Curie conference reflects on impact of discovery

Poland's President, speaking on the centenary of the Curies' discovery of polonium and radium, proposed a permanent dialogue on the "problems at the borderline of politics, science, and economic life."

On Sept. 17, 1998, Polish President Aleksander Kwasniewski keynoted the International Conference on the Discovery of Polonium and Radium—Its Scientific and Philosophical Consequences: Benefits and Threats to Mankind, marking the centenary of Marie and Pierre Curie's discovery of these elements. President Kwasniewski's speech, "Scientific Discovery and Its Consequences—Reflections of a Politician," prompted one Polish scientist taking part in the conference, Dr. Zbigniew Jaworowski, to respond to the President's remarks, praising his vision, but correcting some of the myths relating to ecology, which the President had enunciated.

Jaworowski, a multidisciplinary scientist who is an M.D., Ph.D., and D.Sci., is a professor at the Central Laboratory for Radiological Protection in Warsaw and a former chairman of the United Nations Scientific Committee on the Effects of Atomic Radiation. He is known internationally for his work on radiation protection and climate science, and several of his articles have appeared in 21st Century Science & Technology. *Jaworowski provided* EIR *with translations of President Kwasniewski's speech, his own comments, and a follow-up letter from the President. Dr. Jaworowski's speech at the international conference, "Radiation Risks in the 20th Century: Reality, Illusions, and Ethics," appeared in* EIR*'s July 24, 1998 issue.*

President Kwasniewski's speech, Dr. Jaworowski's reply, and President Kwasniewski's letter appear here, slightly edited and with subheads added.

President Aleksander Kwasniewski

Dear Ladies and Gentlemen:

I welcome cordially all those who have come to Poland to attend the meeting of men of letters on the occasion of the 100th anniversary of the discovery of polonium and radium by Maria Sklodowska Curie and her husband Pierre Curie.

For Poles, the biography of Maria Sklodowska Curie is reason for a great and rightful pride. She is the personality of our national legend, one of those heroes of the past about whom children read in schools. Her life, her scientific career, have been a model for successive generations of researchers. The centenary of the discovery of polonium and radium offers an exceptional opportunity to pay tribute to our great compatriot. This is also an opportunity to express words of gratitude to France—the country which gave a home to the young Poles and offered the conditions for scientific development. I wish to thank the Nobel Prize winners who have honored our meeting.

I wish to thank Prof. Helena Langevin-Joliot and Pierre Joliot—grandchildren of Maria and Pierre Curie—for their presence. I wish to express heartfelt thanks to the representatives of the honorary patrons of our meeting—Mr. Federico Mayor, the General Director of Unesco, and James Dooge, representing the International Council of Scientific Unions.

I am grateful that you have come to Warsaw. The presence of so many eminent persons is a reason for great satisfaction. We have an exceptional opportunity to hear your opinions and suggestions regarding various implications of research studies and the role of the researchers in contemporary civilization.

I am pleased that I can welcome to you to Poland—the country which is making up, at an accelerated speed, for the lost distance dividing it from the highly developed states in Europe. Today's Poland is joining NATO and is negotiating the terms and conditions of its membership in the European Union. The past five years have witnessed a quick economic growth. Inflation is falling, and so is unemployment. Despite



Left to right: Maria Sklodowska Curie, Dr. Zbigniew Jaworowski, Polish President Aleksander Kwasniewski.

the financial crisis that had hit Russia, our foreign exchange reserves are growing. Poland is considered today one of the most stable countries in this part of Europe. These accomplishments are the merit of successive governments that represented very differing political options.

Poland can boast an excellent tradition of scientific achievement, which it treasures in the memory of its great researchers. You have come to a country that understands well the great significance of science, education, and technological advancement for our future.

