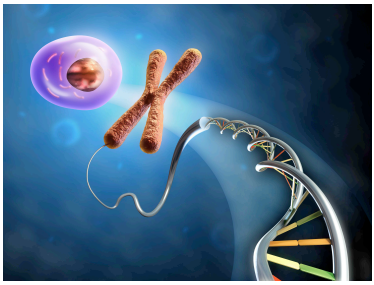
Excerpt from the book "How to live 150 years" by Dr. Dimitris Tsoukalas

Chapter 6 The end of the Genetics era

In modern medicine, there is an assumption that plays the same role that fate did in ancient times. We refer to the hereditary factor. "You cannot escape your genetic make-up".

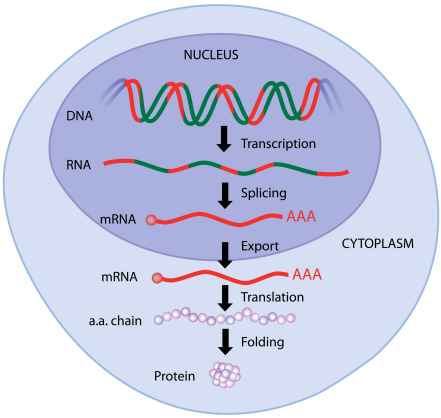
Now, however, genetics - the science of genes - seems to thinks otherwise. Thus, it has begun the end of the genetic era.

The end of the Genetics era



DNA is found in the nucleus of every cell of the body and is essentially an information pool. It is composed of genes placed in series one after the other and forming a long chain, i.e. the genetic code. Twenty-one thousand genes contain information for the creation and operation of the human body.

In recent years, progress in biomedical research and genetic engineering has created great expectations for the transfer of these discoveries into medical practice. Within a few decades, we have discovered part of the inner workings of DNA, completed the map of the human genome, and diseases have been associated to the precise alteration of certain genes.



Each gene contains the information for the construction of a *single* element of our body. As the hard drive in a computer

contains its operating system, genes contain data to construct the operating elements of our body. Even now, however, is not entirely clear how this information is exactly read and translated.

Genes and Metabolomics

In 1966, professor Tanaka Kei, at Yale University, described and measured for the first time a congenital disease related to metabolism. Making use of new technologies and brilliant clinical thinking, he measured a metabolite (isovaleric acid), which was found in higher concentration in the blood and urine of some children suffering from a rare genetic disease. Tanaka's finding wrote a new chapter in the history of medicine.

After Tanaka's discovery in 1966, it was possible to measure metabolites related to different genetic diseases, such as the connection of severe mental retardation with phenylketonuria. Today, all new-borns are screened for the presence of congenital metabolic diseases, and 4,000 genetically inherited diseases have been identified.

Despite the continuing discoveries in the field of genetic abnormalities, results of research regarding the association of the most common chronic diseases (diabetes, heart disease,

cancer) with genes are so far disappointing. Based on gene identification alone, we still ignore whether a person will develop a certain disease.

The initial hypothesis was that, by recording the DNA map, one could associate each gene to a single, specific function or condition. Every single person would then have his/her own DNA map and, therefore, should behave in relation to disease and health in a predictable fashion. Further, people should have a predetermined IQ, concrete features and physical possibilities, as well as maybe a reasonably outlined personality.

The problem arose as we realised that each gene did not consistently produce the same effect on body operation.

For example, say we provide a geneticist with a copy of our DNA and ask him/her to determine our eye colour; he/she will not be unable to do so.

It seems self-evident that heredity is the most important factor in determining our health condition, which is not true. People in the same family may have the same diseases for similar ages and conditions. Of course, there is a common predisposing factor, given that one starts from a similar genetic code. However, the most important factor is that people of the same family tend to have similar habits.

We now know that a single gene can produce up to 31,000 variations of the same information contained therein by varying epigenetic factors. For example, two brown-eyed parents could have a green-eyed child.

Experiments have shown that, in mice with identical genes that should encode a brown colour skin as that of the mother, researchers managed to produce several variations of their skin colour by changing external factors to DNA such as food.

This means that you can have a normal gene yet manifest a disease, or have problematic genes and never suffer from it.

Similarly, every human body starts from twenty-one thousand genes for which you can have up to ten million variations and infinite combinations between ten million results.

Our genes are not static as once thought; they are dynamic units that regulate their expression depending on the surrounding conditions and environment (epigenetics).

The human body is able to change its programming and optimally adapt to its environment. The problem arises though if the environment is too far removed from the ideal; in such situation, the body strives to adapt with "solutions" that are not compatible with its optimal function, and the disease manifests itself.

The new discovery represents a major step forward for the science of biology: from the era of genetics to that of *epigenetics.* Epigenetics is the biological science that deals with factors influencing gene expression (the way in which genes respond to external stimuli), such as nutrition, toxic load, deficiencies of nutrients, our mood, exercise, etc.

It comes from the Greek words epi-(above) and genetics. Epigenetics states that there are factors beyond genes that regulate their function positively or negatively. It is a scientific revolution of enormous importance and its effects will be felt for years to come.

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Genetics and Epigenetics: what is the fairest of them all?

All this means that our current and future health is not solely defined by DNA anymore. While the genetic code certainly influences the final result, it is estimated, however, that its influence in the manifestation of a disease does not exceed 25%. For the remaining 75%, our health is regulated by

epigenetic factors and is thus in our hands. The choice is ours to exploit this power in a positive or negative manner.

In a study published *in the Archives of Internal Medicine* in 2009, entitled "A healthy lifestyle is the best revenge", 23,000 people were followed for 8 years. The purpose of the study was assessing the extent to which three chronic diseases, which are the leading cause of mortality *(cardiovascular disease, cancer and diabetes)*, could be prevented by following a healthy lifestyle. The following four health factors were considered:

1. Non-smoking
2. Avoiding obesity
3. Practicing exercise more than 3.5 hours per week
4. Following a healthy diet.

Results were amazing! Those meeting all health requirements had a lower overall risk of presenting a chronic disease of 78%.

In the western world, the general population is starting to change its lifestyle towards more natural habits. Even if the response to social mechanisms is usually slower, we have noticed some encouraging signs of change. We are witnessing revolutionary changes at scientific and medical level. However, this revolution will not happen out in military battlefields. Indeed, it is taking place in research laboratories and in the minds of eminent researchers and physicians. Medicine is moving from

an era where fate largely determined a patient's health condition to one where we're taking health into our own hands.