# Translation from Croatian into English: Translation and Analysis of Short Texts of Different Genres

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# TRANSLATION FROM CROATIAN INTO ENGLISH: TRANSLATION AND ANALYSIS OF SHORT TEXTS OF DIFFERENT GENRES

Submitted in partial fulfilment of the requirements for the B.A. in English Language and Literature and Computer Science at the University of Rijeka

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## ABSTRACT

The main body of this B.A. thesis consists of four translations from Croatian into English. In the introduction I focus on the definition of translation, the history and evolution of translation and Roman Jakobson's approach to translation. The introduction is followed by translations of articles from various fields of human activity. They are followed by analyses in which I focus on difficulties I encountered while translating each of the articles and the solutions I opted for when dealing with these problems. Each translation is preceeded by an introduction which contains general information about the text. In the Conclusion I give my opinion on translating and summarize my overall work.

# 1 INTRODUCTION

Translation as a process has various definitions. According to the Merriam-Webster's dictionary, translation is the act or process of translating something into a different language[1]. Wikipedia defines it as the communication of the meaning of a source-language text by means of an equivalent target-language text[2]. Even in mathematics, a field of science that has little to do with linguistics, translation is viewed as a process of moving an object without changing it in any other way[3]. Based on these different interpretations, we can define translation as a process of conveying a message from one language to another, without changing the meaning of the message. The original language is known as the source language and the language we are translating the message into is known as the target language. The most important thing while translating is to make sure that recipients of both language receive the same message.

The evidence of first translation dates back to the Ancient Greece and Rome. Translation originally developed because of the need to communicate and overcome the differences between cultures. There are even assumptions that ancient traders and travellers may actually be the predecessors of modern translation experts. In the beginning, translation was based on literal interpretation and the meaning was conveyed by applying the "word for word" approach. This kind of approach was what the Greeks knew as metaphrase. The central concept of literal translation is to find a word in target language that has a literal meaning in source language. The main problem with this kind of approach is that the translation does not convey the sense and actual meaning of the original text as a whole, thus leading to mistranslation. Changes in

[1] *Merriam – Webster: Dictionary and Thesaurus*. Webpage. < http://www.merriam-webster.com/> Accessed August 2015.
[2] *Wikipedia*. 2015. Webpage. < https://en.wikipedia.org/wiki/Translation> Accessed August 2015.
[3] *Study.com*. Webpage. < http://study.com/academy/lesson/what-is-translation-in-math-definition-examples-terms.html> Accessed August 2015.

translation began in Rome when Cicero developed the "sense for sense" approach, also known as paraphrase. The "sense for sense" approach focuses on keeping the essential meaning of the original text by translating the entire sentence as a whole, as opposed to literal approach where the focus is on translating word by word.

During the early Christian period and the Middle Ages, translation had a role of spreading the word of God. The Bible was translated from Latin to various languages, and often by using the literal approach. The "sense for sense" approach became widely used with the beginning of the 17th century. Translation evolved more and more throughout centuries and translation studies started to formulate during the 1960s and they developed immensely in the 1980s and 1990s. Today, translation is even more important than it was before. It serves as a means of overcoming the differences between cultures and it simply helps us communicate with each other.

According to Roman Jakobson's essay "On Linguistic Aspects of Translation" from 1959, there are three types of translation. The first is the intralingual translation which Jakobson defined as "translation within a language which would involve explaining it in words of the same language[4]".The second is the interlingual translation in which the translator interprets one language into another, and the last one is the intersemiotic translation – translation from one linguistic system to another. He also emphasized the complexity of language and how difficult it is to find a complete equivalent in both the source and the target language. Achieving complete equivalence is one of the main problems of translation studies and many scholars agree that they are impossible to find.

Considering all the information I have on translating, I believe that the best way to translate a written text is to combine the "sense for sense" and "word for word" approaches in

[4] *National Programme on Technology Enhanced Learning*. Basic Concepts and Terminology of Translation Studies. Webpage. <http://www.nptel.ac.in/courses/109104050/lecture4/4_5.htm> Accessed August 2015.

order to fully convey the message of the original text. By focusing on just one approach, the translator could end up with a disappointing final result.

# 2 TRANSLATION OF AN ARTICLE FROM THE FIELD OF EDUCATION

## *2.1 Introduction*

The first article I have chosen to translate is from the field of education. I downloaded it from *Hrčak*, the central portal of Croatian scientific journals. *Hrčak* contains articles and publications from various scientific areas such as: natural sciences, technical sciences, biomedicine and health, biotechnical sciences, social sciences and humanities. This article belongs to the field of social sciences, more precisely education. It is focused on Scotland's education system, the transition betweeen kindergarten and school, the appropriate age to enroll children in school and innovative ways of teaching. The author of this article is Aileen McLean, Senior Education Manager from The City of Edinburgh Council. The text contains several education-related terms and phrases but overall it is not very challenging and it is easy to understand and follow.

## *2.2 Translation*

### Taking the first step

That ”weird“ and “scary“ first day of school is in the past. Author Aileen McLean describes how one Scottish city school department prepares for supporting the first graders and their families cope with transition from kindergarten to school.

Beginning of the school year is a tense and nervous period for parents.

Children in Scotland start with their basic education between ages 4.5 and 5.5 which is earlier than most of the European countries. Parents enroll their children in school in November and have 9 months of preparation period until the start of school year in the next August. That is quite a big change for everyone.

Some parents opt to postpone enrolment in case that in August, at the beginning of the school year, their child has not turned 5. The Authorised body has passed a discretionary resolution which declares that children born between August and December have a right to subvention while staying in kindergarten for another year. Out of all Scottish cities, Edinburgh has the highest percentage of parents who delay the start of school for their children. Therefore, we examined the data on postponing enrollments and shared our results with parents and specialized personnel.

There are surprisingly few studies that advocate the idea that enrolling children in school later than their peers is beneficial for them. A study from 2002, conducted by an American developmental psychologist Deborah Stipek and her associates, suggests that an older child achieves greater success at the beginning of their schooling, but this success is not evident later on. The disadvantages of later enrolment are noticeable after only three years of schooling. Such children are more likely to drop out of high school before graduation, and more likely to have social and emotional problems. But one thing is sure: parents worrying and stressing about starting school and whether their child is ready and progressing – this is universal in all countries and in every social system, no matter how old the child is when enrolled in school.

The most important problem we face is how to support and help the child during that sensitive period. “Curriculum for Excellence“ are new Scottish guidelines for nurturing and educating children from the age of 3 and throughout life. They emphasize the importance of each

child's development through engagement and provide exciting opportunities for studying, with special emphasis on child's emotional and physical benefit and freedom to discover and follow their interests. This sounds great to all educators and pedagogues because it gives them more freedom than ever to make the first year of a child's formal education fun and play-based while simultaneously allowing them  to provide the children with opportunities for acquiring skills through active, i.e. empirical studying.

However, we should also encourage acquisition of literacy and mathematical skills by carefully planning a child's progress, keeping in mind the sturdy support to transition, especially if children are coming to first grade from different kindergartens. For instance, a teacher from Edinburgh teaches children coming from 22 different kindergartens. Classes for first graders are not big – they usually have 25 students at most and 16% of all elementary schools do not have more than 20 children per class. The majority of first grades have additional support staff, along with the teacher, and these are mostly educators. Oscillations in the maturity of the children and their abilities at the beginning of the school year every August are high. Our message from Edinburgh is: School should be ready for first graders and not the other way around.

The 'Juniper Green' elementary school starts to connect with children even before they enroll in kindergarten, by arranging house visits for all the children in the school zone. “By doing so, we are getting more involved, which is important in the early years of a child’s development“ Ingrid Donaldson, headmaster's assistant, says. The school has developed active studying strategies for all children of different ages and it should also be noted that most of the children attended the kindergarten, which means that there were plenty of opportunities for them, their families and specialized personnel to get to know each other well. Parents are encouraged to get

involved, sometimes by bringing a photograph of their child in particular phases of studying, and sometimes by taking part and helping with various activities.

Other schools in Edinburgh, the 'Corstophine' elementary school for example, also make it their priority to include parents into school activities. Teacher Jennifer Ross has particularly made a contribution to this by inviting parents twice a week to engage in their children's class activities. This kind of program gets unanimous support from all sides. "Parents specially love the opportunity to witness first-hand the different strategies of teaching in the classroom" Jennifer Ross says. "It gives them insight into how the school works and allows them to ask us real questions about school, but also homework. Attending classes also gives them plenty of great ideas that they can try at home. We will most definitely continue with this method and the experience we gain will be used on different levels of education that the school offers." The educational personnel, of course, is of crucial importance in making it easier for a child to go from kindergarten to the first grade. The 'Juniper Green' elementary school has hired an experienced kindergarten teacher as an additional support to teachers and children. Her job is to help teachers come up with an entire array of activities and games for children, related to the skills that children have acquired or are yet to acquire. The teacher Karen Noble believes that hiring kindergarten teachers in first grades has helped children to maintain continuity and connection with kindergarten. "We are happy that our classrooms are mutually collaborating with each other" she says. "The experience and contribution of educators help us to plan, monitor and support children better, as they choose activities and games created to encourage them to progress and acquire new skills, especially in the field of literacy and mathematical skills."

During the first 5 weeks, first graders finish their classes around lunch time, but every afternoon they come with their parents to meet the teachers personally. Together they evaluate

the child's status and talk about the possible concerns. "Most parents want to know if their child is happy in class and if they have friends. They don't want them to play alone in the schoolyard", teacher Alison Craig, who is teaching a class of first graders for the third time now, says.

In both elementary schools we have mentioned, the transition from kindergarten to the first grade of formal education was much easier for children and not as painful as it was before. The 'Juniper Green' elementary school pairs up each child with an „older" friend who is already attending school. Alison Craig ensures that each child's daily schedule includes working alone, in pairs and groups, with additional choice options. Children easily switch from one activity to another; it is hard to believe that they started school only 3 weeks ago.

