The famous slogan was spread everywhere " PHILIPS IS LOOKING FOR MAN AND GIRLS "

I was one of them and it happened just in the year as I finished Highschool.

3. My background

During the last year of worldwar II in 1944 I was going to the first year of highschool. Holland still was occupied by the Germans and all buildings were taken over by soldiers for lodging their troupes. So we all missed a whole schoolyear. After we were liberated by the American Airborne Division and later on Holland was free the restoration and rebuilding of everything took place with the help of the American General Marchall, wich was called the "Marchall help ". We all still are thankful for that.

In Highschool all students had to study 3 foreign languages: English, French and German and of course our native language Dutch. We had no choice. I also studied Latin and Greece and the exact subjects as chemistry, physics, mathematics and biology. This study lasted for 6 years.

4. Influence of Light on micro-organisms, men, animals and plants

MICRO ORGANISMS

My work at Philips started as assisting a microbiologist, who was investigating the damage and recovery of bacteria caused by radiation with ultra violet light. Irradiation with light with a wave length of about 2500 Å which is equal to 250 micron was most effective.

The irradiation is destroying the capacity of micro-organisms to grow. The bacteria are damaged by radiation in a very short time. I was working on this subject less than a year and I learned a lot about bacteria, and working with them, when my boss became professor at the Florida University in Tallahassee.

Then another subject came along: The practical application of UV light was laying in the foodsector. The environment and the air of the location where food is prepared should be as clean as possible. For instance a production-line where meat, fish or cookies are wrapped in plastic the contamination of these products with bacteria is disastrous.

When the air above the fresh food line is irradiated with ultra-violet light, which kills almost all organisms, the food will be packed "steril" and the meat or fish or whatever product keeps fresh longer. Some products however can not be treated with ultra violet light. For instance milk gets a taste which was disgusting and horrible. The milk tasted as rotten unions! !!!

Ultraviolet radiation also can be used in hospitals and other places where a lot of people are coming together. In the waiting-rooms and dressing-rooms for patients were Ultraviolet lights provided to keep the air as clean as possible. The amount of bacteria in the room causing some kind of infection of the throat can be reduced very rapidly.

Because of the influence of ultra violet rays on men's eyes these lights only were on when there were no people in the rooms. Mostly they were on at night.

INFLUENCE OF LIGHT ON MEN

Another application of ultraviolet light was a sun ray treatment of children who were not in a good shape after the second worldwar. Lots of them were in a very bad condition because of not having sufficient and good food during the last year of the war which as you maybe know was in 1945.

It was known that sunlight has a very good effect on rachitis which is the same as the English Disease. It also was a good treatment for tuberculosis.

When the children got a cure with a special kind of ultraviolet rays their condition turned to be in a much better shape. It had the same result on them as spending a month vacation on the beach. Radiation with ultraviolet rays also reduces the English disease and tuberculosis.

Everybody no matter if it is a human being or animal they all need daylight to grow and to feel happy. Fortunately in most parts of the world almost everybody has the possibility to be outside enjoy the sunshine and get a tanned skin.

In winter it is possible to get an artificial sun-radiation with ultraviolet light which has the same result, as long as the time and intensity of irradiation not are exaggerated. Otherwise the chance to become skin-cancer should not be neglected.

This very severe circumstance was resolved by supplying the ultraviolet tubes with a glass tube of a special kind. The carcinogen rays were not coming through and the "healthy rays" could do their work.

This was tested on white female mice.

INFLUENCE OF LIGHT ON YOUNG CHICKENS AND PIGS

That brings me to another subject I worked on for a couple of years.

The Veterinary Section of the State University in Utrecht, in the center of Holland, asked the Philips Lightning Division for advice and cooperation concerning the ideal conditions for raising young chickens and pigs.

In the past these animals were bred mainly at farms on a rather small scale. We call this: Free range chickens. I found this name in a dictionary.

Gradually this kind of stockbreeding needed to be expanded to a very large production. The export of all kind of chickens and pigs products was increased very rapidly to many countries all over in Europe especially Italy, Germany, Spain and France. And nowadays to Greece and Israel as well.

