

The perception of genetechonology among high school students in Finland and in Poland

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1. The background of the study

Biotechonology and genetechonology as a part of it, has been one of the most rapidly developing areas of science during the 90's. Futurologists, e.g a French group in Recit 2100, estimate that the products of modern biotechonology will have a great impact on the everyday life in the future. New applications, like diagnostic products and drugs, have already been applied to the market in a relatively large scale. New adaptations in health care, such as gene therapy, are waiting their turn to become routine methods (Friedmann, 1993). Genetically manipulated agricultural products are coming to market and different methods to protect environment and produce energy will also make biotechonology more visible in everyday life (Grindley, Bennet, 1993; Smith, 1988; Yoxen, 1987).

In the future we will be challenged more often by both the threats and possibilities of biotechonology. Beck (1990) presents the future society as a risk society where environmental hazards, including the experiments of biotechonology, will be among the main dilemmas of the society.

Especially in the field of genetechonology there exist new types of ethical and social dilemmas. These are not only economic or technological. Gene technology is changing the biological relationship between man and nature more than any other present time inventions. Genetically manipulated ani-

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mals and plants create totally new types of problems in bioethics (Haapala, 1994). By the use of genetechonology for the first time can deliberately modify his own heredity within a very short time. Another possibility would be the production of genetically transformed microbes for biological war (Forss, 1991). These examples show that ethical rules applied so far by scientists will not be sufficient to cope with this new situation.

It is no wonder that the new genetically manipulated products on the market have raised expectations but also insecurity, even fear, among the general public (Gros, 1989). There has been available a lot of public information about biotechnology, genetechonology and the possibilities and risks related to them. In spite of the flow of information, the level of knowledge about biotechnology is rather low (Grindley, Bennet, 1993). The lack of knowledge is preventing critical public discussion of the effects of bio- and genetechonology. Especially old and middle-aged people have difficulties in presenting their opinions on how the humankind should cope with biotechnology. The young generation may be more ready to adapt to the future society. After all, it is the young generation who will accept or reject biotechnological applications in the future.

The public perception of biotechnology may support or hamper biotechnological applications in a country. In Finland and Poland the effect of public perception on the development of biotechnology might be rather different.

In Finland certain limited areas of biotechnology are ranked scientifically to be at a top level in the world, e.g.: paper production, wood processing and machinery. A Finnish futurologist Osmo Kuusi considers the small scale of research institutes in Finland and the negative approach of the public towards biotechnology as major obstacles to the development of biotechnological applications (Kuusi, 1991). Unlike Kuusi, numerous Finnish top scientists consider public perception to be rather positive towards biotechnological progress. As the first application of gene therapy to man in Finland took place during summer 1995, there has lately been a lot of public discussion in about gene therapy and genetic engineering. The tone of the discussion has been rather positive.

A special legislation on genetechonology, following the corresponding European Union directives came to force in Finland on June 1st, 1995. By defining the accepted guidelines, this law has further clarified the situation and is going to encourage both basic research and applications in the near future.

In Poland, the progress of biotechnology may be hindered by the relatively low level of technology, insufficient or totally lacking legislation concerning biotechnology, shortage of funding and "brain drain" to western countries, and not because of the public opposition against biotechnology and its applications (see Azzi, 1993; Twardowski, 1992).

2. Material and method

In this study, the answers of the second year students of high school in the town of Kuopio, Finland and in the town of Poznań, Poland to the questionnaire on public perception towards biotechnology are analysed. Kuopio (83 000 inhabitants) is the biggest town of the region of the Eastern Finland. Poznań (580 000 inhabitants) is the center of Wielkopolska region in the Western Poland. Both of the towns are the administrative and educational centers of their regions with universities and numerous colleges.

The sample consisted of 597 eighteen-years-old high school students from all seven high schools in Kuopio and of 360 students from various high schools in Poznań. In Finland, about 50% of the age group study in a high school (lukio). The curriculum is rather theoretical, with the emphasis on humanities rather than on natural sciences. In Poland only a minority of the age group attend high school. The high school program in Poland varies from one school to another according to specialization. The program is usually exclusively theoretical. The bias possibly caused by the different proportion of the age group studying in high school in these two countries was controlled by analysing the data also against the socio-economic background of the students.