In all the schools in Edinburgh, specialized personnel is trying to ensure numerous different ways for the youngest ones to learn and acquire knowledge. The most important thing is to keep the children happy. Parents, therefore, can breathe easier.

Children need time and space to set their imagination free. When I talked to Reuben, who was playing with seashells in the sand, it didn't take me long to realize that these were not seashells but a spaceship that flew him to the moon. The best thing about school for him is that he can play in activity centers. A girl named Tiegan was eager to tell me this: "In kindergarten, we can do whatever we want, whenever we want – in school only sometimes." She is also worried that it might rain when it is time to play in the schoolyard.

## *2.3 Commentary and analysis*

The first difficulty I encountered was with translating "djeca rođena između kolovoza i prosinca imaju pravo subvencioniranog boravka (…)". "Subvencija" can be translated as "subvention", "subsidy", "grant-in-aid" or "state aid", depending on the context. I decided to use the most literal form so I opted for "subvention". However, I was having trouble with translating "subvencionirani boravak" because "subventioned staying" certainly did not sound good nor seemed grammatically correct. Thus, I decided that the best way to translate this expression was to paraphrase it, so the final result was "(…) children born between August and December have a right to subvention while staying in kindergarten for another year".

One of the biggest problems I had was finding an appropriate translation for the term "nadalje" in the sentence "Nove škotske smjernice odgoja i obrazovanja za djecu od treće godine života nadalje (…)". I was not familiar with the English expression for that word, at least not in the context of the article I was translating. The only options I could think of were "and so on" (which sounded a bit off and strange) and "further" (for which I was not sure whether it could be used in this context). I ended up searching the Internet for *'Curriculum for Excellence'* hoping that it would help me with the translation. The article I read did not really help me with finding the equivalent for the word "nadalje" since it was more precise about the age groups the *Curriculum* deals with (for example, "pre-birth to three", "from 3 to 18")*. One of the phrasesconstantlyused was „throughout life" so I opted for the same expression even though it was a little bit far from the original text ("educating children from the age of 3 and throughout life").

Beside these bigger issues that I have dealt with, I have had trouble with the usual problems such as using appropriate terminology (for example, for translating "osnovno

obrazovanje“, “pripremno razdoblje“, “odgojno-obrazovno osoblje“ I opted to use “basic education“, “preparation period“ and “educational personnel“). I also omitted some words because I found them unnecessary and clumsy when translated (“strategije poučavanja u praksi u učionici“ became “strategies of teaching in the classroom“; the term “praksa“ was omitted). Some of the sentences in the original text were too long and I had trouble with translating them without losing the original meaning and purpose of the sentence so I decided that they would sound better if separated. Also, I had trouble choosing the right equivalents for certain terms beacuse they sounded too formal. For example, in the sentence “Većina prvih razreda uz učitelja ima i dodatno osoblje za podršku, i to su uglavnom odgajateljice“, I translated the term “odgajateljice“ as “educators“ even though I opted for “preschool teachers“ at first. “Educators“ sounded a little bit too formal but in the end I decided to keep that term because I was worried that “preschool teachers“ might be too specific.

Other difficulties I encountered were with phrases and terms that I am not used to hearing in Croatian so I had to find appropriate explanations for them in the source language in order to successfully translate them into the target language. One of these phrases is, for example, “dati obol“ (“Učiteljica Jennifer Ross je tome posebno dala obol“) where I used the explanation of this phrase in order to translate it. I could not find a literal translation for “dala obol“ so i decided that “Teacher Jennifer Ross has particularly made a contribution to this (…)“ was the best solution for translating this sentence. A similar problem arouse with the expression “osobna nota“ which can be translated as “personal touch“, but in this case I found that “getting more involved“ was more fitting.

# 3 TRANSLATION OF AN ARTICLE FROM THE FIELD OF PUBLIC HEALTH

## *3.1 Introduction*

The following article is also from *Hrčak* and it belongs to the field of biomedicine and health, more precisely public health and health care. It was published in the *'Epoch of Health'*, an official journal of The Croatian Healthy Cities network. The main theme of this article is the problem of discrimination of the disabled people and intolerance towards them. Thus, the article deals with promoting 2007 as the year of equal opportunities. The text contains a few legislative terms, as well as the names of organizations, directives and agreements, which is why I found it more challenging than the first article.

## *3.2 Translation*

### European year of equal opportunities for everyone

In compliance with the directive on promoting 2007 as the year of equal opportunities, Croatian civil sector is also working hard to mark this year in order to contribute to the quality of life of the disabled. The Croatian Union of Physically Disabled Persons Associations (CUPDPA) has decided to direct this year's programs towards continuing their original activity – promoting tolerance and respect for diversity, but also encouraging employment of disabled persons.

Respect for diversity and tolerance do not develop on their own, they have to be taught. Everyone knows that early childhood is the most important period of human life so it is important to mention that, during 2001, Croatia had started the project ”Tolerance towards people with disabilities“ which has been implemented for 6 years now in preschool institutions.

The idea for the project came from M.Sc. Mirjana Dobranović, the president of the Croatian Union of Physically Disabled Persons Associations. As an expert on community work who realized the necessity to integrate and include children with developmental difficulties into regular educational programs, she has encouraged the creation of the project through the civil society. The project ”Tolerance towards people with disabilities“ is realized through professional work in preschool institutions with children without difficulties, and later on by educating students who attend colleges. The goals are directed towards developing favourable and positive attitudes. A Group of educators did an amazing job organizing kindergarten work and their work material was sponsored by the State Institute for the Protection of Motherhood, Family and Youth and Croatian Union of Physically Disabled Persons Association and was published as ”Handbook for Educators and Expert Associates“. The handbook was sent to the addresses of 1260 kindergartens all over Croatia that in return thanked them for the methodological paradigms which helped them with their work. The same work methodology, although a bit modified, was implemented at colleges.

After working six years with the story about Heidi, a decision was made to refresh the content of the tolerance project – with new people and a new approach, based on Ivana Brlić – Mažuranić's stories. The expectation is that the project will be recognized by the Ministry of Family Affairs, War Veterans and Intergenerational Solidarity and that they will support this amazing and highly needed activity financially. The activities the goal of which is to support and empower the unemployed disabled people began in the field of employment. Unfortunately, Croatia is in a position to rebuild a social policy that will help people with disabilities to enter the world of work more. The estimation that disabled people are socially the most accepted and economically most viable to employ surely goes in favour of this. It is estimated that approximately 60 percent of the total number of disabled people of working age are qualified for

some sort of economically beneficial work. According to the data of the Croatian Employment Service at the end of 2006 there were 5,576 unemployed disabled persons. Hoping to help this social group with their everyday life, the community is developing various instruments in order to help these people engage maximally in social and economic life. Each community thus develops systematic instruments to help these people, bearing in mind the type and the degree of disability of each individual or group.

It is common practice to develop this kind of social policy through national plans and rehabilitation programs in which the economic stake and contribution of a disabled person have a priority over all other profitable forms of help. This is achieved through various incentives that, among others, include developing an adequate tax system. The concern is that the adopted form of fiscal legislation in the Republic of Croatia does not sufficiently appreciate the role that the tax system could have in integrating people with disabilities into the working environment, thus making them equal to the other members of society.

The civil society is also trying to contribute to finding better solutions with a number of activities. On December 19$^{th}$2005, Zagreb hosted a Round table entitled Employers + Regulations = Business? The participants included: Ante Vučić from the Ministry of Economy, Labour and Enterpreneurship, Mirjan Grgin and Natalija Ozadić from the City Employment Service, dr. Sinan Alispahić from the Croatia Traffic Info, as well as young unemployed people with disabilities from Zadar, Umag, Slavonski Brod and Zagreb.

The head of the Office for the Physically Challenged in Croatian Employment Service, Kristijana Sokač, emphasized and pointed out in her presentation the ways and measures that the Employment Service takes to help the disabled and mediate in finding them employment. She listed a number of essential and necessary incentives for regulating the rights of people with disabilities, such as the Madrid Declaration and the Council Directive 2007/2008. They refer to

equal treatment of people with respect to employment and choosing a career and Croatia will have to implement them. Sokač used graphs and numbers to show the results of a research on employers' attitudes towards people with disabilities, which she conducted in collaboration with prof. Lelija Kiš – Glavaš from the Faculty of Education and Rehabilitation Sciences. These results call for a long term and intense work because they are not satisfactory.

A project to empower disabled people through workshops was also launched under the name ”Hope Dies Last“. The workshops took place in Bjelovar, Slavonski Brod, Zagreb and Solin. The Croatian Union of Physically Disabled Persons Associations made flyers with information for disabled people on how to search for a job and what to do actively for themselves.

The European Commission has decided that 2007 will be the year of promoting equal opportunities for all citizens of the European Union. This action is a part of comprehensive efforts of the EU's institutions which promote equality and non-discrimination in member states and in the work of EU institutions.

The aim of the European year of equal opportunities is to implement the EU's strategy for ensuring an effective campaign against discrimination. Furthermore, it aims to promote diversity and equal opportunities. Its strategy was announced in a notice that was issued by the European Commission on June 2$^{nd}$2005.

The Commission has suggested four main topics to work on during the European year: Rights – raising social awareness about equal rights and non-discrimination; Representation – encouraging public debates about the ways that underrepresented social groups can participate in life; Recognition - treating diversity with praise; Respect and tolerance – promoting social cohesion.

The Commission has estimated that the cost of planning the activities and implementing the strategy in 2007 will amount to 13,6 million of euros. Apart from the initiative for promoting equality in 2007, the Commission has announced two more: the first includes preparing a performance study that should predict new possible measures for improving the existing anti-discrimination legislation, while the second one focuses on establishing a professional advisory group for dealing with the issues of minority integration, especially the Romani people, into society and the work market.

