GENETIC RESEARCH
Genetic Future

1. Human genetic engineering. What will it be like in 2050?

2. Watch a sequence from the film Gattaca. What are your thoughts about our genetic future? http://www.pbs.org/wgbh/nova/genome/program.html (13th DNA databases)

Would you want yourself or a loved one to be tested for a gene that increases your risk for a disease, but does not **determine** whether you will actually develop the disease?

Would you want yourself and your mate to be tested before having offspring to determine whether you were both carriers for a disease, in which case you are at high risk for having a child who contracts the disease?

Should testing of unborn children be restricted to traits that are commonly considered **deleterious**, such as disease genes?

Should altering a newly conceived person to improve normal qualities -- such as **innate** intelligence, appearance, strength, etcetera -- be allowed?

Should genes or other genomic material be patented?

Should employers have access to your genetic information?

Should life insurance companies have access to your genetic information?

http://www.pbs.org/wgbh/nova/genome/survey.html

3. Read the text "Medicine and Genetic Research" and complete the tasks.

Medicine and Genetic Research

In recent years, there has been an enormous increase in interest in and financial support for genetic research. As a result, a great deal of progress has been made in this important area of knowledge. For example, some years ago scientists successfully identified the genes for a number of serious birth defects and diseases that children can inherit from their parents. On the basis of this advance, medical science has developed tests that enable doctors to discover a variety of genetic abnormalities in unborn babies, abnormalities that are usually incurable and which often result in death.

More recently, genetic researchers have begun to use their knowledge not just to diagnose but also to develop treatment for life-threatening genetic illnesses. For cases of diseases such as hemophilia, sickle-cell anemia, cystic fibrosis, and a number of immune-deficiency diseases, researchers are testing ways to introduce perfect genes into patients. Some of the early results of such experimental treatments have been very promising. In one study, a gene whose absence causes immune-deficiency has been introduced into the white blood cells of two young immune-deficient children.

As a result, they are beginning to show the natural resistance to diseases and infection that humans normally have. In other research, medical scientists are studying the effectiveness of a natural human protein that can now be produced in large quantities in the laboratory, thanks to genetic engineering. The protein is being given to patients who suffer from cystic fibrosis, a genetic disease of the lungs that affects fifty thousand Americans and is often fatal by the age of thirty.

Medical researchers are very excited about the possibility of using techniques of genetic engineering to treat conditions like cancer, diabetes, and heart disease. However, they caution that such treatment is still years away. What is fully available today, thanks to genetic research, is the possibility of eliminating a number of incurable genetic diseases. We can begin to do this, health experts argue, by informing people who carry defective genes about the health risks for any children they might have. This practice is already quite common in the United States and in other industrial countries. After tests have shown that they carry a genetic disease, some people have decided not to have children. They don't want to take the risk that a child of theirs will suffer from an incurable mental or physical defect.

However, progress in genetic research is also raising a number of important moral and ethical questions for the medical profession and for society in general. For example, we now have the ability to produce human growth hormone by genetic engineering. The hormone, of course, can be used to help people who are genetically lacking in it. But should it be made available to people who are merely dissatisfied with their size and wish to be taller? A more serious question is raised by our ability to identify defective genes in unborn children and our wish to eliminate some genetic diseases. If tests show that a baby will be born with some incurable disease or abnormality, should the parents have the right to ask for an abortion? Today in the United States and in many other countries, abortions are legal in such cases. However, many people, especially people with strong religious beliefs, disagree strongly with this practice. For them abortion is morally wrong. In their opinion, science must look for other ways than killing unborn babies to eliminate genetic diseases.

Pakenham, J. (1998), Making Connections, CUP

Reading Comprehension

Main idea check:

Choose the sentence that best expresses the main idea of the passage:

a. Progress in genetic research has given us the hope of treating or eliminating genetic disease, but it is also causing moral and ethical problems.

b. Doctors can now identify people who perhaps will have children with genetic abnormalities.

c. Today, although abortion is legal in the United States, many people are opposed to it.

d. Medicine has benefited a great deal from the progress that has been made in genetic research in recent years.

A closer look:

1. **What are the names of some specific genetic diseases?**

2. **At the time this article was written, how much progress had been made by research in the genetic treatment of diseases?**

   a. Research had made such great progress that some treatments were already becoming widely available.

   b. Research had been successful enough to give hope that genetic treatment would become available in the future.

   c. Failures and disappointments in the research had caused serious doubt that genetic treatment would ever be worthwhile.

3. **How do health experts suggest that we begin now to solve the problem of some genetic diseases?**

   a. By encouraging people with certain defective genes not to have children.
   b. By using technology to cure the diseases.
   c. By performing surgery on children with genetic defects.

4. **True or False?**
   Doctors never inform adults who carry defective genes about the danger that they will have children with serious mental or physical abnormalities.