In Finland, out of the 597 testees 55% were women and 45% men, in Poland out of the 360 testees 70% were women and 30% men. Uneven share of the sexes in these two countries was controlled by analysing the results also by dividing the sample according to sex.

In both of the countries almost 90% of the testees live in the centre of the town or in its suburbs. In Poznań, the proportion of urban dwellers is higher. In Kuopio students are more often living in one family house or in a semi-detached house in a suburb.

The socio-economic status of the students was estimated based on their parents' educational background. The parents of Polish students are more often well educated than the parents in Finland. In Poland more than every second father and almost every second mother have passed the matriculation exam or have a college degree. In Finland only 23% of the fathers and 18% of the mothers of the testees have such education. This is not, however, due to the selection of students from different social groups in these countries, but rather due to different access to the higher-level education in these two areas in the past decades.

In Poland almost 90% of the testees believe in God. In Finland equal percentage of the testees belong to the (Lutheran) church but only 50% is saying that they believe in God.

In the questionnaire, the high school students were asked about 1) knowledge of the details of biotechnology, 2) opinion about the ethical and social acceptability of the use of biotechnology to microbes, animals and humans, 3) background knowledge.

3. Results

When comparing the results between countries or within a country, differences are studied not only using general frequencies but also according to sex, religiousness of the student and the socio-economic status of the parents. Only statistically significant differences are presented ($p=0.05$).

When students were asked questions related to their knowledge of biotechnology, genetechonology, and also biology and chemistry, the number of correct answers in Finland and Poland varied a lot according to the type of question.

Rather easy questions based on the curriculum of the school were answered more often correctly in Finland than in Poland. In Finland, more than 90% of the testees gave correct answers to these "easy questions". In Poland, the number of correct answers were only two out of three. (Sample questions: the name of the founder of the rules of heredity, the number of chromosomes in a human cell.)

Almost every second person in both countries knew the correct answer to the questions which were based on everyday knowledge from the media or popular scientific magazines. The level of knowledge was higher in most questions in Finland, but this difference was smaller than in the case of the easier questions. (E.g.: Possibilities to remove oil from the surface of the sea by using bacteria; whether gene therapy has been applied to human yet.)

It seems to be no statistically significant distinction in the level of knowledge between the countries when observing the students' religiousness or parents social status. However, in Poland the knowledge of biotechnology is significantly better among students whose parents have matriculation exam

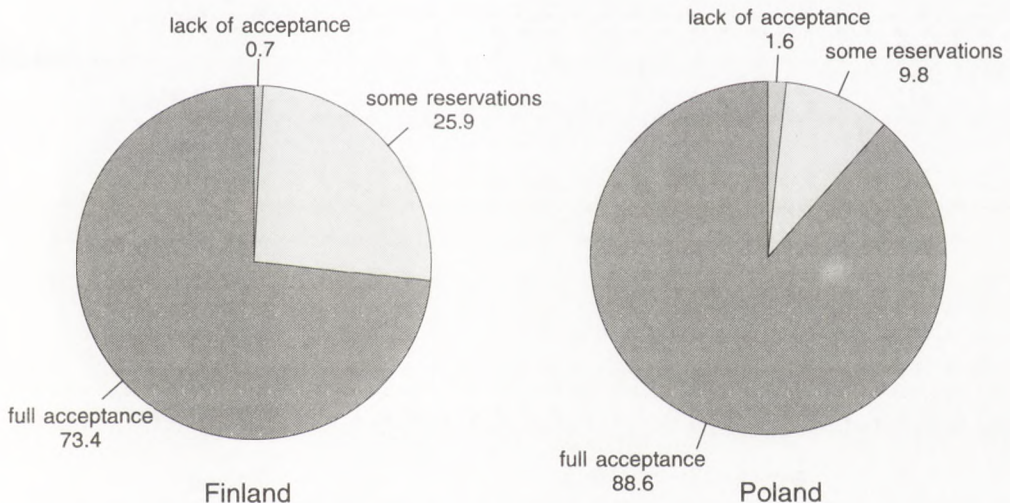


Fig. 1. Acceptance of laboratory research and applications of biotechnology in the case of microorganisms saving human life.