Looking back at the last century

This conference is devoted to the centenary of the discovery of polonium and radium. The anniversary character of this meeting and an imminent turn of the century lead one to make historical comparisons, summaries, and reflections. "Nothing in the world is constant, but change"—this saying, widespread among the futurologists, has never been more topical than today. The world has faced problems, the depth and scope of which have never been envisaged by anybody, but which have to be urgently resolved. Within 500 days or so we will enter the 21st century. We are all asking ourselves the question, what century will it be? Let us recall—the 19th century was the era of steam and electricity; these were the days that gave birth to modern industry. The 20th century is the era of extraordinary development of science and great discoveries, the era of the atom. Scientific discoveries of the past 100 years played a fundamental role in the great transformation of the world of the 20th century. They also strongly affected people's lives on Earth.

The extraordinary accomplishments of nuclear physics initiated by the discovery made by Maria Sklodowska Curie and her husband brought the development of nuclear energy. They also offered completely new possibilities of treating numerous diseases that used to plague people. The great discoveries of the first half of the 20th century—which broke with the classical understanding of the micro-world—offered the possibility to develop, not only nuclear energy, but also, a later discovery of the transistor and the laser. These great discoveries stimulated the development of electronics, telecommunications, and computer sciences. Their immediate consequence was the creation of the global computer network, which linked not only scientific laboratories, but also PCs on every continent. Equally imposing is the development of chemistry, biology, medicine, and industry that implemented these magnificent discoveries. In the second half of the 20th century, the first transplantation of a human heart took place. At the turn of our century, the famous Dolly sheep was cloned.

On the other hand, disappointments and fear accompany the development of science. Technological progress and discoveries do not always serve to benefit humanity. We can observe it whilst remaining within the domain of interest of the Curies. It turned out that radiological therapy has not become a panacea for cancer. We have not eliminated the global threat of nuclear annihilation, which is the direct effect of their discovery.

An example from another domain: Spectacular chemical discoveries have brought a civilizational advancement, but also pollution of the environment, with long-term biological and civilizational consequences that are difficult to foresee.

The same applies to molecular biology and genetics. Even with technical protection and legal regulations, one cannot assume that this rapidly developing domain of science is absolutely safe, without any potential danger. Growing industry, and societies which are growing richer, carry the threat of polluting our planet, especially the threat of climate changes. The growing use of energy accounts for the pollution of the atmosphere. The greenhouse effect is growing. The protective ozone layer is increasingly thinner.

Despite the passage of 100 years, neither the politicians nor the researchers can effectively solve the problems of our planet. After the end of the 19th century, terrorist bombings took place in the streets of many European capitals. Paradoxically, not much has changed in this respect—only Alfred Nobel's dynamite was replaced by semtex, the discovery of Czech researchers.

Fascinating discoveries lie before us

Today, nobody will have the courage, as in the 19th century, to say that there is nothing more to discovered. The most fascinating discoveries are probably before us. We have learned to make use of nature over the past centuries. I believe that the 21st century will bring us knowledge of how to respect it, and not to disturb the balance of the natural environment, whilst using its renewable resources, and how to live with it in harmony. It is the obligation of the current generations to pass knowledge to the coming generations. The time has come to think, not only about the acquisition and transfer of knowledge, but also about the conditions under which we can utilize that knowledge and boost it. And this means, above all, concern for the natural environment and its resources.

The researchers are not to be blamed for the fact that the 20th century, called the century of science and advancement, has not lived up to its expectations. One hundred years ago, during the *belle époque,* it was believed that it would be the century of freedom, peace, development, and progress. It turned out to be the years of two world wars, brutal force and violence, invasions, and ravages. Therefore, there are reasons to perceive the forthcoming century without excessive optimism. However, there are no reasons for fear, which could paralyze the will to act. I am convinced that the 21st century will be the era of growing competition, but also the era of cooperation. A lot, a lot indeed, depends on how people—politicians, managers, and researchers—make use of their power, money, and knowledge.