## *3.3 Commentary and analysis*

This text was the most demanding out of all four in terms of finding correct translations of the names of organizations. The first difficulty I encountered was with translating "Hrvatski savez udruga tjelesnih invalida (HSUTI)". At first I thought that the correct translation would be "Union of Associations of Persons with Disabilities in Croatia (SOIH)". However, after more research I learned that the Union of Associations of Persons with Disabilities in Croatia is actually an umbrella association that represents more than 200 organizations of persons with various disabilities from all parts of Croatia[5]. One of these organizations is the Croatian Union of Physically Disabled Persons Associations (CUPDPA), which is the correct translation of "Hrvatski savez udruga tjelesnih invalida (HSUTI)". I faced a similar problem while translating "Ministarstvo obitelji, branitelja i međugeneracijske solidarnosti". At first I opted simply for "Ministry of Veterans' Affairs" but later on I changed it to "Ministry of Family Affairs, War Veterans and Intergenerational Solidarity". Some of the other names of organizations were: "the Ministry of Economy, Labour and Enterpreneurship" ("Ministarstvo gospodarstva, rada I poduzetništva"), "Office for the Physically Challenged" ("Odjel za osobe s invaliditetom"), "Faculty of Education and Rehabilitation Sciences" ("Edukacijsko - rehabilitacijski fakultet"), etc. The text also contains names of projects and literary works that are not translated into English so I had to come up with the translation of these titles on my own. Therefore, I translated "Tolerancija prema osobama s invaliditetom" as "Tolerance towards people with disabilities" and "Priručnik za odgojitelje I stručne suradnike" as "Handbook for Educators and Expert Associates". I had many problems with translating "odmjerene instrumente" because I was not familiar with the meaning of the phrase in Croatian. I finally opted for "systematic instruments"

[5] *Academic Network of European Disability experts*. Webpage. < http://www.disability-europe.net/content/disabled-people%E2%80%99s-organisations-7 > Accessed August 2015.

because I felt that this translation was the closest to the original. Several legislative terms were present throughout this text and I had to be careful to find the appropriate verbs that are commonly used with some of the terms (for example, “the Commission has announced”, “conduct the strategy”).

# 4 TRANSLATION OF AN ARTICLE ABOUT WEATHER EXTREMES

## *4.1 Introduction*

The following article about weather extremes is also from *Hrčak*. It belongs to the field of natural sciences, more precisely chemistry. The text offers interesting facts about weather extremes and its consequences. Even though the text is coherent and easy to understand, there were some longer sentences that required extra attention while I was translating them. The text also contains a lot of weather related terminology and names strictly related to the topic.

## *4.2 Translation*

### Extreme weather – causes and consequences

#### Introduction

Every year, natural catastrophes have a significant impact on the social and economic development of every country. Weather and climate extremes cannot be avoided. Having a forehand and accurate notice of them can considerably reduce the often catastrophic consequences on the society as a whole. Dangerous weather and climate phenomena become natural catastrophes when they endanger normal life, cause casualties, seriously damage assets and/or cause their loss, or damage infrastructure and/or environment, to the degree that surpasses the normal ability of a community to repair the damage without help. The socio-economic impact of these extremes is increasing, as a consequence of their more frequent appearance, but also because of the economic and demographic expansion.

Croatia is no exception – on average, 80% of all the damage and economic losses caused by natural catastrophes in the period between 1980 – 2012 have been caused by meteorological and hydrological factors. Therefore it is obvious that information about weather, climate, water levels, and their extremes (droughts, floods, wind storms, heat waves etc.) should be an integral part of every national strategy for managing and reducing the risk of catastrophes.

The understanding of the causes and consequences of these extreme occurrences has advanced remarkably over the last few decades. This knowledge has resulted in more accurate prognoses and made it possible to warn about these occurrences on time. Knowing the weather and climate risk helps in the processes of mitigation of their consequences. There is a tendency to underestimate the risks of natural disasters when a catastrophe has not happened for a longer period of time. Due to high climate variability and changes, it is important to foresee rare, but possible, extremes that have not occurred for decades or even centuries, in order to more realistically estimate the possibility of damage they might cause. According to The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) from 2007, the increase in the number of extreme phenomena is to be expected. Hence the need to make risk reduction a national priority with a strong institutional basis for implementation. Coordination, collaboration and establishment of operating procedures for the system of forehand notice and warnings are necessary for all institutions and agencies engaged in managing risks.

**Organisational framework for reducing the risks of a catastrophe**

The Hyogo Framework for Action (HFA) is a key instrument for implementing disaster risk reduction in Croatia since it is a member state of the United Nations. This framework urges to act upon five priority areas: 1. reducing risks as a national and local priority; 2. enhancing the knowledge about risks and enhancing the capacities for early warning; 3. strengthening

awareness and knowledge to build a culture that people will feel safe in; 4. working on reducing risks; 5. enhancing disaster preparedness in case of catastrophes.

The Law on Protection and Rescue (adopted in 2004 and revised in 2007 and 2009) is the essential legal document that prescribes how to manage disasters in Croatia. The National Protection and Rescue Directorate (DUZS) is a key state institution that coordinates the activities in this area. The Sector within the National Protection and Rescue Directorate is also for 112 System that is in charge of the public alert system and collecting and sharing information about real time risks. The information and data that the Meteorological and Hydrological Service (DHMZ) provides are extremely important for this System. This is why a standard operating procedure (SOP) has been established between the Meteorological and Hydrological Service and the 112 System, which regulates the flow of information and prognoses.

The County Protection and Rescue Office is an operational and coordinating body responsible for preparing activities during disasters and helping in special circumstances that was established on a national level. The Croatian National Platform for Disaster Risk Reduction was also established (www.platforma.hr) and it includes all the relevant expert and scientific institutions, as well as the local community, with the goal of harmonizing attitudes and reducing disaster risks. The Platform is focused more on the activities that precede disasters, and much less on those that come after as a part of the response to the catastrophe.

**The role of the Meteorological and Hydrological Service in the system of reducing disaster risks**

As a part of the European and worldwide network of national meteorological and hydrological services under the leadership of the World Meteorological Organization, the Meteorological and Hydrological Service is an important member responsible for monitoring the state of the atmosphere and waters, as well as analizing and estimating their future status in the

territory of Croatia. Based on these activities, warnings about possible weather forecasts and hydrological conditions and phenomena that endanger lives, material goods, economy and environment can be issued. A great deal of data and prognoses is available on the web page www.meteo.hr.

Managing disaster risks consists of three main activities: mitigating, preparedness and beforehand alerting. Mitigating includes reducing risks; preparedness includes assessment and risk analysis, identifying the danger, research and development, educating and informing the public, whilst beforehand alerting consists of predicting danger, posting and spreading information.

The Meteorological and Hydrological Service contributes to risk management in two ways:

**a) Identification and risk assessment**

Since risk represents a combination of endangerment and vulnerability of a community, it is necessary, above all, to have knowledge of possible dangers. The Meteorological and Hydrological Service is responsible for measuring and observing, as well as gathering and processing, meteorological and hydrological data and information about air quality using strictly defined measures and criteria provided by the World Meteorological Organization. These data are used to study the weather, climate and hydrological conditions, and for the prognoses and warnings about possible emergencies. The Meteorological and Hydrological Service manages a network of meteorological stations that follow a specific work program.

Constant monitoring of the state of atmosphere at meteorological stations, altitude measurements using radiosondes (Zagreb Maksimir and Zadar Zemunik), radar measurements and satellite measurements (supervised by the European Meteorological

Satellite Organization EUMETSAT) enables quick identification of dangerous meteorological phenomena and issuing of warnings.

The Meteorological and Hydrological Service is also in charge of maintaining the database containing all they have measured and monitored in their stations, some of which have been active since the middle of the 19th century. These data are a result of observations during a long period of time and they represent priceless information in analyzing climate conditions and climate changes, spatial distribution of particular meteorological parameters, estimating possible extremes and probability for their appearance (DHMZ, 2002; the Climate Atlas of Croatia, 2008). This information also serves as the basis for estimating how much a particular dangerous meteorological phenomena endangers a certain area in Croatia.

Continuous monitoring of the state of the atmosphere requires a lot of financial resources for maintaining the measuring system, processing, controlling and saving data, as well as constant investment into new technologies and measuring systems.

**b) Risk prognosis and early warning**

Apart from knowing the risks of an extreme weather phenomena (a local storm, heavy rain, storm winds, draught, flood, etc.), it is important to know something about the prognosis of these events in order to warn beforehand about their potential danger.

The efforts of the Meteorological and Hydrological Service's meteorologists are directed towards issuing beforehand and reliable weather reports and warnings and other information that are necessary for various economic branches (agriculture, energetics, traffic, tourism, health, etc.) to help decrease the risk, increase the production and minimize the losses.

### *4.3 Commentary and analysis*

Translating this text was much more difficult for me than translating the first two texts. The most challenging thing about translating this text was definitely the terminology. Most of the weather related terms were pretty simple to translate because they are commonly used in Croatian too. For example, I did not have trouble translating "weather and climate extremes", "natural catastrophes" or "meteorological and hydrological factors" since I was familiar with their meaning.

The difficulties I encountered were mostly related to creating coherent and sensible sentences without mistranslating them or losing the original meaning. I was not sure if some verbs can be used with certain nouns, or whether some of the adjectives make sense when paired with certain nouns. For example, I used "forehand notice" to translate "pravovremena najava" even though I was not quite sure whether that adjective usually precedes the noun "notice". "Opasne vremenske i klimatske pojave postaju prirodne katastrofe kad prekidaju normalno odvijanje života, uzrokuju žrtve, štetu većeg opsega na imovini i/ili njezin gubitak, te štetu na infrastrukturi i/ili okolišu, u mjeri koja prelazi normalnu sposobnost zajednice da ih sama otkloni bez pomoći" was one of the longer sentences that I spend some time translating because I had trouble making it grammatically correct without losing the meaning of the sentence. At first I wanted to break it in two sentences because of its length, but I realized that each part of the sentence is linked to the previous part and separating them would not make sense. After dealing with it for a while, I opted to translate the sentence as "Dangerous weather and climate phenomena become natural catastrophes when they endanger normal life, cause casualties, highly damage assets and/or cause their loss, or damage infrastructure and/or environment, to the degree that surpasses the normal ability of community to repair the damage without help". "Kada

prekidaju normalno odvijanje života" became "when they endanger normal life" because the verb "interrupt" would be too literal and it is not commonly used in this structure.