The management of our research laboratory was asked for advice about the optimal conditions of light and temperature control in enormous buildings which were called: MEAT PRODUCTION FACTORIES.

The faster the animals grow the better the profit. The influence of optimal illumination, temperature control { day and night } and air circulation is extremely important for very young animals.

Since a long time it was known that the first week of the life of little animals has an enormous influence on the growing process during the following weeks.

The purpose of this work was to create conditions in which the animals at the age of 6 to 8 weeks all have the same weight. So an 100 percent output.

I'll try to explain what I mean. When a mother pig, a sow, gives birth to 15 to 20 baby pigs at once some of them have a lower weight than the others.

The mother pig does not have enough nipples (teats) available to give all of them a chance to drink at the same time.

So the baby pigs have to fight for a place to drink. Right from the first day the strongest ones win the game and start growing very rapidly. The baby-pigs, whose weight is less than the others, when they were born, do not get a place to drink immediately. This means that the second day the first-born ones already have gained weight and are stronger than the last-born ones who have to fight every day more and never win the game.

After 8 to 10 weeks the difference in weight between the heaviest and the lightest in weight can be more than 25 percent. The conclusion of this theory is that all young animals right away after birth should have the same chance to eat and to drink. So they all gain the same weight at the same time.

At the large scale production this is very important.

In Holland exists a veterinary industry, which is producing and exporting meat of chickens and pigs, eggs, one day old chickens and more all over Europe and the Middle East.

In Iceland an island far north in the Atlantic ocean, Philips has installed an enormous amount of greenhouses with the suitable illumination.

So in winter, when the amount of sunshine is very low, they have the possibility to produce vegetables and flowers all year around.

By using High pressure Mercury lights the growth is improving as well.

For mass production of plants all year around the conditions were studied. The use and sort of artificial light was investigated for every sort of plant separately. So the production of tulips in winter or daffodils in August is possible nowadays. The export of Dutch plants all over the world all year around is one of our most important business of Holland even as it is one of the smallest countries in Europe.

Most transport is going by air. Also cooled trucks are bringing flowers, plants, chickens, eggs and meat all over Europe and the Middle East. A fundamental investigation of Photosynthesis was done during several years. We wanted to resolve the structure of 2 photosystems of the photosynthesis. All green plants have the capacity to transform light-energy into chemical energy. Chlorophyll in each plant is responsible for this transformation

Already in 1950 in our laboratory they worked on looking at the influence of various sorts of light.

By working with a two-layer plant-system, one above the other, it is possible to give the top layer sunshine and artificial light as much as necessary during the day.

Downstairs plants are kept in the dark during the day. After 12 hours the plants are changed from up to down and reverse for the following 12 hours.

By using this system of double layers the production is doubled for the same costs of energy. It also is possible by changing the period of radiation during day and night a plant can produce flowers whenever you want. For these experiments I was asked to move to Utrecht, a large city in the middle of Holland. There is the only Veterinary University of Holland.

Philips proposed to set up a program on a rather small scale there. There they constructed several pens, each housing 100 1-day old chickens or 25 just-born pigs.

The optimal environmental conditions for the fastest growth were investigated.

These conditions concerned:

- sort and amount of light per square meter,
- visible and infrared lights
- how many hours a day light on or off
- optimal temperature for growing
- composition and circulation speed of the air
- sufficient food and water available for every animal

We controlled the growing condition of the animals by weighing them at first every two days and later on every week always at the same time of the day. Once in a while a drop of blood was taken to measure their condition.

The result of this extended experiment was that all animals were growing at the same speed and reached the same weight after 8 weeks. So the survival of the fittest was over.

We also had wanted to find out the influence of different kind of music but the university did not give permission for doing that experiment.

Nowadays when you drive through the countryside you can see everywhere huge stables with thousands of chickens lighted in all different colors almost day and night all year around. The influence of the summer or winter season is not there anymore.

PLANTS

You of course know that any plant, placed in the dark for some days, loses his green color and turns into white. The influence of sunlight is quite obvious. In winter all plants, far from the equator, don't grow at all or very slowly. There is short of sunlight. Using a glow lamp had effect but produces too much heat. By using neonlight this problem mostly was solved.