We should not be surprised or indignant over the fears of many people who are bombarded by the growing amount of information about the negative consequences of certain discoveries or ecological disasters. The effect of Chernobyl was not only a disaster on an immense scale. It also made us aware where arrogance and human errors can lead. Certainly Chernobyl is responsible for the restrained attitude toward nuclear energy, which is considered by many scientific authorities as the most ecological and safe way to generate energy. Among others, as a consequence of that disaster, the nuclear energy project has been laid off, for at least a couple of years.

What conclusions can be drawn from that by the politicians and scientists, but also by you, who have gathered here today?

Firstly, we have to prevent the consolidation of a negative syndrome of social opposition against scientific and technological advancement. The influence of various pseudo-scientific prophets operating with simplified generalizations and half-truths, creating myths and collective fears, has to be weakened. In order to achieve this aim, scientific circles should improve their communication with society. The ability to break the frequently hermetic language of science should become increasingly popular.

Freedom from irrational fears

Secondly, we must give ourselves an unequivocal answer, whether self-imposed limitations on researchers and cessation of research in potentially dangerous domains are necessary. I am convinced that otherwise, we would experience a true catastrophe with consequences for the future of all of humanity. The striving to seek the truth, and discover the rules which govern nature is an immanent feature of the human mind and an inalienable right. This is the source of development.

This is why society and public opinion must be helped to draw a picture of the world and the situation in the domain of research, which is free of irrational fears. Scientists can accomplish that, above all. No one else understands better all the possible threats—but also immense development opportunities, stemming from the development of science and technology. Science and scientists can and should create a unique "early warning system" for threats resulting from new discoveries, warning against dead-end streets. It is easier to be such a voice of warning for the man of letters than for politicians.

Politicians are responsible to their electorate and must represent their interests in decisions to be taken. For a politician in a democratic country, the only road to the realization of his strivings is to convince others of his reasoning and to obtain consent for their realization. The search for a compromise is one of the fundamental methods of effective rule.

The scientist must be different. In my conviction, they cannot seek a common denominator with the spokesmen of other scientific views. Nobody would ever think about the determination of scientific reality by way of a vote. What is more, the scientist must at all times be ready to leave the road he was pursuing and his reasoning, if the facts contradict his hypothesis. Moreover, whilst a compromise in the striving to discover the laws of nature and truth is impossible for a man of letters, for a politician and decision-makers, such a position would be close to fundamentalism.

But also, politicians must know when to say "*non possumus*" [not possible], because the morality of a politician

cannot differ from that of a scientist. Politicians, like scientists, should have a sense of responsibility, including responsibility for the coming generations. They should also have the vision of the future in a perspective much longer than the next term of office or elections. They should perceive the opportunities for and threats to social development. Politicians and men of letters pursue only different roads and are guided by differing rules of conduct.

The Manhattan Project breakthrough

Some years ago, science was practiced by a small group of people based at universities. Laboratories were small and modestly equipped. No state authorities dealt with the financing of science, since the expenditures were relatively small. It was enough to allocate funds for the construction and equipment of universities, whereas the universities or private sponsors funded the research work of various scientists. Frequently, great discoveries were the fruit of individual passions or modest salaries or even their own funds. Archimedes, Copernicus, Leonardo da Vinci, or Darwin, were eminent scientists of their days, but, for none of them, was research how they made their living.

The Second World War and the implementation of the Manhattan Project brought the real turnaround. It was the first time that such a large group of people was gathered in one place and at one time, including physicists, mathematicians, chemists, engineers, and, finally, the military men, whose only objective was to construct an atom bomb. It was the only way to realize the idea born in the minds of a number of outstanding nuclear physicists over such a short time. This was a political decision, and it was taken by politicians led by the then-President of the United States of America, Franklin Delano Roosevelt. It was also his successor, the next President of the U.S.A., Harry Truman, and not researchers, who took a decision on the first — and so far, the only — use of the terrifying vision and the research product, namely the nuclear weapon. This event shows very clearly the immense moral burden shouldered by politicians and scientists — for the practice of science and the use of its fruits.