There were several names of organizations and laws, such as "Državni hidrometeorološki zavod" ("The Meteorological and Hydrological Service"), "Zakon o zaštiti I spašavanju" ("The Law on Protection and Rescue"), "Hrvatska platforma za smanjivanje rizika od katastrofa" ("The Croatian National Platform for Disaster Risk Reduction"), etc. By far the most challenging was "sustav 112" which sounded simple to translate at first. First of all I had to find a correct name used in English, so after searching the Internet I decided that "the Sector for 112 System" would be the best solution. Furthermore, I had to translate the sentence in which this term was used. I decided to break the sentence into two parts because I could not come up with a suitable translation. The sentence sounded fine in Croatian, but when I tried to translate it, it ended up being clumsy and incoherent. Thus, I opted to translate "The Sector within the National Protection and Rescue Directorate is also for 112 System that is in charge of public alert system and collecting and sharing information about real time risks" as an individual sentence.

# 5 TRANSLATION OF AN EXCERPT FROM A BIOLOGY TEXTBOOK

## *5.1 Introduction*

This last texts belongs to the field of biology. It is an excerpt from a biology textbook and its topic is genetic engineering. It is very well written since it has an academic purpose, but the author also used simple vocabulary to provide the definitions of terms and give coherent and understandable explanations. Sentences are mostly short and easy to understand. However, the text contains a lot of terms from the field of genetics and biology so the reader could have trouble understanding it if he or she is not familiar with the terminology.

## *5.2 Translation*

### Genetic engineering

Modern biotechnology began to develop in the 1970s when the scientists began to contemplate the use and risks of mixing the DNA of different species. Biotechnology changes the hereditary traits of living organisms in order to make them as useful as possible to the human race. In the past farmers used biotechnology to control breeding in order to improve crop productivity or the characteristics of domestic animals. They used the methods of biotechnology when they used yeast and other microorganisms to produce beer, vine, cheese, etc., even though they could not explain how they work. Classical plant breeding creates new gene combinations by using propagation of parent plants with desirable traits. However, the number of available genes is limited since the undesirable genes are inherited along with the desirable ones.

In the broadest sense, genetic engineering manipulates the DNA molecules in order to create new ones (with better quality) for the benefit of the humankind. Therefore, it is possible to change the genetic makeup of living organisms' cells with the help of a wide repertoire of recombinant DNA technologies. More precisely, genetic engineering or recombinant DNA technology is a set of biochemical methods used to cut the entire genes or a group of genes from the DNA after which they are inserted into a specific part of the prokaryote's or eukaryote's DNA. The recombinant DNA is DNA that contains desirable (wanted) genes. You have learned that every living organism, organelle or cell structure that contains a DNA molecule shares the same structure. The formation of Recombinant DNA molecules requires desired genes, a cloning vector and bacteria or the host organism. Gregor Mendel used peas in his experiments, Thomas Morgan wine flies, and genetic engineering often uses bacteria known as *Escherichia coli*.

You probably want to know how recombinant DNA is formed. Restriction enzymes (restriction endonucleases) "cut" the DNA molecule of the desired gene (donor gene) every time they come across a specific sequence of nitrogenous bases. For example, the restriction enzyme of *Escherichia coli*, named EcoR1, cuts the GAATTC base sequence. However, the matching sequence on the other strand is CTTAAG, which read backwards is GAATTC. You have learned that these words are called palindromes – the base sequence reads the same backwards and forwards: from the 5' end to the 3' end, as well as from the 3' end to the 5' end. Apart from their role as molecular "cutters", restriction enzymes produce matching "sticky" ends, which means that the end of one strand of the cut piece of DNA could stick to any other strand of another DNA molecule that has been cut with the same enzyme, regardless of which living organism the DNA molecule comes from. The ligase enzyme glues the "sticky ends" to each other. A cloning vector is a DNA molecule that the desired gene "glues" onto. The cloning vector allows the desired gene to enter the bacterial cell, where the gene will multiply. A plasmid is a small double-stranded

DNA molecule that is usually used as a cloning vector. Plasmids can be found in some bacteria, yeast, plant cells and in other kinds of organisms. Besides plasmids, bacteriophages ( the lambda phage), retroviruses, and artificially produced chromosomes from bacteria and yeast can also be used as cloning vectors.

The one-stranded “sticky ends” of some plasmids combine with the “sticky ends” of the donor’s DNA when the separated plasmid mixes with the DNA of the donor. The result is a new recombinant DNA that is inserted into the bacteria. Cloning of this type of useful bacteria results in producing the desired genes.

The receiver are usually bacteria or yeast that can replicate this gene multiple times in a short period of time and also produce great amounts of proteins that the desired gene encodes. Usually the desired genes of a more complex organism which are then inserted into a genome of another organism are used with a much simpler structure.

The techniques of genetic engineering are used in various human activities. In pharmaceutical industry, they are used to produce medications that cannot be produced any other way. For example, people with the type 1 diabetes (*Diabetes mellitus 1*) are insulin-dependent their entire life because their pancreas is not able to produce insulin on its own.

In the beginning, the only available form of treatment was using the animal-sourced insulin. However, there was always a possibility of various allergic reactions and the demand for porcine and bovine pancreata was high. It is interesting that the porcine and human insulin differ in one amino acid and the bovine and human insulin differ in three. The advantages of using bacteria that were genetically engineered are simpler and cheaper manufacturing process and a limitless amount of necessary proteins. Today, human insulin for diabetics is produced from yeast so that the insulin manufacture is even more economic.

Producing proteins from bacteria is of great importance for medicine and pharmacy. Apart from insulin, the hepatitis B vaccine, growth hormone, interferon (used for treating hepatitis C, leukaemia and multiple sclerosis), coagulation factors (hemophilia), etc. are also produced today. Gene therapy refers to delivering a functional gene into a patient's cells. Nowadays, it is used to treat multiple gene disorders (cystic fibrosis – a genetic disorder where the patient is prone to bacterial infections, haemophilia, sickle-cell disease and other illneses). The diseases caused by the activity of multiple genes – polygenic diseases (heart disorders, diabetes, malignant diseases) are future candidates for gene therapy. The food industry uses this method for producing lipases (for producing cheese), amylase (for producing beer), the chemical industry uses it for producing protease (for detergents) and the textile industry for producing indigo (a blue pigment used for dying denim), etc.

The process of artificially inserting foreign genes into an organism is called transfection and the organisms produced this way are called transgenetic or genetically modified organisms (GMO). Over the last twenty years, the technique of using recombinant DNA in plants has improved to such an extent that it could be used for almost every important crop. These methods enhance many features, for example nutritional value, chemical structure, taste and smell. They can also "create" immunity to certain diseases, herbicides, pesticides, insecticides, viruses or even stressful conditions. The most common crops are transgenic soybean, followed by corn, rapeseed, cotton, tomato and many other cultures. The natural genetic engineers of plant life are the bacteria *Agrobacterium tumefaciens* and *Agrobacterium rhizogenes*.

Plant cloning in laboratories is achieved by using cell structure methods. You have learned in the first grade of high school that this is the way that the cells outside of an organism are cultivated, i.e. by planting the cells of multicellular organisms on nutrient-rich surfaces where the cells will grow and divide. The technique of cultivating cells and tissue is not used only as a

research method. It is also widely used in producing medications and proteins and cultivating plants, i.e. producing genetically modified plants.

Animals, are also genetically engineered. Since they are subject to transfection, a couple of hundred of hereditary traits of transgenic animals are included in the research. As opposed to the bacteria and yeast, animals can have genes in organs and organic systems that are very similar to those of humans. This advantage is the reason why animals are used in genetic engineering in order to observe human genetic diseases, but also to test the effectiveness of medications on animals first, and only then on humans. Animals such as sheep and goats could become "factories" capable of producing proteins useful for humans. These proteins could be extracted from their milk or gametes and they would serve as a basis for developing organisms necessary for gene therapy.

The most effective way of inserting genes into an animal is by using a virus for the transfection of a fertilized egg cell or an early embryo.

## *5.3 Commentary and analysis*

Even though the text is full of fixed terms and phrases, I was surprised how easy it was to find their equivalents in English. Most of the terms sound practically the same in both English and Croatian, so I had no trouble with translating them. For example, starting from the title itself, "genetičko inženjerstvo" is translated as "genetic engineering", "biotehnologija" as "biotechnology", "organel" as "organell", and even the term "rekombinantna DNA" ("recombinant DNA") was not difficult to translate. However, there were some terms that needed closer attention since they could not be translated literally. "Spolno križanje", for example, cannot be translated literally as "sexual crossing" because that term does not exist in the English language. I am not really familiar with the topic of engineering, or with biology in general, so that was definitely a big disadvantage. First I had to find an explanation of the terms in Croatian in order to understand them better and hopefully find an equivalent term in English. Also, it was hard to distinguish between some terms because they are very similar. Finally, I opted to translate "spolno križanje" as "propagation" because it seemed to me that the definition of propagation was the same as "spolno križanje". Futhermore, "nasljedna tvar" cannot be translated along the lines of "hereditary structure", so I opted for "genetic makeup of cells". In the additional sources I read, "λ-virus" was referred to as "lambda phage" so I opted for that solution instead of rendering it literally as, "λ-virus".

There were also a lot of diseases mentioned, such as "cystic fibrosis" ("cistična fibroza"), "multiple sclerosis" ("multipla skleroza"), etc., but it was not difficult to find their translations since they sound pretty much the same in Croatian as they do in English (with the exception of "sickle-cell disease" - "srpasta anemija").