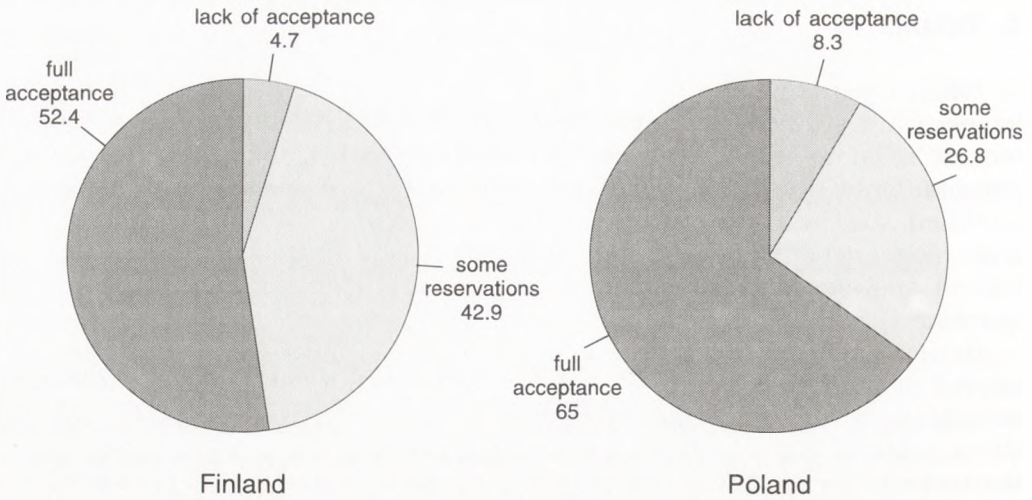


Fig. 2. Acceptance of laboratory research and applications of biotechnology in the case of microorganisms for food industry.

or college degree comparing to the students whose parents have education of lower level.

When asked about their opinion on the use of genetically modified microbes to: 1) rescue human life, 2) food and beverage production, 3) environment protection, the Polish students were more ready to accept all these applications than the Finnish students. The students in both countries seem

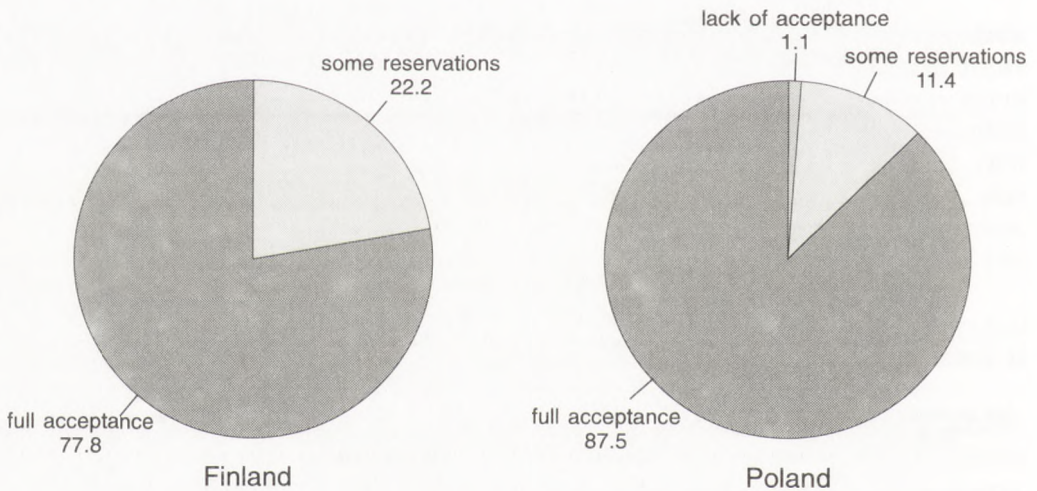


Fig. 3. Acceptance of laboratory research and applications of biotechnology in the case of microorganisms for cleaning and protection of the environment.