It is worth noting that the Manhattan Project turned out to be a turning point in the history of science, also, in another aspect. It was the beginning of an entirely new attitude toward science and toward the financing of research studies. After the end of World War II, research was included, for the first time, in state budgets. Also, major industries started building their large laboratories, employing the most outstanding minds, which were given means and opportunities not to be found in any university laboratories.

Paradoxically, it is from that time that accusations began to be addressed more frequently that misunderstood the role of science in the development of society. Public opinion often accuses governments and parliaments of having mistaken priorities. There are voices reflecting the pressures of the electorate on the implementation of short-term election promises — and science rarely fits into them — leading to shrinking public outlays for research.

This state of affairs has been observed both in democratic countries and in authoritarian systems. The situation could be illustrated by an anecdote regarding a conversation that a Nestor of Polish physics, Leopold Infeld, had with a minister of the communist government, about the need to raise the extremely low salaries of researchers. It happened some 40 years ago. According to Infeld, the then-minister rejected him, by saying that scientists would not stop working even if they were paid low salaries, whereas the miners would.

The morality of a politician cannot differ from that of a scientist. Politicians, like scientists, should have a sense of responsibility, including responsibility for the coming generations.

What has changed since those days? It might seem that everything has changed in Poland. Today, we are encouraging miners with material incentives to change their profession, to facilitate the closing of unprofitable mines. But this, however, does not make the scientific milieu feel any better.

It must be said, in all seriousness, that, if science does not become, soon, one of the top priorities of the state, we will not be able to look without fear into Poland's future in the increasingly competitive world. Science is the best investment for societies entering the 21st century. This applies to the entire state, but also to decisions made by individual people. Education and related research are a vital necessity for the developing countries.

I have every basis to believe that Poland's political elites accept this statement as one of the programmatic imperatives. Not only because this is the need of our country, but also because this attitude is taken by an increasing number of states worldwide.

The place of nations and states in the 21st century depends on science and education. I believe that this applies both to the advanced countries and to Poland, which is making up for delays. We have entered the road of systemic changes aiming to free the possibilities of man. In the previous system, they were hampered and restricted. The effectiveness of the market economy and inviolability of democracy is related to the level of public education. New economic conditions accounted for a sudden awakening of educational aspirations.

What does modernization of the educational process mean today? Above all — the consolidation of general knowledge and, as a consequence, the growth of fundamental sci-

ences. This also means a better knowledge of what is going on in the world. We are living in the days of the globalization of the economy, technology, and science. These domains require appropriately prepared people. Whoever fails to meet competition will condemn himself to degradation in his perspective.

I am deeply convinced that the dreams and strivings of the past generations for a prosperous and broadly educated Poland will come true now. Also Maria Sklodowska Curie deeply believed that education could change and make society more sophisticated. True to positivistic ideology, she wrote in her biography: "There is no possibility of building a better world without improving the fate of individuals."

Society and science in the new millennium

I have not the slightest doubt that the realization of dreams and expectations of humanity for the future millennium will only be possible if we use the creative accomplishments of the intellectual elites. They can analyze the aims of development and define the roads leading to its realization. They can be the voice of warning and they can help avoid future threats flowing from scientific and technological progress. They can finally help to carry out fundamental changes in the educational system. We should do our utmost to make the voice of intellectuals heard and listened to. In this, I see a great role to be played by governments and international organizations. I believe that the international community of scientists will not refrain from participating in such important social tasks in a way it has never done before.

I am posing an open question from this standpoint: Do all of us—the fathers of scientific and technological progress and its consumers—need to establish a permanent international forum for consultations and exchange of ideas, where we discuss the main problems at the borderline of politics, science, and economic life? Such a forum could play an advisory role, like that of the Economic Forum at Davos. I am leaving this issue for your consideration.