There were some sentences that were a little more challenging, for instance "Biotehnologija podrazumijeva mijenjanje nasljednih svojstava živih bića da bi ona bila što korisnija čovjeku". At first glance this seems like a simple sentence, not too long and not too complicated, but I found it problematic to translate the word "podrazumijeva". The possible solutions I came up with were "means" and "implies" but to translate it as "biotechnology implies" did not sound correct and it made translating the rest of the sentence more complicated. This is why I opted for omitting the word "podrazumijeva" and I decided to focus on the word "mijenjanje". I changed the noun into a verb and translated the sentence as "Biotechnology changes hereditary traits of living organisms in order to make them as useful as possible to the human race". I encountered a similar problem in the case of "oboljele osobe". Since the context of the sentence was diabetes, I chose to translate this expression as "diabetics" because it sounded much better than "sick people". In some sentences, I opted to omit certain words. For example, in "preinačene genetičkim inženjerstvom" I omitted the word "preinačene" and translated the phrase as "genetically engineered" since I believe that in this context "genetically engineered" and "modified" means practically the same. On the other hand, there were examples where I added an extra word because it seemed like the term was too ambiguous and general. For instance, instead of simply saying "vector" I opted for "cloning vector" because I think it gives more information about the sentence.

There were some terms that I thought I knew how to translate, but with further research I realized that they have slightly different equivalents in English. Therefore, "stanica primateljica" cannot be translated as "host cell" but as "host organism", and "DNA lanac" should be "DNA strand" and not "chain".

# 6 CONCLUSION

While translating the articles and writing their analyses, I realized that translating is not as easy as it seems to be. At first glance, I thought that the articles I chose would not represent that big of a problem. However, when I started to translate them I realized that even the simplest words I am familiar with can be difficult to translate. There are endless possibilities when choosing an adequate translation and I had to be careful to choose a word that will be the closest equivalent of the word I was translating. It is easy to misinterpret and mistranslate sentences and give them an entirely new meaning. Translating only one word in a wrong way can easily lead to mistranslation.

I realize now that translating is a difficult process that has endless possibilities and can go wrong easily. Translators have a great responsibility of translating the message of the text in a way that would be easy to understand. They have to make sure that they have kept the original meaning of the sentence, even if they parphrased it in order to . Translating has progressed immensely since the ancient times and nowadays it is becoming more and more important.

# BIBLIOGRAPHY


1. Bujas, Željko. 1999. *Veliki englesko – hrvaski rječnik*. Zagreb: Nakladni zavod Globus

2. Bujas, Željko. 1999. *Veliki hrvatsko – engleski rječnik*. Zagreb: Nakladni zavod Globus

3. Lichtenthal, Melita et al. 2010. "Genetičko inženjerstvo" in Melita Lichtenthal (ed.), *Biologija 4*. Zagreb: ALFA, p. 82 – 86.

**ONLINE SOURCES**


1. *Academic Network of European Disability experts*. Webpage. < http://www.disability-europe.net/content/disabled-people%E2%80%99s-organisations-7 > Accessed August 2015.

2. Cincan, Alina. 2013. *Inbox Translation*. The History of Translation. Webpage. < http://inboxtranslation.com/blog/history-translation/> Accessed August 2015.

3. Dobranović, Mirjana. 2007. "Europska godina jednakih mogućnosti za sve". *Epoha zdravlja* vol. 3: p. 6 – 7. Retrieved from < http://hrcak.srce.hr/122755>

4. *Hrvatsko - engleski online rječnik*. Webpage. < http://www.rjecnik.net/> Accessed August 2015.

5. Ivančan – Picek, Branka. 2015. "Vremenski ekstremi – uzroci i posljedice". *Kemija u industriji* vol. 64: p. 306 – 308. Retrieved from < http://hrcak.srce.hr/138937>

6. *Language Scientific*. Webpage. < http://www.languagescientific.com/translation-services/multilingual-interpreting-services/interpreting-vs-translation-services.html> Accessed August 2015.

7. McLean, Aileen. 2012. "Učiniti prvi korak". *Djeca u Europi* vol. 4: p.21 - 22. Retrieved from < http://hrcak.srce.hr/123571>

8. *Merriam – Webster: Dictionary and Thesaurus*. Webpage. < http://www.merriam-webster.com/> Accessed August 2015.

9. *National Programme on Technology Enhanced Learning*. Basic Concepts and Terminology of Translation Studies. Webpage. <http://www.nptel.ac.in/courses/109104050/lecture4/4_5.htm> Accessed August 2015.

10. *Study.com*. Webpage. < http://study.com/academy/lesson/what-is-translation-in-math-definition-examples-terms.html> Accessed August 2015.

11. *Wikipedia*. 2015. Webpage. < https://en.wikipedia.org/wiki/Translation_studies> Accessed August 2015.

12. *Wikipedia*. 2015. Webpage. < https://en.wikipedia.org/wiki/Translation> Accessed August 2015.

# APPENDICES

Appendix A

## Učiniti prvi korak

Taj ‘čudni i strašni’ prvi dan škole postaje prošlost. Autorica Aileen McLean opisuje kako se jedan škotski gradski odjel za školstvo priprema za podršku prvašićima i njihovim obiteljima kako bi lakše prebrodili prijelaz iz vrtića u školu.

Početak škole je razdoblje napetosti i nervoze za roditelje.

U Škotskoj, djeca započinju osnovno obrazovanje u dobi između 4,5 i 5,5 godina, što je ranije od većine europskih zemalja. Roditelji djecu upisuju u školu u studenome, te im predstoji 9 mjeseci pripremnog razdoblja do početka škole sljedećeg kolovoza. To je prilično velika promjena za sve.

Neki roditelji biraju mogućnost odgode upisa u slučaju da im djeca u kolovozu, na početku školske godine, još neće imati navršenih 5 godina – djeca rođena između kolovoza i prosinca imaju pravo subvencioniranog boravka dodatne godine u vrtiću po diskrecijskoj odluci nadležnog tijela. Od svih škotskih gradova, Edinburgh ima najveći postotak roditelja koji odgađaju početak škole za svoju djecu. Stoga smo istražili podatke o prolongiranju upisa i svoje nalaze podijelili s roditeljima i stručnim osobljem.

Iznenađujuće je malo istraživanja koja podržavaju ideju kako je kasniji upis djeteta u školu od njegovih vršnjaka od koristi za djecu. Postoji studija iz 2002. godine koju je provela američka razvojna psihologinja Deborah Stipek sa suradnicima, a koja sugerira kako starije dijete u početku ostvaruje veći napredak, no to kasnije nije evidentno. Već nakon tri godine školovanja mogući su vidljivi nedostaci kasnijeg upisa djeteta u školu. Kod njih je veća vjerojatnost da će napustiti srednju školu prije diplome, kao što je veća i vjerojatnost da će imati socijalne i

emocionalne probleme. No jedno je sigurno: roditeljske brige i stres oko polaska u školu, djetetove spremnosti i napretka – isti su u svim zemljama i svim društvenim sustavima, bez obzira o kojem se godištu djeteta radi pri upisu u školu.

Najvažniji problem s kojim se suočavamo jest kako podržati dijete u tom osjetljivom razdoblju i kako mu pomoći. Nove škotske smjernice odgoja i obrazovanja za djecu od treće godine života nadalje, pod nazivom‘Kurikulum za izvrsnost’, pridaju važnost razvoju svakog djeteta kroz angažiranost i uzbudljive mogućnosti za učenje, s posebnim osvrtom na djetetovu emocionalnu i fizičku dobrobit i slobodu da otkriva i slijedi svoje interese. Ovo odlično zvuči svim odgajateljima i pedagozima jer im daje više slobode nego ikad da prvu godinu djetetovog formalnog školovanja učine zabavnom i utemeljenom na igri, a istovremeno im se otvara mogućnost da djeci pruže prilike za stjecanje vještina aktivnim, tj. iskustvenim učenjem.

Ipak trebamo poticati i usvajanje pismenosti i matematičkih vještina kroz pomno planiranje napretka djeteta, imajući u vidu robusnu podršku tranziciji, osobito tamo gdje djece ulaze u prvi razred iz različitih vrtića: npr. jedan učitelj iz Edinburgha dobiva djecu iz 22 različita vrtića. Razredi za prvašiće nisu veliki – uglavnom imaju najviše do 25 učenika, a u 16% svih osnovnih škola u razredu ima i manje od 20 djece. Većina prvih razreda uz učitelja ima i dodatno osoblje za podršku, i to su uglavnom odgajateljice. Velike su oscilacije u dječjoj zrelosti i sposobnostima na početku škole svakog kolovoza. Naša poruka iz Edinburgha je: Škola bi trebala biti spremna za prvašiće, a ne obrnuto.

U osnovnoj školi ‘Juniper Green’, povezivanje počinje još prije njihova upisa u vrtić, kućnim posjetima stručnog osoblja svoj djeci s područja škole. ‘Tim činom dajemo osobnu notu, koja je važna u djetetovim ranim godinama’, izjavljuje pomoćnica ravnatelja Ingrid Donaldson. Škola je razvila aktivne strategije učenja za svu djecu različitih dobi, a treba napomenuti i kako je većina djece pohađala vrtić, što znači da su imali dovoljno prilika da se djeca, njihove obitelji i

stručno osoblje dobro upoznaju. Roditelje se ohrabruje da i sami sudjeluju, nekad donošenjem fotografija koje prikazuju dijete u određenim aktivnostima učenja, a nekad ih se potiče da i sami sudjeluju i pomažu u različitim centrima aktivnosti.