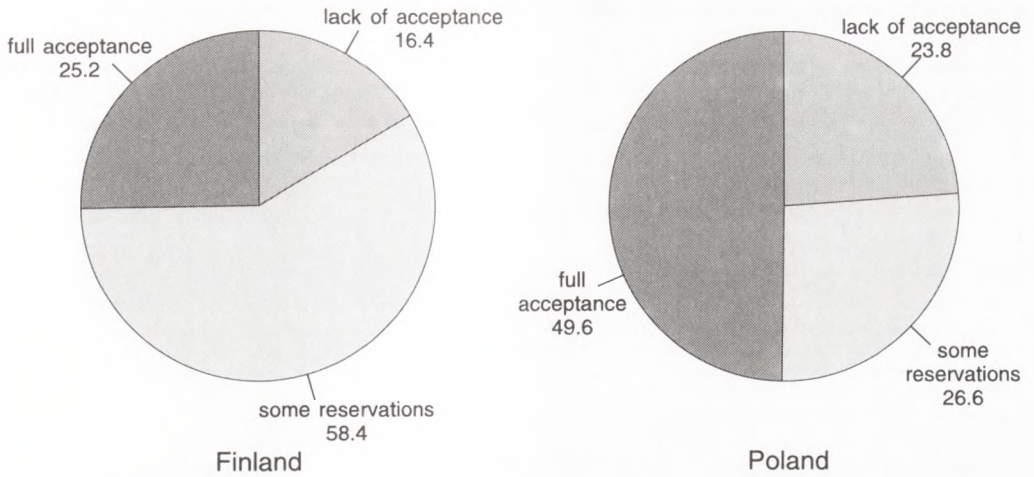


Fig. 4. Acceptance of applications of biotechnology in the case of animal tests.

to be ready to accept the use of microbes to save human life (89% in Poland and 73% in Finland without reservations) and for environment protection (88% in Poland and 78% in Finland). Smaller number of students are ready to accept the use of genetically modified microbes to produce foodstuffs (65% in Poland, 52% in Finland).

The use of gene manipulation for animal tests is far more widely accepted in Poland (50%) than in Finland (25%). The difference is especially big among women (47% in Poland, 15% in Finland). Genetic engineering for animal

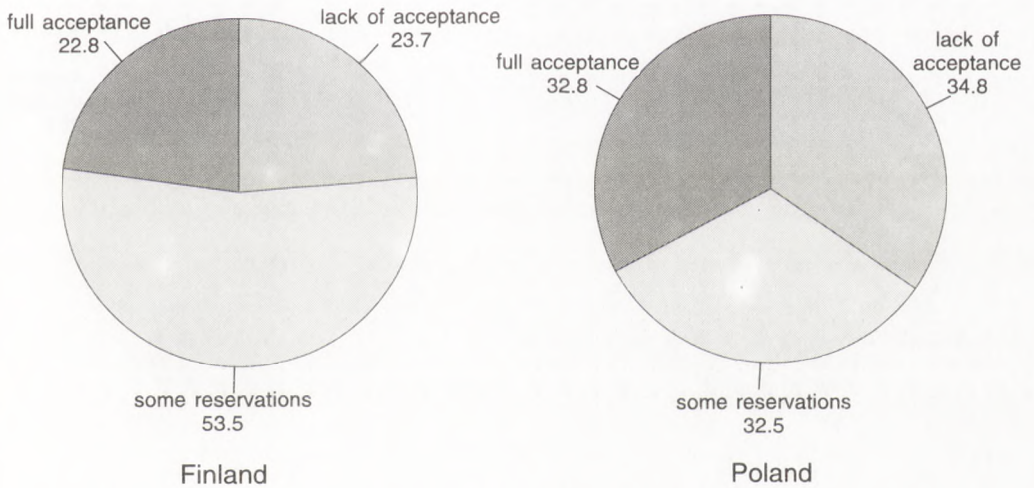


Fig. 5. Acceptance of applications of biotechnology in the case of animal breeding.