I wish you fruitful debates, and pleasant memories of your stay in Poland when you return home.

Response from Dr. Zbigniew Jaworowski

Warsaw, Sept. 26, 1998
Dear Mr. President,

It was a pleasure to hear your opening lecture on Sept. 17 at the International Conference on the Discovery of Polonium and Radium—Its Scientific and Philosophical Consequences: Benefits and Threats to Mankind. Both I and many other participants of the conference highly appreciated your realistic assessment of the relationship between science and contemporary civilization.

I was impressed by your arduous stressing of the need to prevent consolidation of the negative syndrome of social opposition, against false prophets of doom, creating myths and collective fears. This is one of the important challenges of our time that should be addressed by scientists and politicians. Not an easy task, as myths and fears have intoxicated society as a whole, including scientists, intellectuals, and politicians. In scientific literature, this situation is sometimes likened to the obsessive fears of witchcraft in past centuries.

These myths, however, resounded in your presentation. They are (1) global nuclear annihilation; (2) dimensions of the Chernobyl disaster; (3) man-made climatic catastrophe; (4) disastrous consequences of ozone layer destruction; and (5) pollution of the global environment. In my professional work I deal with scientific aspects of all these five menaces. May I, please, comment on them?

(1) Currently there are about 50,000 nuclear weapons stocked in arsenals worldwide, with a total explosive yield of about 13,000 megatons. This is only 30 times more megatons than up until now have been exploded in atmospheric nuclear weapons tests. According to estimates of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), a respected international authority on this matter, the average individual radiation dose from all these nuclear tests, accumulated between 1945 and 1998, is about 1 millisievert (mSv); that is, less than 1% of the average natural radiation dose. Exploding, in a short time, all the nuclear weapons stocked in the arsenals, with combat geographic distribution similar to that in past nuclear tests, the average individual would receive a long-term radiation dose of about 60 mSv. This is a far cry from the short-term lethal dose of 3,000 mSv for man. We are unable to annihilate either all human beings or all life on Earth, even after a substantial increase in nuclear arsenals.

(2) According to the estimates of UNSCEAR, the average radiation dose from the Chernobyl fallout outside the former U.S.S.R. consists in a tiny fraction of the natural dose (e.g., 0.3% in Central Europe). In the most contaminated parts of Belarus, Ukraine, and Russia, it reaches about 6 mSv per year, which is less than natural doses in many regions of the world. For example, in the city of Chernobyl in 1992, the average annual dose was about 5 mSv; inside the granitic Grand Central Station in New York, 5.4 mSv; in a region in Sweden, 35 mSv; in Brazil, 37 mSv; in India, 53 mSv; and in Ramsar county in Iran, from 89-285 mSv. In all these high natural radiation regions, no increase in cancer incidence or genetic disease has been observed.

Twelve years after this catastrophe, UNSCEAR estimates that "apart from the dramatic increase in the thyroid cancer in those exposed as children, there is no evidence of a major public health impact to date from the radiation exposure caused by the Chernobyl accident in the three most affected countries. No major increase in all cancer incidence or mortality has been observed that could be attributed to the accident.

In particular, no major increase has been detected in rates of leukemia, even among the accident recovery workers, one of the major concerns after radiation exposure." At its 1998 session, UNSCEAR also stated that "screening must . . . play a role in the reported increases in thyroid cancers." In other words, the increases in thyroid cancers are partly the result of more people being screened for the disease, not the result of an increase in incidence. On the other hand, psychosomatic disturbances, occurring in the former Soviet Union on a mass scale (not related to irradiation), are caused by scare propaganda, and by the policies of authorities, based on radiological ignorance.

The Chernobyl accident cost 31 victims their lives. Thus, it was a less harmful industrial catastrophe than many other catastrophes in the 20th century, even compared with the average number of 70 traffic fatalities occurring over one weekend in Poland. An industrial catastrophe in Bhopal, India, in 1984 killed 15,000 persons. In this perspective, the Chernobyl accident was not, as you said, "a disaster of an immense scale." But the false myth of thousands of fatalities in this catastrophe led, in many countries, including in Poland, to the virtual strangling of the development of human- and environment-friendly nuclear power.

