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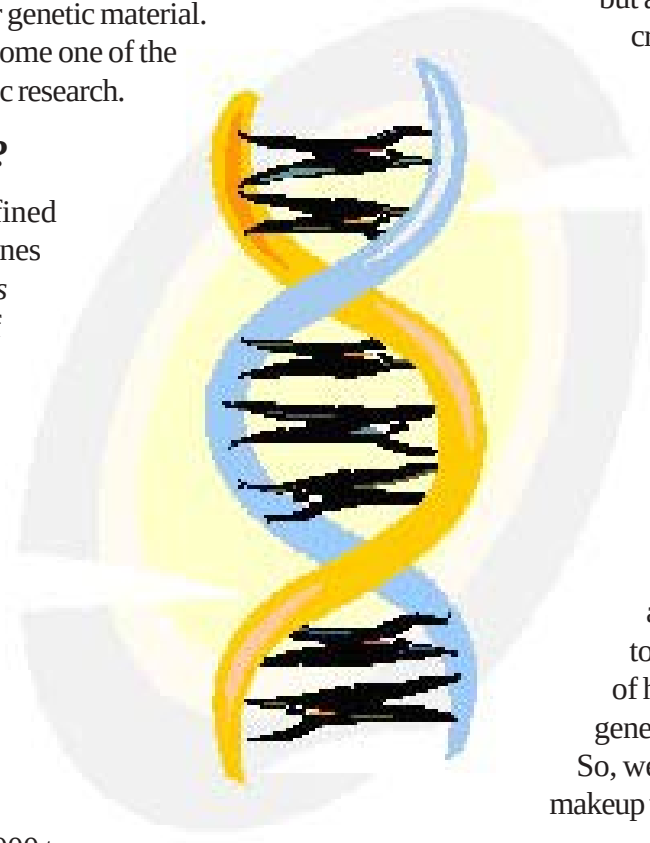
So many genes!

It can be a bit overwhelming. It seems every day there is news of another completed animal, plant or microbial genome sequence. The Human Genome Project sought to develop a representative sequence map of human DNA, our genetic material. That sequencing has become one of the big milestones in genomic research.

What is genomics?

The *genome* can be defined as the complete set of genes inside the cell. *Genomics* is, therefore, the study of the genetic make-up of organisms.



Genomics usually involves sequencing all the bases in an organism's DNA, each A, T, C, and G (adenine, thymine, cytosine, and guanine, respectively). For the human genome there are over 3 billion bases, and these make up from 30,000 to 35,000 genes. The arrangement of these bases is extremely important, and determines the kind of an organism, whether a plant, animal or a fungus. It is the countless possible arrangements of these four bases that account for the huge diversity of life on Earth.

Once a genome is sequenced it can be used for studies of function of the numerous genes (functional genomics), or comparison of the genes in one organism with those of another (comparative genomics).

Researchers study not only the human genome, but also the genomes of all kinds of creatures, from microbes to animals like mice and pigs. The more we learn about other genomes, the more we may discover about our own. For example, the genetic makeup of a pygmy chimpanzee human is over 98 per cent the same as that of a human. On the surface, humans seem very different from each other. Indeed, we are all *unique* - but we are also very much the same! Genetically speaking, the most that any two people differ from each other is only 0.01 per cent. What about living things that do not appear to be at all alike? Almost ten per cent of human genes are related to certain genes in creatures like flies and worms. So, we even share some of our genetic makeup with unlikely relatives.

Dr. Craig Venter, head of the Institute for Biological Energy Alternatives, is well know for his work on the human genome project. Recently, his research group reported the identification of more than 1.2 million new genes from microbial life in the Sargasso Sea. Dr. Venter suggested the results indicate there must be between 10 and 20 billion different genes in the planet Earth's repertoire.

Getting DNA from your cheek cells!

Want to help out with the effort to sequence these billions of genes? Although it will be hard to sequence a genome at home or in the classroom anytime soon, an interested individual can try one of the first steps. The raw material for genome sequencing is DNA. Getting this DNA can actually be a relatively easy process and can be done on a shoestring budget. Household materials can be substituted for those used in the lab. Give it a try!

Here's how:

Approximate Time: 10 minutes

Materials:

Liquid Soap	Distilled and Bottled Water
Salt	Dixie cups (1 per person)
Rubbing alcohol	Glass pipettes and bulb

Test tubes & stoppers (1/person)

Preparation: Dissolve 8 grams of salt in 92 ml of distilled water. A group can share this solution.

Procedure:

1. Pour 1ml (about 1 pipette full) of the salt solution into your test tube.
2. Pour bottled water into Dixie up to the first white band (about 10ml or about a tablespoon) and swirl the water vigorously in your mouth for 90 seconds.
3. Spit the water back into the Dixie cup and pour it into your test tube.
4. Add 1 ml (about 1 pipette) of soap to the test tube.

Liquid detergent causes cell membranes to break down by emulsifying the lipids and proteins of the cell and disrupting the bonds that hold the cell membrane together. The detergent causes the lipids and proteins to precipitate out of the solution. Salt enables DNA to precipitate out of an alcohol solution because it shields the negative phosphate end of DNA, causing the DNA strands to come closer together.

5. Use stopper to seal the test tube and GENTLY tilt it back and forth to mix the contents.
6. Add 5 ml (about 1 teaspoon) of alcohol to the test tube by pouring it gently down the side. It helps if you hold the test tube at an angle.

DNA is soluble in dish detergent solution but insoluble if ethanol is added. Adding ethanol precipitates the DNA so you can see it. Ethanol causes every component in the filtrate to stay in solution except the DNA.

7. Let this sit for 5 minutes. You should see the DNA float to the surface. It should be white and look a bit like a very small jellyfish.
8. Pour 1ml of alcohol into the small plastic test tubes with lids attached.
9. Remove the DNA from the big test tube by twirling the glass pipette GENTLY. If your DNA breaks apart, you can still transfer it to the little tube piece by piece.
10. Place the DNA into a little test tube and make sure the lid is closed tightly.

DNA technology has already had a great impact on science, research and medicine. With continuing developments and researchers desiring to learn more, this technology holds much for the future.

For more information:

AgBiotech InfoSource:
http://www.agwest.sk.ca/e_infosrc.shtml
See issues: 53, 54, 65, 66, 81, 84, 88

J. Venter et al., "Environmental Genome shotgun sequencing of the sargasso sea," *Science,* DOI:10.1126/science.1093857, March 4, 2004.
http://www.sciencemag.org

The GEEE! in Genome
http://www.nature.ca/genome/index_e.cfm

The National Human Genome Research Institute
http://www.nhgri.nih.gov/

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