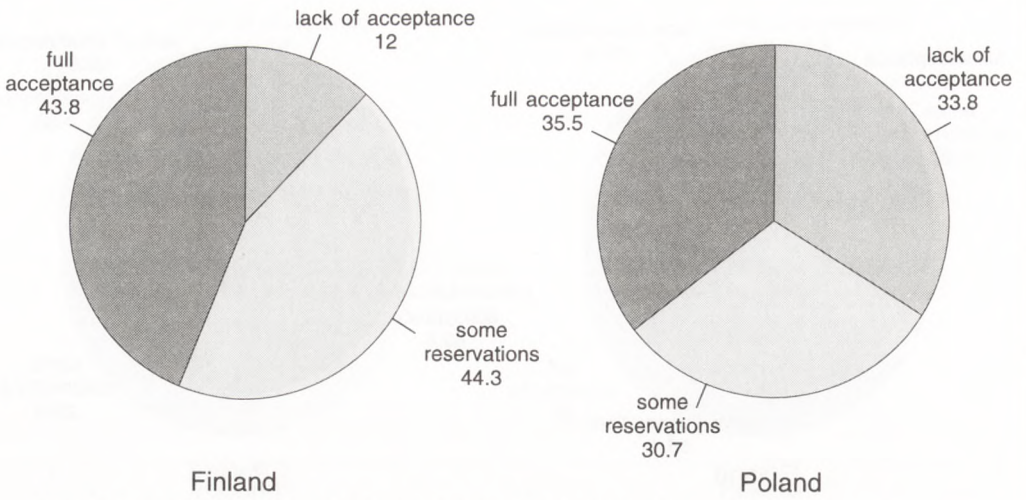


Fig. 6. Acceptance of biotechnological methods of prenatal research.

breeding is also more commonly accepted in Poland (33%) than in Finland (23%). Only 15% of Finnish women are ready to accept this type of experiments.

A majority of the students (62%) in both countries are ready to accept the use of gene technology to cure genetically inherited diseases. The number of students accepting the biotechnological study of human embryo (36% in Poland and 44% in Finland) and genetic basis of human characters (29% in Poland and 40% in Finland) are remarkably smaller. Especially small is the

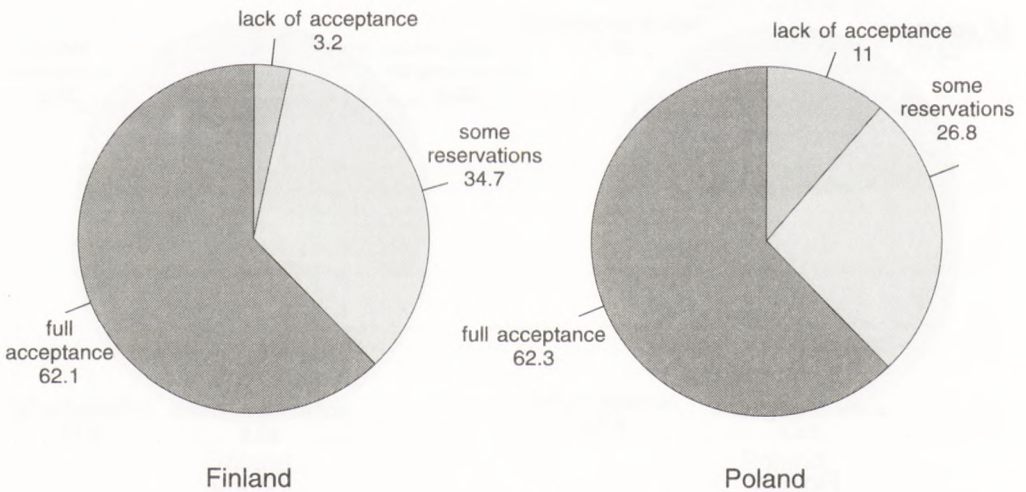


Fig. 7. Acceptance of biotechnological treatment of genetic diseases.