I u drugim je školama u Edinburghu, na primjer u Osnovnoj školi 'Corstorphine', prioritet uključiti roditelje u školske aktivnosti. Učiteljica Jennifer Ross je tome posebno dala obol, pozivajući roditelje dvaput tjedno da se na kraju školskog dana uključe u aktivnosti svoje djece u razredu. Ovakav program prima jednoglasnu podršku sa svih strana.'Roditeljima se posebno svidjela prilika da iz prve ruke vide različite strategije poučavanja u praksi u učionici', kaže Jennifer Ross. 'To im pruža uvid u rad u školi i daje mogućnost da nam postavljaju prava pitanja o školi, ali i dječjim zadaćama. Također im i prisustvovanje nastavi daje mnogo dobrih ideja, koje i sami mogu primjenjivati kod kuće. Sigurno ćemo nastaviti s ovakvom praksom, a tako stečena iskustva pokušati primijeniti i na drugim razinama obrazovanja u školi.' Odgojno-obrazovno osoblje je, naravno, od ključne važnosti za lakši prijelaz djeteta iz vrtića u prvi razred škole. U Osnovnoj školi 'Juniper Green' zaposlena je iskusna vrtićka odgajateljica, kao dodatna podrška učiteljima i djeci. Njezina je uloga da s učiteljima planira cijeli spektar aktivnosti i igara za djecu, povezanih s usvojenim dječjim vještinama ili onima koje tek trebaju usvojiti. Učiteljica Karen Noble drži da je angažiranje vrtićkih odgajateljica u prvim razredima pomoglo da djeca zadrže kontinuitet i povezanost s vrtićem. 'Sretni smo što su nam učionice otvorene za međusobnu suradnju', kaže. 'Iskustvo i doprinos odgajateljica pomažu nam da bolje planiramo, pratimo i podržavamo djecu dok ona odabiru aktivnosti i igre koje su osmišljene kako bi ih potaknule na razvoj i usvajanje novih vještina, osobito u području pismenosti i matematičkih vještina.

U prvih 5 tjedana, za prvašiće nastava završava u vrijeme ručka, no svakog popodneva prvašiće i njihove roditelje učitelji pozivaju u učionicu kako bi se osobno upoznali, napravili

zajedničku procjenu statusa djeteta, te razgovarali s roditeljima o nedoumicama koje bi mogli imati. ‘Većina roditelja želi znati je li im dijete u razredu sretno, te ima li prijatelje. Ne žele da im se dijete na školskom igralištu igra samo’, kaže učiteljica Alison Craig, koja već treći put ima razred prvašića.

U obje osnovne škole iz naših primjera, djeci je ovaj prijelaz iz vrtića u prvi razred formalnog obrazovanja mnogo lakši i bezbolniji nego prije. U Osnovnoj školi ‘Juniper Green’ svako se dijete uparuje sa starijim ‘prijateljem’ koji već pohađa školu. Učiteljica Alison Craig vodi računa da u dnevnom rasporedu svako dijete radi samostalno, u paru i grupi, uz dodatne mogućnosti izbora. Djeca brzo i lako prelaze s jedne aktivnosti na drugu; teško je povjerovati da je od polaska u školu proteklo tek 3 tjedna.

Po svim školama Edinburgha, stručno osoblje trudi se osigurati najmlađima da uče i usvajaju znanja na brojne i različite načine. Najvažnije je da djeca budu relaksirana i sretna. Roditelji, stoga, mogu odahnuti.

Djeca trebaju prostora i vremena kako bi pustila mašti na volju. Kad sam razgovarala s Reubenom, koji se igrao školjkama u pijesku, nije mi dugo trebalo da shvatim kako to nisu školjke, već on leti svemirskim brodom na Mjesec. Njemu je kod škole najbolje to što se može igrati u centrima aktivnosti. Jedna djevojčica, Tiegan, požurila mi je kazati ovo: ‘U vrtiću možemo raditi što želimo, kad god to hoćemo – u školi, samo ponekad.’ Također je zabrinuta da slučajno ne padne kiša kad je vrijeme za igru na školskom igralištu.

**Source:**

McLean, Aileen. 2012. “Učiniti prvi korak”. *Djeca u Europi* vol. 4: p.21 - 22. Retrieved from < http://hrcak.srce.hr/123571>

Appendix B

## Europska godina jednakih mogućnosti za sve

Slijedom upute o promicanju 2007. kao godine jednakih mogućnosti, i u Hrvatskoj civilni sektor snažno djeluje u njenom obilježavanju kako bi se dao doprinos kvaliteti života osoba s invaliditetom. Hrvatski savez udruga tjelesnih invalida (HSUTI) odlučio je ovogodišnje programe usmjeriti na nastavak svoje tradicionalne aktivnosti – na promicanje tolerancije i poštivanja različitosti, ali i poticanja zapošljavanja.

Poštivanje različitosti i tolerancija ne nastaju sami po sebi već se moraju graditi. Svima je poznato da je najvažnije djelovanje u najranijoj dobi ljudskoga života, pa je značajno napomenuti da je u Hrvatskoj tijekom 2001. započeo projekt »Tolerancija prema osobama s invaliditetom« koji se provodi već šestu godinu u predškolskim ustanovama.

Projekt je idejno osmislila mr. sc. Mirjana Dobranović, predsjednica Hrvatskog saveza udruga tjelesnih invalida. Kao stručnjak za rad u zajednici i uvidjevši potrebu integracije i inkluzije djece s teškoćama u razvoju u redovne odgojno-obrazovne programe, potakla je izradu projekta kroz civilno društvo. Projekt "Tolerancija prema osobama s invaliditetom" ostvaruje se kroz stručni rad s djecom bez teškoća u razvoju u predškolskim ustanovama u kojima djeca borave, a potom kroz edukaciju studenata na fakultetima. Ciljevi su usmjereni na izgradnju povoljnih i pozitivnih stavova. Rad u vrtiću sjajno je osmislila grupa odgajatelja te je njihov radni materijal tiskan kao "Priručnik za odgojitelje stručne suradnike", pod sponzorstvom Državnog zavoda za zaštitu obitelji, materinstva i mladeži i Hrvatskog saveza udruga tjelesnih invalida. Priručnik je poslan na adrese 1260 vrtića diljem Hrvatske, iz kojih su stizale zahvale za metodološki obrazac po kojemu mogu raditi. Ista metodologija rada, iako malo modificirana, provodila se na fakultetima.

Nakon šest godina rada uz priču o Heidi, donesena je odluka o osvježenju sadržaja u projektu tolerancije – s novim ljudima i novim pristupom, s pričama Ivane Brlić- Mažuranić. Očekuje se da će projekt prepoznati u Ministarstvu obitelji, branitelja i međugeneracijske solidarnosti te financijski poduprijeti ovu sjajnu i potrebnu aktivnost. Na području zapošljavanja pokreću se aktivnosti potpore i osnaživanja nezaposlenih osoba s invaliditetom. Na žalost, Hrvatska je danas u poziciji da iznova gradi socijalno-radnu politiku koja će osobe s invaliditetom snažnije uključiti u svijet rada. Tome u prilog svakako ide procjena da su osobe s invaliditetom socijalno najprihvatljivije i gospodarski najisplativije kada se zapošljavaju. Procjenjuje se da je približno 60 posto od ukupnog broja osoba s invaliditetom radne dobi sposobno za neki oblik gospodarski isplative djelatnosti. Prema evidenciji Hrvatskog zavoda za zapošljavanje na kraju 2006. evidentirano je 5.576 nezaposlenih osoba s invaliditetom. U nastojanju da pomogne toj skupini u svakodnevnom življenju, zajednica izgrađuje brojne instrumente sa svrhom da ih se maksimalno uključi u socijalni i gospodarski život. Svaka zajednica pritom izgrađuje odmjerene instrumente kojima pomaže tim osobama, vodeći računa o vrsti i stupnju invaliditeta svakog pojedinca ili skupine osoba s invaliditetom.

Uobičajeno se ovakva socijalna politika gradi putem nacionalnih planova i programa rehabilitacije u kojima gospodarski udio i doprinos osobe s invaliditetom ima prednost pred svim drugim rentnim oblicima pomoći. To se postiže različitim poticajnim mjerama od kojih je izgradnja odgovarajućeg poreznog sustava jedna od njih. Smatramo da usvojeni paket poreznoga zakonodavstva u Republici Hrvatskoj ne uvažava dovoljno ulogu poreznog sustava glede moguće integracije osoba s invaliditetom u svijet rada, a time i njihova izjednačavanja s ostalim članovima društvene zajednice.

I civilno društvo nizom svojih aktivnosti nastoji pridonijeti pronalaženju boljih rješenja. Tako je 19. prosinca 2006. u Zagrebu održan Okrugli stol pod nazivom Poslodavci + Propisi =

Posao? Gosti i uzvanici bili su: Ante Vučić iz Ministarstva gospodarstva, rada i poduzetništva, Mirjana Grgin i Natalija Ozadić iz Gradskoga zavoda za zapošljavanje, doc. dr. Sinan Alispahić iz HAK-a, kao i mlade nezaposlene osobe s invaliditetom iz Zadra, Umaga, Slavonskog Broda i Zagreba.

Kristijana Sokač, načelnica Odjela za osobe s invaliditetom u Hrvatskom zavodu za zapošljavanje, u svojem je izlaganju istaknula i ukazala na koje sve načine i kojim mjerama Zavod pomaže i posreduje zapošljavanju osoba s invaliditetom. Nabrojila je mnoštvo propisa koji su neophodni i potrebni u reguliranju prava invalidnih osoba, kao što su Madridska deklaracija i Direktiva vijeća 2007/2008. Njih će Hrvatska morati ispoštivati, a odnose se na jednak tretman pri zapošljavanju i odabiru zvanja. Grafički i brojčano prikazala je rezultate istraživanja o stavovima poslodavaca prema osobama s invaliditetom koje je provela u suradnji s prof. Lelijom Kiš-Glavaš s Edukacijsko rehabilitacijskog fakulteta. Na tim rezultatima treba dugoročno i intenzivno raditi jer oni nisu zadovoljavajući.

Isto tako, pokrenut je projekt osnaživanja osoba s invaliditetom kroz radionice pod nazivom "Nada umire posljednja", koje su održane u Bjelovaru, Slavonskom Brodu, Zagrebu i Solinu. Hrvatski savez udruga tjelesnih invalida izradio je letke kojima upućuje osobe s invaliditetom na informacije kako tražiti posao i što činiti aktivno za sebe.