(3) The hypothesis of man-made climatic change is opposed by more and more scientists. For example, the "Oregon Petition" against the Kyoto Protocol [the December 1997 amendment to the 1992 "Earth Summit" treaty, mandating drastic reductions in emissions of "greenhouse gases"], was signed in 1998 by 17,000 American scientists. Contrary to what the media and politicians (including Vice President Al Gore) proclaim, scientists are far from a consensus on this matter. I discuss this in an enclosed paper. [Cf. Zbigniew Jaworowski, Ph.D., "Ice Core Data Show No Carbon Dioxide Increase," *21st Century Science & Technology,* Spring 1997.]

(4) That the ozone scare is not a real danger, one can learn from a basic geophysical datum: Traveling from any place on the globe about 22 km in the direction of the Equator, increases the dose of UV [ultraviolet] radiation by 1%. Were the production of chlorine-containing CFCs [chlorofluorocarbons] (supposedly destroying the ozone layer in the stratosphere, which shields us against UV) not stopped, the maximum decrease of the ozone layer could reach about 5%. This would cause an increase in UV dose corresponding to moving 113 km toward the Equator. Nature introduces thousands of times more chlorine into the stratosphere than man does. If not for this natural flow of chlorine and other natural mechanisms of stratospheric ozone destruction, the concentration of ozone in the atmosphere would very soon surpass the lethal level for all life.

(5) Finally, let's have a look at pollution. One of the most fashionable contaminants of man and the environment is lead. It was the fear of the health impact of atmospheric lead pollution that was behind elimination of leaded gasoline from gas stations. Production of unleaded gasoline needs 25% more crude oil; by this factor we increased consumption of oil at the expense of future generations. However, the advent of leaded gasoline in 1925 coincided with a dramatic decrease of lead levels in Europeans, in comparison with its level in our ancestors from the Middle Ages and the 19th century.

Metallic lead was unknown in Poland 2,000 years ago, when its level in humans from the southern part of the country was about 2 micrograms (μg) per gram of bone. But in the 11th century, a monk from a monastery near Krakow had a lead level in his bones of about 100 μg/g, and between the 13th and 19th centuries, among inhabitants of Krakow and its surroundings, the lead level ranged from 50 up to 300 μg/g. Now, in Krakow, the average lead concentration in human bones has decreased to 4 μg/g. Similar trends occurred in other European countries, in the U.S.A., and Japan. A study of snow and ice from nine glaciers in Spitsbergen, Alaska, northern and southern Norway, the Alps, Ruwenzori, Uganda, the Peruvian Andes, and from the Antarctic Peninsula, demonstrated that, in the 19th century, the global atmosphere was slightly more contaminated with lead than now (probably due to higher volcanic activity before 1900 than after) and that more than 90% of atmospheric lead was of natural origin.

I strongly support your initiative, Mr. President, to create a forum where scientists, economists, and politicians could exchange views and educate each other. It could be a means of helping to dispel the myths and illusions that hound the end of this century.

Sincerely yours,
Zbigniew Jaworowski

Response from President Kwasniewski

Warsaw, Nov. 9, 1998
Prof. Dr. Zbigniew Jaworowski
Central Laboratory for Radiological Protection
Dear Professor:

My cordial thanks for your letter. I read with great interest your enclosed articles. I fully agree with your opinion on the myths of: global nuclear annihilation, Chernobyl, climatic warming, destruction of the ozone layer, and the danger of contamination of the environment. I appreciate also your support of the initiative of creating a forum, where politicians, scientists, and economists could exchange opinions and learn from each other.

I wish you, Professor, much success in your scientific work.

Sincerely,
Aleksander Kwasniewski