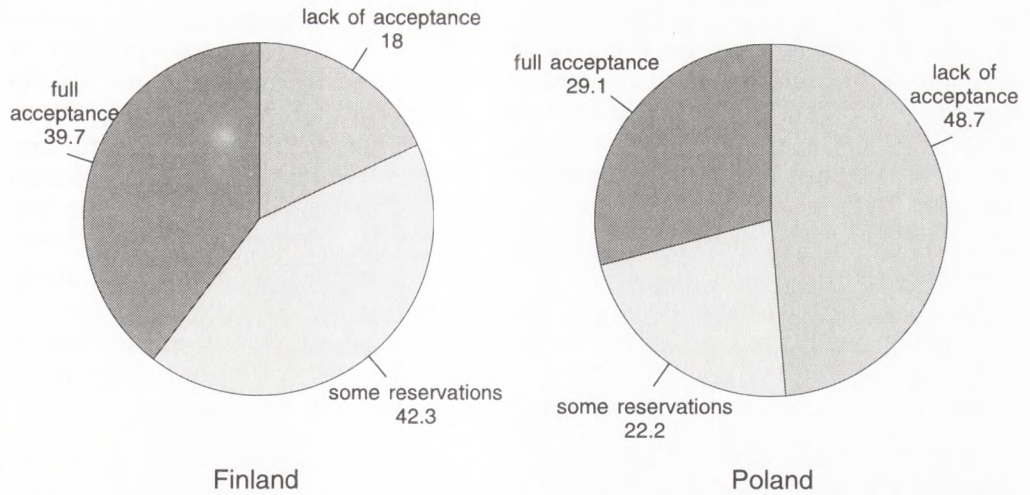


Fig. 8. Acceptance of biotechnological methods for the recognition of positive and negative characters of people.

number of testees ready to accept gene technological effort to create a new better human beings (9% in both countries).

Men seem to be more ready than women to accept the use of biotechnology to almost any purpose. The bigger difference between sexes concerning the acceptability of creating a new, better human was observed in Finland (2% of women, 17% of men). The discriminant analysis run between the sexes also confirms this fact. When sex was taken into consideration as a confo-

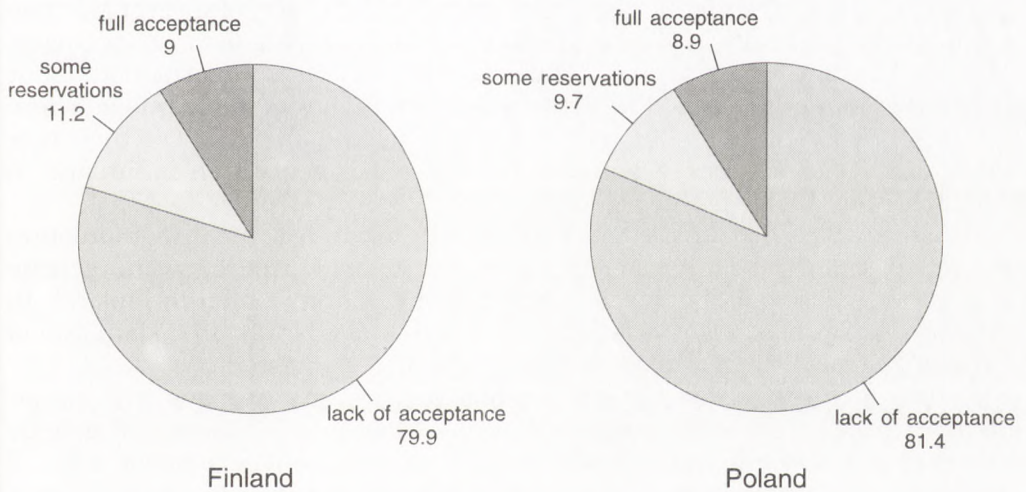


Fig. 9. Acceptance of biotechnological methods for creation of new, better people (humans).

unding factor, student's religiousness was subject to quite a small number of variables. Religious people most often reject the use of biotechnology to study human embryo. They are also more often ready to accept the use of genetically transformed microbes to save human life than non-religious people.