Europska komisija je odlučila da 2007. bude godina u kojoj će se promicati jednake mogućnosti za sve građane Europske unije. Akcija je dio sveobuhvatnih nastojanja institucija EU kojima se promiče jednakost i nediskriminacija u zemljama članicama i u radu institucija Unije. U Europskoj godini jednakih mogućnosti želi se provesti strategija koju je EU postavila za osiguravanje učinkovite borbe protiv diskriminacije. Nadalje, želi se promicati različitost i jednake mogućnosti. Strategija ove akcije je objavljena u obavijesti koju je Europska komisija donijela 2. lipnja 2005. godine.

Komisija je predložila četiri osnovne teme na čijoj bi provedbi trebalo raditi tijekom Europske godine: Prava (rights) – podizanje svjesnosti u društvu o pravu na jednakost i nediskriminaciju; Predstavljanje (representation) – poticanje javnih rasprava o načinima sudjelovanja podzastupljenih društvenih skupina; Priznanje (recognition) – pohvalno odnošenje prema primjerima različitosti; Poštovanje i tolerancija (respect and tolerance) – promicanje socijalne kohezije. Komisija je predvidjela da će za planiranje aktivnosti i provedbu strategije u 2007. godini dostajati 13,6 milijuna eura. Osim inicijative za promicanje jednakosti u 2007. godini, najavila je još dvije inicijative: prva uključuje pripremu studije izvedivosti koja bi trebala predvidjeti nove moguće mjere za poboljšanje postojećeg antidiskriminacijskog zakonodavstva, dok se druga inicijativa odnosi na osnivanje stručne savjetodavne grupe koja će se baviti pitanjima integracije manjina, posebice Roma, u društvo i tržište rada.

**Source:**

Dobranović, Mirjana. 2007. "Europska godina jednakih mogućnosti za sve". *Epoha zdravlja* vol. 3: p. 6 – 7. Retrieved from < http://hrcak.srce.hr/122755>

Appendix C

# Vremenski ekstremi – uzroci i posljedice

## Uvod

Prirodne katastrofe svake godine imaju znatan utjecaj na društveni i ekonomski razvoj svake zemlje. Vremenski i klimatski ekstremi ne mogu se izbjeći, ali njihova pravovremena i točna najava može znatno ublažiti nerijetko katastrofalne posljedice na cjelokupno društvo. Opasne vremenske i klimatske pojave postaju prirodne katastrofe kad prekidaju normalno odvijanje života, uzrokuju žrtve, štetu većeg opsega na imovini i/ili njezin gubitak, te štetu na infrastrukturi i/ili okolišu, u mjeri koja prelazi normalnu sposobnost zajednice da ih sama otkloni bez pomoći. Društveno-ekonomski utjecaj ovih ekstrema je u porastu, što je posljedica njihove sve češće pojave, ali i zbog rastućeg gospodarskog i demografskog širenja.

Ni Hrvatska nije iznimka pa u prosjeku 80 % svih šteta i ekonomskih gubitaka od prirodnih katastrofa u razdoblju 1980. – 2012. pripadaju meteorološkim i hidrološkim čimbenicima. Stoga je posve jasno da informacija o vremenu, klimi te stanju voda i njihovim ekstremima (suše, poplave, olujni vjetrovi, toplinski valovi i sl.) mora biti sastavni dio svake nacionalne strategije upravljanja i smanjenja rizika od katastrofa.

Razumijevanje uzroka i posljedica takvih ekstremnih događaja iznimno se razvilo tijekom posljednjih nekoliko desetljeća. To znanje rezultiralo je točnijom prognozom i mogućnošću njihove rane najave. Poznavanje vremenskog i klimatskog rizika pomaže u procesima njegovog ublažavanja. Postoji tendencija podcjenjivanja rizika od prirodnih nepogoda kada se katastrofalan događaj nije dogodio dugo vremena. Zbog velike klimatske varijabilnosti i promjena važno je procijeniti rijetke, ali ipak moguće ekstremne događaje s velikim povratnim razdobljima od desetljeća ili čak stoljeća, kako bi i procjene vjerojatnosti šteta koje uzrokuju bile realnije. Prema

Četvrtom izvješću Međuvladinog panela za klimatske promjene (engl. *The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC)*) iz 2007. godine može se očekivati porast broja ekstremnih pojava. Upravo stoga nameće se potreba da smanjenje rizika od prirodnih katastrofa bude nacionalni prioritet s jakom institucionalnom osnovom za provedbu. Koordinacija i suradnja te uspostava operativnih procedura pri sustavu pravovremene najave i upozorenja je nužna sa svim institucijama i agencijama uključenim u upravljanje rizicima.

**Organizacijski okvir za smanjenje rizika od katastrofa**

Okvirni plan djelovanja iz Hyoga (HFA) ključni je instrument za provedbu smanjenja rizika od katastrofa i u Hrvatskoj kao zemlji članici Ujedinjenih naroda. Ovaj plan poziva na djelovanje u pet prioritetnih područja: 1. Smanjenje rizika kao nacionalni i lokalni prioritet; 2. Unapređenje znanja o rizicima i poboljšanje njihove rane najave; 3. Jačanje svijesti i znanja s ciljem stvaranja kulture sigurnosti; 4. Rad na smanjivanju rizika; 5. Povećanje spremnosti za akciju u slučaju katastrofa.

Ključni zakonski dokument kojim se definira upravljanje katastrofama u Hrvatskoj je Zakon o zaštiti i spašavanju (prihvaćen 2004. te dopunjen 2007. i 2009. godine). Državna uprava za zaštitu i spašavanje (DUZS) ključna je državna institucija koja koordinira sve akcije u ovom području, a u njezinom okviru djeluje i sustav 112 zadužen za rano uzbunjivanje i kontinuirano prikupljanje i dijeljenje informacija o rizicima u realnom vremenu. U tom sustavu informacije i podatci kojima raspolaže Državni hidrometeorološki zavod (DHMZ) iznimno su važni. Upravo stoga uspostavljen je standardni operativni postupak (SOP) između DHMZ-a i sustava 112 kojim se regulira protok informacija i prognoza.

Na državnoj razini uspostavljen je i Stožer zaštite i spašavanja kao stručno, operativno i koordinacijsko tijelo odgovorno za pripremu aktivnosti tijekom katastrofa i pomoći u

izvanrednim situacijama. Uspostavljena je i Hrvatska platforma za smanjivanje rizika od katastrofa (www.platforma.hr) u čiji su rad uključene sve relevantne stručne i znanstvene institucije te lokalna zajednica s ciljem usuglašavanja stavova i smanjenja rizika od katastrofa. Platforma se više bavi aktivnostima prije nastanka katastrofa, a znatno manje onima koje slijede u odgovoru na katastrofu.

**Uloga meteorološke i hidrološke službe u sustavu smanjenja rizika od katastrofa**

Državni hidrometeorološki zavod (DHMZ), kao dio europske i svjetske mreže nacionalnih meteoroloških i hidroloških službi u okviru Svjetske meteorološke organizacije, ključan je partner odgovoran za praćenje stanja atmosfere i voda te analizu i prognozu njihovog budućeg stanja na području Republike Hrvatske. Temeljem tih aktivnosti upozorava se na moguća vremenska i hidrološka stanja i pojave koje ugrožavaju živote, materijalna dobra, gospodarstvo i okoliš. Velik dio podataka i prognoza raspoloživ je na internetskim stranicama www.meteo.hr.

Upravljanje rizikom od katastrofa sastoji se od tri općenite aktivnosti: ublažavanja, pripravnosti i pravovremenog upozoravanja. Ublažavanje uključuje smanjenje rizika; pripravnost uključuje procjenu i analizu rizika, prepoznavanje opasnosti, istraživanje i razvoj, edukaciju i informiranje javnosti, dok se pravovremeno upozorenje sastoji od prognoziranja opasnosti, objavljivanja i širenja obavijesti.

DHMZ pridonosi upravljanju rizikom na dva načina:

**a) Identifikacija i procjena rizika**

Kako rizik predstavlja kombinaciju ugroze i ranjivosti zajednice, nužno je prije svega imati saznanja o mogućim opasnim ugrozama DHMZ je odgovoran za mjerenja i opažanja te prikupljanje i obradu meteoroloških i hidroloških podataka kao i podataka o kvaliteti zraka po

strogo definiranim normama i kriterijima prema smjernicama Svjetske meteorološke organizacije. Ti podatci primjenjuju se za proučavanje vremenskih, klimatskih i hidroloških prilika, kao i za prognoze i upozorenja mogućih izvanrednih prilika. DHMZ brine o mreži meteoroloških postaja koje rade po određenom programu rada.

Stalno praćenje stanja atmosfere putem prizemnih meteoroloških postaja, radiosondažnih visinskih mjerenja (Zagreb Maksimir i Zadar Zemunik), radarskih mjerenja te satelitskih mjerenja (zadužena Europska organizacija za korištenje meteoroloških satelita EUMETSAT) omogućuje brzu identifikaciju opasnih meteoroloških pojava i izdavanje upozorenja.

DHMZ je zadužen i za održavanje baze podataka svih svojih mjerenja i motrenja, koji na nekim postajama traju neprekidno još od sredine 19. stoljeća. Ti podatci dugogodišnjih motrenja predstavljaju neprocijenjenu vrijednost pri proučavanju klimatskih prilika i klimatskih promjena, prostorne razdiobe određenih meteoroloških parametara, procjeni mogućih ekstrema te vjerojatnosti njihovog pojavljivanja (DHMZ, 2002; Klimatski atlas Hrvatske, 2008). Također, ti su podatci temelj za izradu procjene ugroženosti pojedinog područja Hrvatske od određene opasne meteorološke pojave.

Stalno praćenje stanja atmosfere zahtijeva velika financijska sredstva potrebna za održavanje sustava mjerenja, obradu i kontrolu podataka te njihovu pohranu, kao i stalno ulaganje u nove tehnologije i mjerne sustave.

