

Editorial

The Future of Medicine

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According to WHO within 20 years: All human genes will have been mapped and identified. The *Human Genome Project* is a \$3 billion global initiative to map and sequence every one of the estimated 100,000 genes that make up each individual. The human genome project is a major worldwide scientific undertaking to identify the location of all human genes. A genetic linkage map shows the relative locations of specific DNA markers along the chromosome. Each marker is like a mile marker along a highway.

In the year 2020, the genetic mechanisms of each disorder will have been described. Medicine will become more predictive and preventive. Diagnosis and therapy will become more specific and effective. Genetic diagnosis and counselling will be integrated into an increasing range of medical services. Genetic methodology will become a basic approach for health improvement and disease control. Gene therapy will be a universal method for disease prevention and treatment.

In next 20 years the practice of medicine would have changed radically, that even those who continued to practice medicine would have difficulty in catching up with the new knowledge emerging through the Genome project. We would know the genetic cause and treatment of most of the common diseases that we are treating now. We would know the pharmaco-genomic nature of the drugs (Which drug would give side effects and to whom?).

The genetic mapping of the human being would tell us who is liable to what diseases? This would be a scary thing to many people and it would pose a great difficulty for medical insurance and employment. If the individual genetic map is known to the medical insurance or employing authorities it might jeopardize his ability to be insured, to find employment and/or be discriminated against.

Should the individual genetic map be considered as individual property, disclosing it would be considered infringement on the civil liberties of the individual? It would be scary when genetic mapping exposes somebody who is completely normal in the community but genetically showing criminal tendency (50% of behaviors are genetically influenced).

Our practice in the hospitals or clinics would change radically because there would be a curative treatment designed for each patient according to his genetic map, as well as a prophylactic treatment for the same patient according to the risk of disease known from his genetic map.

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Bahrain Medical Bulletin – Established 1979
State of Bahrain

The Genome project would expose that there is no such thing as a pure human race or a pure tribal descendency. Most probably it would show that most of the so called pure races are mixed in reality, also those who claim to be pure or superior race will find out that they were clinging to a fake identity.

Bahrain is one of leading countries in the Gulf cooperation council to establish a genetic department in 1984, pioneered by Dr. Sheikha Alarrayed. This department needs to expand in order to cope with the new developments in this field, not only that, this department needs to be the focal point of the hospital and the coordinator with other departments, because most of the information regarding the genetic mapping would flow from that department. We need to invest in genetic research and a genetic department in every hospital in order not to fall behind like what happened in 1975 when high officials in the ministry of health said that CT scan is a sophisticated investigation.

The benefits of mapping the human genome are so many, to cite only a few:

1. In the field of Molecular Medicine
 - improved diagnosis of disease*
 - earlier detection of genetic predispositions to disease rational drug design*
 - gene therapy and control systems for drugs*
 - pharmacogenomics "custom drugs", better design of drugs for psychiatric disorders or other rare diseases.*
2. In the field of Risk Assessment
 - assess health damage and risks caused by radiation exposure, including low-dose exposures*
 - assess health damage and risks caused by exposure to mutagenic chemicals and cancer-causing toxins*
 - reduce the likelihood of heritable mutations*
3. In the field of Anthropology, Evolution, and Human Migration
 - study evolution through germline mutations in lineages*
 - study migration of different population groups based on female genetic inheritance*
 - study mutations on the Y chromosome to trace lineage and migration of males*
4. In the field of DNA Forensics
 - identify potential suspects whose DNA may match evidence left at crime scenes*
 - exonerate persons wrongly accused of crimes*
 - identify crime and catastrophe victims*
 - establish paternity and other family relationships*
 - detect bacteria and other organisms that may pollute air, water, soil, and food*
 - match organ donors with recipients in transplant programs*

In order to protect the individual and his civil liberties the WHO advocates and promotes the following governing principles:

- Medical application of genetic knowledge must be carried out with due regard to the general principles of medical ethics: doing good to individuals and families, offering autonomy of choice after information is given and facilitating personal and social justice.
- Genetic services should be available to all regardless of the ability to pay and should be provided first to those whose needs are greatest.
- There should be no compulsory genetic testing of adult individuals or populations. People should be free to refuse or accept. All testing should be preceded by the provision of adequate information and counselling. Genetic counselling is essential before testing and should continue afterwards if necessary.
- Genetic data should only be used to the advantage of a family or ethnic groups, never to stigmatize or discriminate. It should be confidential and should not be given to a third party other than with the consent of the person tested.
- Education about genetics for the public and health care professionals is a priority. General practitioners will need to incorporate genetics into clinical practice if patients are to benefit from scientific advances. They will also require training to appropriately screen the relevance of media output to deliver proper counselling to patients.

Human genome project will lead to significant changes in the treatment and control of human diseases. Genetics will be the key to future progress in our understanding of diseases. However, genetics can be misused by infringement on the civil liberties, genetic discrimination, designer babies or designer race and many others. To avoid that we need to work from now on the possible ethical problems we could face. We need to form a committee of doctors, scientists, sociologists and religious leaders.

The Genome project would uncover many facts and realities about human beings, but it would not be able to tell us or to predict the personality change, human emotions, love and other human feelings. The genome project would not be able to tell us about the soul of the human being.