When social status of parents is taken into consideration as a confounding factor, differences in opinions on biotechnology between the countries remain the same. However, in Poland students having better educated parents are less ready to accept the use of genetically manipulated microbes or the genetic engineering on animals, than students whose parents have lower education.

In sum, Polish students seem to be more ready to accept the use of genetically engineered microbes for different purposes as well as the use of gene manipulation of animals. Finnish students, on the other hand, are more often ready to accept the use of genetechnology towards humans.

4. Discussion

The study proves that, in the case of biotechnology, the most basic things taught at school are better known among the high school students in Finland than in Poland. The knowledge from the media and popular scientific magazines as well as more detailed knowledge from the school curricula is known by equally large proportion of the students in both countries. It is difficult to say whether the difference of level of knowledge in the case of the "easy questions" is due to the differences in curricula at school in these two countries or to some other reasons.

When considering the acceptability of modern biotechnology in manipulating microbes the opinions are rather positive in both countries. It seems that the reservations the students may have towards animals and humans do not extend to the manipulation of microbes. The acceptance of the use of microbes is low only in Finland in the case of producing food or beverages. This opinion may have a temporary basis. A lot of negative information about genetically manipulated food in European Union (EU) was made public before the 1994 referendum in Finland concerning joining the EU. On the other hand, there is a permanent tendency among young generation in Finland to consume ecologically produced food.

Polish people seem to be more pragmatic towards genetic manipulation of animals than the Finns. According to the unstructured answers, genetic engineering of animals is objected especially by young women in Finland. In Finland, the animal rights movement is not limited only to a handful of activists but is getting a lot of support from the youngsters.

In the case of the use of gene technology towards humans, the rather altruistic idea of curing genetically heridited diseases by means of genetic engineering is commonly accepted in both countries. The eugenic idea of creating a new, better human is almost unanimously rejected by the students in both countries. Genetic manipulation of human embryo as well as the

study of human genome for clarifying the genetic base of human character, divided the opinion more than the issues mentioned above. These experiments contain possibilities of both altruistic and eugenistic orientations of the study.

When considering public perception of gene technology, based on the answers given by the Finnish students to direct questions we might conclude the attitude to be rather critical. No gene manipulation is accepted without consideration of risks and ethical dilemmas related to the operation. Gene manipulation is considered not to be safe enough yet, and it is claimed that it might have consequences, physical and social, of which the scientists are not yet fully aware.

At the moment it is possible only to set some hypotheses about the relationship between religiousness of the student and his/her opinion on the use of biotechnology. When taking into consideration the great number of students believing in God and the strong influence the church has on the Polish society, the Catholic religion probably influences the opinion of the students on biotechnology. This fact may be reflected by the large percentage of the students resisting the use of biotechnology on humans. In Finland, the students are most critical towards the use of biotechnology on animals. The ethical basis of this opinion may have only a little to do with religion. When asked in questionnaire, the (Lutheran) religion in Finland has a great impact on the opinions of only every tenth high school student.

In the future, people may be more aware of the risks and ethical dilemmas related to the manipulation of heredity. At the moment, even if scientists claim that people are ready to accept genetechonology, the general public may demand good reasons for the biotechnological, and especially genetechonological applications. It is not enough to give only technical or economic reasons for actions but the ethical and social aspects also have to be taken into consideration.

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Summary

The effect of public perception to the acceptance of biotechnology in Finland and Poland was tested. For research the students of high schools were selected. In the study the following aspects were included; social background; believing in God; knowledge of biology, perception of genetechnology towards humans animals and food.

Key words:

biotechnology, public perception, Finland, Poland.

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