**b) Prognoza rizika i njihova rana najava**

Uz poznavanje rizika od neke ekstremne vremenske pojave (lokalna oluja, obilna kiša, olujni vjetar, suša, poplava i sl.) vrlo je važno imati i spoznaje o njihovoj prognozi kako bi se moglo pravovremenom najavom upozoriti na potencijalnu opasnost.

Napori meteorologa DHMZ-a usmjereni su na izdavanje pravovremenih i što je moguće točnijih vremenskih prognoza i upozorenja te ostalih informacija potrebnih u raznim gospodarskim granama (poljoprivreda, energetika, promet, turizam, zdravlje i sl.) kako bi pomogli umanjiti rizik, povećati proizvodnju i ublažiti gubitke.

**Source:**

Ivančan – Picek, Branka. 2015. "Vremenski ekstremi – uzroci i posljedice". *Kemija u industriji* vol. 64: p. 306 – 308. Retrieved from < http://hrcak.srce.hr/138937>

Appendix D

## Genetičko inženjerstvo

Moderna biotehnologija počela je svoj razvoj 1970-ih godina, kada su znanstvenici prvi put počeli razmišljati o uporabi, ali i o rizicima miješanja DNA različitih vrsta. Biotehnologija podrazumijeva mijenjanje nasljednih svojstava živih bića kako bi ona bila što korisnija čovjeku. Nekoć su se ratari kroz kontrolirani uzgoj služili biotehnologijom da bi poboljšali usjeve ili karakteristike domaćih životinja. Koristili su se biotehnologijom kada su rabili kvasac i druge mikroorganizme za proizvodnju piva, vina, sira i drugog, iako zapravo nisu znali objasniti njihovo djelovanje. Klasičnim biljnim oplemenjivanjem postižu se nove kombinacije gena spolnim križanjem roditeljskih biljaka poželjnih svojstava. No kako se uz poželjne gene nasljeđuju i nepoželjni, broj je raspoloživih gena ograničen.

Genetičko inženjerstvo u širem smislu podrazumijeva uporabu molekule DNA i njezino mijenjanje s ciljem nastanka novih (kvalitetnijih) molekula DNA za dobrobit čovjeka. Dakle, promjena nasljedne tvari u živim bićima moguća je uz pomoć širokog repertoara rekombinantnih DNA tehnologija. U užem smislu, genetičko inženjerstvo ili tehnologija rekombinantne DNA jest skup biokemijskih metoda kojima se izrezuju cijeli geni ili skupine gena iz DNA i njihovo umetanje na određeno mjesto u DNA prokariota ili eukariota. Rekombinantna DNA jest DNA koja sadržava željene (interesne) gene. Naučio/naučila si da svako živo biće, organel ili stanična struktura koja sadržava molekulu DNA ima jednak ustroj (građu). Za dobivanje rekombinantnih molekula DNA potrebni su izolirani željeni geni, vektori te bakterija ili stanica primateljica. Kao što je Gregoru Mendelu bio grašak, a Thomasu Morganu vinska mušica, tako se u genetičkom inženjerstvu bakterija *Escherichia coli* koristi u mnogim eksperimentima.

Sigurno te zanima kako nastaje rekombinantna DNA. Restrikcijski enzimi (endonukleaze) „odrežu“ molekulu DNA željenog gena (gena donora) svaki put kada naiđu na određeni slijed dušićnih baza. Primjerice, restrikcijski enzim bakterije *E. coli* nazvan EcoR1 siječe slijed baza GAATTC. Međutim, podudarni je slijed na drugom lancu CTTAAG, koji – ako ga čitamo unatrag – glasi GAATTC. Učio/učila si da se takve riječi zovu palindromi – slijed baza čita se isto: od smjera 5' do smjera 3', kao i od smjera 3' prema smjeru 5'. Osim što djeluju kao molekularne „škare“, restrikcijski enzimi stvaraju iste „ljepljive krajeve“, što znači da bi se kraj jednog lanca izrezanog dijela molekule DNA mogao zalijepiti na bilo koji drugi kraj lanca neke druge molekule DNA izrezane istim enzimom, bez obzira na to od kojeg je živog bića potekla molekula DNA. Enzim ligaza lijepi „ljepljive krajeve“ jedan na drugi. Molekula DNA na koju će se „zalijepiti“ željeni gen naziva se vektor. Vektor omogućava ulazak i umnožavanje željenog gena u bakterijskoj stanici. Najčešće se kao vektor koristi plazmid, mala kružna dvolančana molekula DNA.

Plazmidi se nalaze u nekim bakterijama, kvascu, stanicama biljaka i u drugim vrstama organizama. Osim plazmida, kao vektori mogu poslužiti i bakteriofagi (λ-virus), retrovirusi, kao i umjetno proizvedeni kromosomi iz bakterija i kvasca.

Kada se presječeni plazmid pomiješa s DNA davatelja, jednolančani „ljepljivi krajevi“ nekih plazmida povezuju se s „ljepljivim krajevima“ DNA davatelja. Rezultat je novonastala rekombinantna DNA koja se ugrađuje u bakteriju. Kloniranjem takve korisne bakterije dobivaju se željeni geni.

Primatelj je obično bakterija ili kvasac koji može replicirati taj gen u mnogo kopija u kratkom vremenu te proizvodot velike količine proteina koje poželjni gen kodira. Uglavnom se

rabe željeni geni složenijeg organizma koji se ubacuju u genom drugog, jednostavnije građenog organizma.

Tehnike genetičkog inženjerstva primjenjuju se u različitim ljudskim djelatnostima. U farmaceutskoj industriji koristi se za proizvodnju lijekova koji se ne mogu proizvesti na nijedan drugi način. Primjerice, osobe koje boluju od šećerne bolesti tipa 1 (*Diabetes mellitus 1*) doživotno moraju uzimati inzulin jer ga njihova gušterača ne proizvodi.

Inzulin životinjskog podrijetla u početku je bio jedini dostupan način liječenja. Međutim, bile su moguće različite alergijske reakcije, a potreba za svinjskim i goveđim gušteračama bila je velika. Zanimljivo je da se svinjski inzulin razlikuje od ljudskog u jednoj aminokiselini, a goveđi u trima aminokiselinama. Prednosti uporabe bakterije preinačene genetičkim inženjerstvom podrazumijevaju jednostaviji i jeftiniji postupak proizvodnje te dobivanje neograničenih količina potrebnih proteina. Danas se ljudski inzulin za oboljele osobe dobiva iz kvasca, pa je proizvodnja inzulina još ekonomičnija.

Dobivanje protein apomoću bakterija od velikog je značenja za medicinu i farmaciju. Tako se danas osim inzulina proizvodi i cjepivo za hepatitis B, potom hormon rasta, interferon (služi za liječenje hepatitisa C, leukemije i multiple skleroze), koagulacijski faktori (hemofilija) i dr. Genska terapija se primjenjuje na mnogogenskim bolestima (cistična fibroza – nasljedna sklonost bakterijskim infekcijama, hemofilija, srpasta anemija i drugo). Bolesti prouzročene djelovanjem više gena – poligenske bolesti (srčane bolesti, šećerna bolest, maligne bolesti) budući su kandidati genske terapije. U prehrambenoj se industriji na taj način dobiva lipaza (za dobivanje sira), amilaza (za dobivanje piva), u kemijskoj industriji dobivaju se proteaze (za detergente), u tekstilnoj industriji indigo (plavi pigment za bojenje trapera) i drugo.

Proces umjetnog uvođenja stranih gena u organizam naziva se transfekcija, a organizmi nastali na taj način nazivaju se transgenični ili genetički modificirani (preinačeni) organizmi (GMO). U posljednjih dvadesetak godina primjena tehnika rekombinantne DNA na biljkama se toliko usavršila da se može primijeniti na gotove sve važnije poljoprivredne kulture. Tim se postupcima poboljšavaju mnoga svojstva, primjerice, prehrambena vrijednost, kemijski sastav, okus, miris, a može se „uvesti“ otpornost a neke bolesti, herbicide, pesticide, insekticide, viruse ili čak na stresne uvjete. Najzastupljenija je transgenična soja, nakon nje kukuruz, uljana repica te pamuk, rajčica i mnoge druge kulture. Prirodni genetički inženjeri biljnog svijeta jesu bakterije *Agrobacterium tumefaciens* i *Agrobacterium rhizogenes*.

Kloniranje biljaka u laboratoriju odvija se metodom kulture stanice. Naučio/la si u prvom razredu gimnazije da se stanice izvan organizma uzgajaju na ovaj način, tj. nasađivanjem stanica mnogostaničnih organizama na hranjive podloge na kojima stanice rastu i dijele se. Osim u istraživačke svrhe, metoda kulture stanice i tkiva ima veliku primjenu u proizvodnji lijekova i proteina, u oplemenjivanju biljaka, odnosno u dobivanju genetički preinačenih biljaka.

Životinje su također podvrgnute genetičkom inženjerstvu. Budući da su podložne transfekciji, nekoliko je stotina nasljednih svojstava transgeničnih životinja uključeno u istraživanje. Za razliku od bakterija i kvasca, životinje mogu imati gene u organima i organskim sustavima vrlo sličnima ljudskima. Zbog te se prednosti životinjske modele počelo oblikovati kako bi se proučavale ljudske genske bolesti, a i da bi se najprije ispitala učinkovitost lijekova na životinjama, a zatim na ljudima. Životinje poput ovce i koze mogle bi postati „tvornice“ koje su sposobne proizvoditi proteine korisne ljudima, a mogle bi ih izlučivati u svom mlijeku ili spolnim stanicama iz kojih bi se razvili organizmi potrebni za gensku terapiju.

Najučinkovitiji je način umetanja gena u životinje upotrebom virusa za transfekciju oplođenoj jajašca ili ranog zametka.

**Source:**

Lichtenthal, Melita et al. 2010. “Genetičko inženjerstvo” in Melita Lichtenthal (ed.), *Biologija 4*. Zagreb: ALFA, p. 82 – 86.