5. **True or False?**
   Everyone agrees that abortion should be available to women who are carrying unborn babies with incurable genetic diseases. True or False?

GENETICS – Tasks

1. T, A C, G - Do these letters ring a bell?

2. What could the nurse read from the baby's DNA. What's going to happen to the baby?
   a. .... 60% probability

   b. .... 89% probability

   c. .... 99% probability

   d. .... 30.2 years

3. What expression was used for lékařská zpráva?

4. Study the vocabulary – match the terms with their definitions. Focus on pronunciation.

5. Listen to a part of the lecture on Genetics (Prof Eric Lander, MIT)
   http://videolectures.net/mit7012f04_lander_lec06/ (timing 2:48-9:20)
   Take notes. If you need any help, write your question/s on a piece of paper.
   Without using your notes, draw a diagram and explain it.

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What we really want to do is understand biological function. That's what we most want. How is it that an organism is able to breathe in air and distribute it to its cells? How is it that an organism is able to move its muscles? How is it that an organism is able to fight off invaders to its body, microbes, things like that? How is it that an embryo develops into a full adult? Zillions of questions. That's what I mean by biological function. The two complimentary approaches to studying biological function, over the course of the past century or so in biology, have been the following.

There have been the biochemists. Biochemistry seeks to break down the organism into individual components and study them on their own in a test tube. They will take an organisms, and to a biochemist wishing to study the beauty of a butterfly flapping in the wind and understanding all of the mechanics of how it could possibly flap those wings and all, he or she would start by taking the butterfly, putting it in the blender, pressing puree and making an extract, and trying to purify individual components that would explain muscles moving back and forth and all that.

This is, of course, a geneticist's point of view, but it's all right. You have Bob who will represent biochemistry just fine. And they want to purify out individual components. Individual components away from the organism.

And the most important individual type of component that they study are proteins because there are zillions of proteins and they do all sorts of things in the body. And so you could say, in some sense, that this whole theme of biochemistry, which got started at the turn of the 20th century, really just a few years before the turn of the 20th century, of grinding up an organism, studying its components and being able to find, for example, I want to understand how I can digest lunch. Well.

Or how yeast can digest the sugar. Grind up yeast, fractionate it and find some protein that's able to digest the sugar all by itself without the rest of the organism, an enzyme to do that. That's the logic of biochemistry. Genetics is the complimentary point of view. Genetics is the study of organisms minus one component. Of course, what I mean by that are mutants.

The geneticist who wants to understand the butterflies and how the butterfly can fly would isolate butterfly strains that have lost the ability to fly. And ideally one is extremely closely related to the normal butterfly, but for some reason, ideally due to the mutation of a single component they're now unable to fly. And the geneticist would then say, ah-ha, that component must matter an awful lot for the ability to fly because the butterfly that lacks that component cannot fly. It's a totally complimentary point of view.

And the objects the geneticists study in order to do that are genes. Now, what is of course hard for you guys to understand but will form a structure for some of the lectures that I'm going to give over the continuing part of this course, is that through most of the 20th century the folks who studied biochemistry and tried to understand proteins and the folks who studied genetics and tried to understand mutants had nothing to say to each other. They didn't speak the same language.

They had nothing to relate to each other by because there was no idea of how this gene stuff, which started as a totally abstract business, could possibly relate to this protein stuff which started as a very practical in the test-tube thing. And they went for a very long time as if they were just ships sailing in the dark unaware of each other. And I exaggerate, but it's more true than not. The great intellectual event was the unification of these two points of view through the discipline of molecular biology.

Molecular biology was the discipline that realized, oh, my goodness, these are two different sides of the same coin. That, in fact, genes encode proteins, proteins are encoded by genes. Ah-ha. This was a wonderful and important thunder clap in the 20th century. Now, it was a theoretical piece of information at first.

The idea that genes and proteins were related in this way was abstract, very important, but you couldn't do anything really with it, because it turned out you couldn't actually work with individual genes. The next great revolution of the 20th century was a technological revolution that let you actually work with genes.

And that was the recombinant DNA revolution in which the tools to be able to study genes on their own away from the organism, study proteins, use genes to figure out what protein they encode, given a protein and figure out what the gene is, given a gene and actually go in and make a mutant in it, not wait for a random one to rise in the lab but deliberately knock it out, all of that operationalized this intellectual procedure, this intellectual framework. So that is, in some sense, a roadmap to coming lectures that I'm going to give.

I'm going to talk about genetics, I'm going to talk about molecular biology, and I'm going to talk about recombinant DNA. That's the structure of the next several weeks of this course. And what I want you to do is to recognize that although we're going to dive down into the individual components of it, everything we're going to do over the coming weeks fits into this very amazing intellectual framework. And this is the intellectual framework that you inherit as the new students coming into this field and going into the 21st century is all this was worked out in the last century.