AQUARIA.

Another request came from an Association of Aquarium owners called Vivarium. In the Netherlands there are more than 300.000 aquaria fans. They wanted to know which are the best lights to use in their aquarium at home.

There must be ecological balance between fish and waterplants. Most of the time the plants at home do not get sufficient light.

We got the following problems to solve:

An aquarium must be pleasant to look at .

The fish should look nice and stay in a good condition.

A problem was the condition of the aquaria-plants, because some of the most common types did not do it too well. Some did not grow at all and others died within a week.

The costs of electricity must be as low as possible.

The result of the aquaria experiments were that all kind of fish did not show any influence of the sort of light. Only the fluorescent fish looked sometimes much nicer.

Concerning the cost of energy these were very cheap thanks to the very low voltage of the advised lights.

Do you know that Dutch people are known as being rather economical: they make a penny and go a long way. This expression also was in my dictionary.

5. Scanning electron microscope

At the age of around 50 the management decided to stop all subjects connected with the biology. Their policy was that Philips was going to be mostly an electrical company. And biology did not fit in this program. I was too young to stop working and too old to find a job somewhere else.

Fortunately in a services section of our lab there was a vacancy in a microscopy group. Because I was trained as a microbiological technician before I had some experience in this field. I was lucky to get that job. Just at that moment the first scanning electron microscope was developed by Philips and was used for enlarging all kind materials. The magnification of a light microscope reaches only up till an enlargement of plus minus 500 times.

THE FIRST MICROSCOPE

The first microscope was made by Antoni van Leeuwenhoek who lived from 1632 till 1723. He made the first microscope himself by hand. He reached a magnification of almost 200 times. He started looking at a drop of blood. He became a member of the Royal Society in London.

With a SEM, the short name for scanning electron microscope it is possible to enlarge details of a

sample up to hundred thousand times or even more depending on the sort of material. After an intensive course of getting experience with the SEM, I became a operator specialist in the field of the micro electronic development of integrated circuits socalled CHIPS. In the IC world a SEM is essential to control each step of the production Gradually the amount of samples wich I had to look at were many more than I could handle, so more electron microscopes were needed. And I became some sort of teacher, called: "the SEM expert".

Many young people just finished there university studies got a job in the IC world. I gave all of them a course how to work with such a microscope.

It was a week 's course in which they got experience enough to go on by themselves. I wrote a simple manual with a red cover, called Riet's red book. The official manuals for all kind of electronical instruments seem to my opinion very complicated and confusing.

The researchers don't need to know how the microscope looks inside especially the electroncolom is very complicated.

As long as they can produce sharp photograph's of their samples at a very high magnification exactly of the spot, they were looking for, it is OK.

As material used for teaching IC , s are not that interesting so I got other samples like very little animals as flies, ants, flies and other insects which I collected from a window seat which is not cleaned for some time.

I liked this teaching work very much but at the age of 60, I had to stop working which I did not like at all. After being retired for almost a year I was asked to give courses again now and then . It was not at the research lab but on other places connected with the mass production of chips. I was very pleased with this work but since last year I really don't work anymore.

6. Philosophy on working as a technician in research

During the time I was working as a technician in research every assistant used to work for one PhD.

Having a position like this it needs a lot of cooperation and understanding between the two of you.

Your boss has to be sure that the results of the experiments you do are done very accurate.

For instance doing organic chemistry investigation every experiment has to be done at least 2 times giving exactly the same result. If not the same, the same experiment has to be done for the third time.

Also doing a blanc experiment was absolutely necessary.
Do not be satisfied if you are sure it could have be done better.

I think that the most important thing between boss and technician is a good cooperation and understanding between each other.

I heard that at this moment the cooperation is changing in competition between researchers. Who can publish a new item first. The salary and chance for promotion are influenced very much by the number and importance of the publications. At least so the situation is at this moment in our lab. I think maybe it is interesting for you who are working maybe in research as I did.

The only work I did recently was preparing this lecture for all of you during the last weeks. I hope you enjoyed it.

Thank you !!!!